Differential Calculus & Linear Algebra		Semester	1
Course Code	**1BMATE101**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40Hours Theory+ 20Hours Tutorials	Total Marks	100
Credits	04	Exam Hours	3 Hours
Examination type (SEE)	**Theory**		

Course Outcomes (Course Skill Set)

CO1: Apply foundational concepts of calculus and differential equations to analyze geometric properties of curves, solve first and higher-order ordinary differential equations, and model physical phenomena in science and engineering.

CO2: Apply the principles of linear algebra to solve systems of linear equations, determine eigenvalues and eigenvectors, and analyze real-world problems such as traffic flow.

CO3: Demonstrate the applications of electrical engineering and allied engineering science using modern ICT tools.

Module-1: Differential Calculus **(8 Hours Theory + 4 Hours Tutorial)**

Polar curves, angle between the radius vector and the tangent, angle between the polar curves, pedal equations. Curvature and radius of curvature in cartesian, polar, parametric and pedal forms.

Module-2: Power Series Expansions, Indeterminate Forms and Multivariable Calculus
(8 Hours Theory + 4 Hours Tutorial)

Statement and problems on Taylor's and Maclaurin's series expansion for one variable.
Indeterminate forms - L'Hospital's rule. Partial Differentiation: Partial differentiation, total derivative - differentiation of composite functions. Jacobian. Maxima and minima for a function of two variables.

Module-3: Ordinary Differential Equations (ODE) of First Order and First Degree and Nonlinear ODE
(8 Hours Theory + 4 Hours Tutorial)

Exact and reducible to exact differential equations- Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{-1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ only.
Linear and Bernoulli's differential equations. Orthogonal trajectories, L-R and C-R circuits.
Non-linear differential equations: Introduction to general and singular solutions, solvable for p only, Clairaut's equations, reducible to Clairaut's equations.

Module-4: Ordinary Differential Equations of Higher Order **(8 Hours Theory + 4 Hours Tutorial)**

Higher-order linear ODEs with constant coefficients, homogeneous and non-homogeneous equations - e^{ax}, sin(ax+b), cos(ax+b), x^n only. Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. L-C-R circuits.

Module-5: Linear Algebra **(8 Hours Theory + 4 Hours Tutorial)**

Elementary transformations on a matrix, Echelon form, rank of a matrix, consistency of system of linear equations. Gauss elimination, Gauss –Seidel method to solve system of linear equations. Eigen values and eigen vectors of a matrix, Rayleigh power method to determine the dominant eigen value of a matrix.

Suggested Learning Resources: (Textbook/Reference Book):

Textbooks:

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. B.V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017
2. Srimanta Pal & Subodh C.Bhunia, Engineering Mathematics, Oxford University Press, 3rd Ed., 2016.
3. N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014.
5. David C Lay, Linear Algebra and its Applications, Pearson Publishers, 4th Ed., 2018.

Web links and Video Lectures (e-Resources):

- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program
- https://nptel.ac.in/courses/111106135
- https://nptel.ac.in/courses/111105160
- https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
- https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of 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 students' 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 to 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).
- As a revision of topics (post-lecture activity).
- As additional examples (post-lecture activity).
- As an additional material of challenging topics (pre-and post-lecture activity).
- As a model solution of some exercises (post-lecture activity).

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

The CIE Theory component consists of average of TWO IA tests for 25 marks and Continuous Comprehensive Assessments (CCA) for 25 marks.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted with a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity-1: Tutorial: Practicing problems (Lab Activities/Surprise Test/ Seminar for 15 Marks) Execute the following lab exercises with the aid of any modern technological tool (Matlab/ Mathematica/ Scilab/ Python/ Maxima, etc).

Learning Activity-2: Assignments (Marks-10).

List of Lab activities:

1) 2D plots for Cartesian and polar curves,
2) Finding angle between polar curves,
3) Finding Radius of curvature,
4) Expansion of Taylor's and Maclaurin's series,
5) Finding partial derivatives and Jacobian,
6) Solution of first order and higher order ordinary differential equations,
7) Plotting solutions of ODE,
8) Finding rank, reduced echelon form, solving system of linear equations using Gauss elimination method,
9) Solving system of linear equations using Gauss-Seidel method,
10) Determine Eigenvalues and Eigenvectors.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator- 1 (CO/PO Mapping)					
Performance Indicator-2 (CO/PO Mapping)					
...					
Performance Indicator-n (CO/PO Mapping)					

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation

- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Calculus, Laplace Transform and Numerical Techniques		Semester	2
Course Code	**1BMATE201**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40Hours (Theory)+ 20Hours Tutorials	Total Marks	100
Credits	04	Exam Hours	3 Hours
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

CO1: Apply the concepts of integral calculus and vector calculus to model and solve problems in engineering applications such as area, volume.

CO2: Apply appropriate numerical methods to find approximate solutions of algebraic, transcendental, and ordinary differential equations and to perform interpolation and numerical integration in engineering contexts.

CO3: Apply Laplace transform techniques for time domain, wave forms, periodic functions and solving differential equations.

CO4: Demonstrate the applications of electrical engineering and allied engineering science using modern ICT tools.

Module-1: Integral Calculus and its Applications (8 Hours Theory + 4 Hours Tutorial)

Multiple Integrals: Evaluation of double and triple integrals, change of order of integration, changing to polar coordinates. Area and volume using double and triple integrals.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions.

Module-2: Vector Calculus and its Applications (8 Hours Theory + 4 Hours Tutorial)

Vector Differentiation: Scalar and vector fields, gradient of a scalar field, directional derivatives, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector, physical interpretation of gradient, divergence and curl and scalar potential.

Vector Integration**:** Line integrals, Statement of Green's and Stokes' theorem without verification problems.

Module-3: Numerical Methods-1 (8 Hours Theory + 4 Hours Tutorial)

Solution of algebraic and transcendental equations: Regula-Falsi method and Newton-Raphson method.

Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton forward and backward interpolation formulae, Newton's divided difference interpolation formula and Lagrange's interpolation formula.

Numerical Integration: Trapezoidal rule, Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule.

Module-4: Numerical Methods-2 (8 Hours Theory + 4 Hours Tutorial)

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 and Milne's predictor corrector method and Adam-Bashforth predictor-corrector method.

Module-5: Laplace Transform (8 Hours Theory + 4 Hours Tutorial)

Laplace transform (LT): Definition and Formulae of Laplace Transform, LT of elementary functions. Properties– linearity, scaling, shifting property, differentiation in the s domain, division by t. LT of periodic functions, square wave, saw-tooth wave, triangular wave, full and half wave rectifier, Heaviside Unit step function.
Inverse Laplace Transforms: Definition, properties, evaluation using different methods, and applications to solve ordinary differential equations.

Suggested Learning Resources: (Textbook/Reference Book):

Textbooks:

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. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8thEd., 2022.

Reference books:

1. B.V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017
2. Srimanta Pal & Subodh C.Bhunia, Engineering Mathematics, Oxford University Press, 3rd Ed., 2016.
3. N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014.
5. Steven V. Chapra and Raymond P. Canale, Applied Numerical Methods with Matlab for Engineers and Scientists, McGraw-Hill, 3rd Ed., 2011.
6. Richard L. Burden, Douglas J. Faires and A. M. Burden, Numerical Analysis, 10th Ed.,2010, Cengage Publishers.
7. S.S. Sastry, "Introductory Methods of Numerical Analysis", PHI Learning Private Limited, 5th Ed., 2012.

Web links and Video Lectures (e-Resources):

- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program
- https://nptel.ac.in/courses/111105160
- https://nptel.ac.in/courses/127106019
- https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/
- https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2012/pages/syllabus/

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of 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 students' 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 to 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).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).

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

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted with a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity-1: Tutorial: Practicing problems (Lab Activities/Surprise Test/ Seminar for 15 Marks) Execute the following lab exercises with the aid of any modern technological tool (Matlab/ Mathematica/ Scilab/ Python/ Maxima, etc).

Learning Activity-2: Assignments (Marks-10).

List of Lab Activities:

1) Evaluate double integration and compute area and volume,
2) Evaluate triple integration and compute volume,
3) Finding gradient, divergence and curl,
4) Evaluate line integrals,
5) Regula Falsi and Newton Raphson method,
6) Interpolation,
7) Numerical integration,
8) Modified Euler's method, Fourth order Runge -Kutta method,
9) Laplace transform,
10) Inverse Laplace transform.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator- 1 (CO/PO Mapping)					
Performance Indicator-2 (CO/PO Mapping)					
...					
Performance Indicator-n (CO/PO Mapping)					

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

CALCULUS AND LINEAR ALGEBRA		Semester	1
Course Code	**1BMATS101**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40Hours Theory + 20Hours Tutorial	Total Marks	100
Credits	4	Exam Hours	3 hrs
Examination type (SEE)	**Theory**		

Course Outcomes

CO1: Apply the concepts of multivariable calculus and vector calculus to compute derivatives, optimize functions, and analyze vector fields for applications in computer science engineering.

CO2: Solve system of linear equations and determine eigenvalues and eigenvectors using direct and iterative methods.

CO3: Apply the concepts of vector spaces and linear transformations to problems in computer science engineering.

CO4: Demonstrate the applications of computer science and allied engineering Science using modern ICT tools.

Module-1: Calculus **(8Hours Theory + 4Hours Tutorial)**

Partial differentiation, total derivative, differentiation of composite functions, Jacobian, Statement of Taylor's and Maclaurin's series expansion for two variables. Maxima and minima for the function of two variables.

Module-2: Vector Calculus **(8Hours Theory + 4Hours Tutorial)**

Scalar and vector fields, Gradient, directional derivatives, divergence and curl - physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential.

Introduction to polar coordinates and polar curves.

Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality.

Module-3: System of Linear Equations, Eigenvalues and Eigenvectors
(8Hours Theory + 4Hours Tutorial)

Elementary row transformation of a matrix, Echelon form, rank of a matrix. Consistency and solution of system of linear equations: Gauss elimination method, Gauss Jordan method. Applications: Traffic flow.

Eigenvalues and Eigenvectors, diagonalization of the matrix, modal matrix.

Module-4: Vector Space **(8Hours Theory + 4Hours Tutorial)**

Vector spaces: definition and examples, subspace: definition and examples. Linear Combinations, linear span, linearly independent and dependent sets, basis and dimension, row space and column space of a matrix, Coordinates vector, inner products and orthogonality.

Module-5: Linear Transformation **(8Hours Theory + 4Hours Tutorial)**

Definition and examples, algebra of linear transformations, matrix of a linear transformation. Singular, non-singular linear transformations and invertible linear transformations. Rank and nullity of linear transformations, Rank-Nullity theorem.

Suggested Learning Resources: (Textbook/Reference Book):

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021.
2. Gilbert Strang, Linear Algebra and its Applications, Cengage Publications, 4th Ed., 2022.
3. Seymour Lipschutz and Marc Lipson, Linear Algebra, Schaum's outlines series, 4th Ed., 2008.

Reference books:

1. V. Ramana, Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. N. P Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
3. James Stewart, Calculus, Cengage Publications, 7thEd., 2019.
4. David Poole, Linear Algebra, a modern introduction, Cengage publishers, 4th Ed., 2014.
5. David C Lay, Linear Algebra and its Applications, Pearson Publishers, 4th Ed., 2018.
6. Gareth Williams, Linear Algebra with applications, Jones Bartlett Publishers Inc., 6th Ed., 2017.

Web links and Video Lectures (e-Resources):

- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program
- https://nptel.ac.in/courses/111106135
- https://nptel.ac.in/courses/111105160
- https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
- https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of 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 students' 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 to 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).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

The CIE Theory component consists of average of TWO IA tests for 25 marks and Continuous Comprehensive Assessments (CCA) for 25 marks.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted with a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity-1: Tutorial: Practicing problems (Lab Activities/Surprise Test/ Seminar for 15 Marks) Execute the following lab exercises with the aid of any modern technological tool (Matlab/ Mathematica/ Scilab/ Python/ Maxima, etc).

Learning Activity-2: Assignments (Marks-10).

List of Lab Activities:

1) Finding partial derivatives and Jacobian,
2) Expansion of Taylor's and Maclaurin's series,
3) Finding Gradient, divergence and curl,
4) Finding rank, reduced echelon form, solving system of linear equations using Gauss elimination method,
5) Solving system of linear equations using Gauss-Seidel method,
6) Determine Eigenvalues and Eigenvectors,
7) Linearly Independence and Dependence sets,
8) Basis and dimension,
9) Linear transformation-range space and null space,
10) Verification of the rank nullity theorem.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator- 1 (CO/PO Mapping)					
Performance Indicator-2 (CO/PO Mapping)					
...					
Performance Indicator-n (CO/PO Mapping)					

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration

- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

NUMERICAL METHODS		Semester	2
Course Code	**1BMATS201**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40Hours Theory + 20Hours Tutorial	Total Marks	100
Credits	4	Exam Hours	3 hrs
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

CO1: Apply numerical methods to solve transcendental equations, perform interpolation, numerical integration, and solve ordinary differential equations.

CO2: Solve first and higher-order differential equations using analytical methods and apply them to mathematical models.

CO3: Demonstrate the applications of computer science and allied engineering science using modern ICT tools.

Module-1: Introduction to Numerical Methods (8Hours Theory + 4Hours Tutorial)

Errors and their computation: Round off error, Truncation error, Absolute error, Relative error and Percentage error.

Solution of algebraic and transcendental equations: Bisection, Regula-Falsi, Secant and Newton-Raphson methods.

Module-2: Numerical solutions for system of linear equations (8Hours Theory + 4Hours Tutorial)

Norms: Vector norms and Matrix norms-L_1, L_2 and L_∞, Ill conditioned linear system, condition number.

Solution of system of linear equations: Gauss Seidel method and LU-decomposition method.

Eigenvalues and Eigen vectors: Rayleigh power method, Jacobi's method.

Module-3: Interpolation (8Hours Theory + 4Hours Tutorial)

Finite differences, interpolation using Newton Gregary forward and Newton Gregary backward difference formulae, Newton's divided difference. Lagrange interpolation formulae, piecewise interpolation-linear and quadratic.

Module-4: Differential Equations of First and Higher Order (8Hours Theory + 4Hours Tutorial)

Linear and Bernoulli`s differential equations. Exact and reducible to exact differential equations with integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{-1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$. Homogeneous and non-homogeneous Differential equations of higher order with constant coefficients. Inverse differential operators - e^{ax}, sin(ax+b), cos(ax+b) and x^n.

Module-5: Numerical Integration and Numerical Solution of Differential Equations (8Hours Theory + 4Hours Tutorial)

Numerical integration: Trapezoidal, Simpson's $1/3^{rd}$, Simpson's $3/8^{th}$ rule and Weddle's rule.

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 and Milne's predictor-corrector method.

Suggested Learning Resources: (Textbook/Reference Book):

Textbooks:

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8thEd., 2022.
2. David C Lay, Linear Algebra and its Applications, Pearson Publishers, 5th Ed., 2023.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEd., 2021.

Reference books:

1. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017
2. N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
3. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 5th Ed. 2012.
4. Steven V. Chapra and Raymond P. Canale, Applied Numerical Methods with Matlab for Engineers and Scientists, McGraw-Hill, 3rd Ed., 2011.
5. Richard L. Burden, Douglas J. Faires, A. M. Burden, Numerical Analysis, 10th Edition.,2010, Cengage Publishers.

Web links and Video Lectures (e-Resources):

- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program
- https://nptel.ac.in/courses/111105160
- https://nptel.ac.in/courses/127106019
- https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/
- https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2012/pages/syllabus/

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of 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 students' 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 to 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).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

The CIE Theory component consists of average of TWO IA tests for 25 marks and Continuous Comprehensive Assessments (CCA) for 25 marks.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted with a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity-1: Tutorial: Practicing problems (Lab Activities/Surprise Test/ Seminar for 15 Marks) Execute the following lab exercises with the aid of any modern technological tool (Matlab/ Mathematica/ Scilab/ Python/ Maxima, etc).

Learning Activity-2: Assignments (Marks-10).

List of Lab Activities:

1) Errors and approximation,
2) Root finding methods,
3) Norms, Condition number,
4) Gauss Seidel method and Rayleigh power's method,
5) Forward and Backward interpolation,
6) Lagrange's interpolation,
7) Solving differential equations of first and higher order,
8) Numerical integration,
9) Taylor's method, Modified Euler's method,
10) Runge-Kutta method of fourth order.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator- 1 (CO/PO Mapping)					
Performance Indicator-2 (CO/PO Mapping)					
...					
Performance Indicator-n (CO/PO Mapping)					

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Applied Chemistry for Emerging Electronics and Futuristic Devices		Semester	I/II
Course Code	**1BCHEE102/202**	CIE Marks	**50**
Teaching Hours/Week (L:T:P:S)	**3:0:2:0**	SEE Marks	**50**
Total Hours of Pedagogy (Theory and Lab hours)	**60**	Total Marks	**100**
Credits	**04**	Exam Hours	**03**
Examination type (SEE)	Descriptive		

Course outcome (Course Skill Set)

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

CO1: Understand and analyze the properties, classification and applications of semiconductor materials, energy storage and conversion devices.

CO2: Demonstrate knowledge of nanomaterials and quantum dots including their synthesis, properties, and device applications.

CO3: Explain the role of functional polymers and composites in flexible electronic applications.

CO4: Apply electrochemical concepts to sensor systems and evaluate corrosion control and e-waste management techniques.

Module-1 Materials for Energy Devices

Semiconductors: Introduction, n-type and p-type semiconductor materials, difference between organic and inorganic semiconductors, organic photovoltaics - Poly (3-hexylthiophene) (P3HT) as a donor and Phenyl-C61-butyric acid methyl ester (PCBM) as a acceptor, construction, working and applications.

Energy Storage Devices: Introduction, classification of batteries-primary, secondary and reserve battery, characteristics (capacity, power density, cell balancing & cycle life), construction and working of lithium-ion battery advantages in EV applications, construction and working of ultra-small asymmetric super capacitor and its applications in IoT/wearable devices.

Energy Conversion Devices: Introduction, construction, working principal, advantages and applications of photovoltaic cell of (PV cell), Introduction to MEMS-Based Energy Harvesters, working principle and applications.

Number of Hours**: 08**

Module-2 Nano and Quantum Dot Materials

Nanomaterials: Introduction, size dependent properties of nanomaterials -Surface area, Catalytic and electrical, synthesis of TiO_2 nanoparticles by sol-gel method for sensor applications.

Quantum Dot Materials: Introduction, types, optical and electronic properties of quantum dots (QDs).

Inorganic Quantum Dot Materials (IQDMs): Introduction, synthesis and properties of silicon based QDs by Sol-Gel method and CdSe Quantum Dots by hot injection method and applications in optoelectronic devices, Quantum Dot-based copper conductive ink by wet chemical reduction method, properties and applications.

Organic Quantum Dot Materials (OQDMs): Introduction, synthesis and properties of chitosan-carbon quantum dots hydrogel applications in next-generation flexible and wearable electronics, synthesis and properties of Graphene Quantum Dots using citric acid method its applications in emerging electronics.

Number of Hours**: 08**

Module-3 Functional Polymers and Hybrid Composites in Flexible Electronics

Stretchable and Wearable Microelectronics: Introduction, basic principle and working of Lithography for micro-patterned copper deposition, synthesis, properties and applications of PDMS (Polydimethylsiloxane) in e-skin (electronic skin) applications.

Polymers: Introduction, Synthesis, conduction mechanism polyaniline and electronic devices applications, Number average molecular weight and weight average and numerical, synthesis and properties of Polydimethylsiloxane (PDMS) in RFID (Radio Frequency Identification) applications, synthesis and properties of Polyvinylidene Fluoride (PVDF) applications in E-nose devices.

Polymer Composites: Introduction, synthesis and properties of epoxy resin- Fe_3O_4 composite for sensors applications, synthesis of Kevlar Fiber Reinforced Polymer (KFRP)-properties and smart electronic devices applications.

Number of Hours: **08**

Module-4 Electrode System and Electrochemical Sensors

Electrode System: Introduction, types of electrodes, Nernst equation (Preview), reference electrode, construction, working and applications of calomel electrode, Ion selective electrode- definition, construction, working of glass electrode, determination of pH using glass electrode, construction and working of concentration cell and numericals.

Sensing Methods: Introduction, principle and instrumentation of colorimetric sensors; its application in the estimation of copper in PCBs, principle and instrumentation of potentiometric sensors; applications in the estimation of iron in steel, conductometric sensors; its application in the estimation of acid mixture in sample.

Number of Hours: **08**

Module-5 Corrosion Science and E-waste Management

Corrosion Chemistry: Introduction, electrochemical theory of corrosion, types of corrosion differential metal corrosion in electronic circuits and differential aeration corrosion, corrosion control-galvanization and anodization, cathodic protection and impressed current method, corrosion penetration rate (CPR)-definition, importance and numerical problems.

Metal Finishing: Introduction, difference between electroplating & electroless plating, electroplating of chromium for hard and decorative coatings, electroless plating of copper on PCBs.

E-waste: Introduction, need of e-waste management, sources & effects of e-waste on environment and

human health, extraction of gold from e-waste from bioleaching method.

Number of Hours: **08**

PRACTICAL COMPONENTS OF IPCC

FIXED SET OF EXPERIMENTS

1. Estimation of total hardness of water by EDTA method.
2. Determination of chemical oxygen demand (COD) of industrial effluent sample.
3. Estimation of iron in TMT bar by diphenyl amine indicator method.
4. Determination of alkalinity of given boiler water sample.
5. Green synthesis of copper nanoparticles for conductive ink applications.
6. Estimation of acid mixture by conductometric sensor (Conductometry)
7. Estimation of iron in rust sample by Potentiometric sensor (Potentiometry)
8. Determination of pKa of vinegar using pH sensor (Glass electrode)
9. Estimation of copper present in e-waste by optical sensor (Colorimetry).
10. Smartphone-Based colorimetric estimation of total phenolic content in coffee products.
11. Data analysis of pka of a week acid and its interpretation using origin software.
12. Chemical structure drawing using software: Chem Draw/ Chem Sketch.

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. Engineering Chemistry, Suba Ramesh, Vairam, Ananda Murthy, 2011, Wiley India, ISBN: 9788126519880.
2. Engineering chemistry, Shubha Ramesh et.al., Wiley India, 1st Edition, 2011, ISBN: 9788126519880.
3. Chemistry for Engineering Students by Dr B S Jai Prakash, Prof R Venugopal, Dr Shivakumaraiah.

Reference books / Manuals:

1. Electrochemical Energy System: Dr. K. K. Rajeshwar (IIT Madras), Publisher: IIT Madras Open Courseware (Free PDF & videos), ISBN: N/A (Open Educational Resource).

2. Advances in corrosion science and technology, M.G. Fontana, R.W. Staettle, Springer publications, 2012, ISBN: 9781461590620.

3. Engineering Chemistry: Jain & Jain, **Publisher:** Dhanpat Rai Publishing Company, **ISBN:** 978-9353161181.

4. Smart materials, Harvey, James A. Handbook of materials selection, 2002, John Wiley & Sons Canada, Limited, ISBN: 9780471359241.

5. Energy storage and conversion devices; Supercapacitors, batteries and hydroelectric Cells Editor: Anurag Gaur, 2021, CRC Press, ISBN: 9781000470512.

Web links and Video Lectures (e-Resources):

1. **https://youtu.be/HT21wrGl6oM**
2. **https://youtu.be/aG2F-fd2drM**
3. **https://youtu.be/ivWXuOd5SrI**
4. **https://www.youtube.com/watch?v=BGdCj3-PEoE**
5. **https://www.youtube.com/watch?v=xvtOPHsukzE**
6. **https://www.youtube.com/watch?v=VxMM4g2Sk8U**

7. **https://www.youtube.com/watch?v=0bjRNq1PKak**
8. **https://youtu.be/XIjDw5Sw9c4**
9. **https://youtu.be/lB2zbQvnwXw**
10. **https://youtu.be/FNohb7ZKxMI**
11. **https://www.youtube.com/watch?v=Y-nZbZzBOPg**
12. **https://en.wikipedia.org/wiki/Graphene_quantum_dot**
13. **https://youtu.be/NCOwWEMEQN8**
14. **https://youtu.be/u_2YRTmOTWQ**
15. **https://youtu.be/ygtbo5KDXeI**
16. **https://youtu.be/whyIdJab1kM**
17. **https://youtu.be/3TYH-8pPDV4**
18. **https://youtu.be/xS60SGWSw4s**
19. **https://youtu.be/zJTQLce-WC8**
20. **https://www.youtube.com/watch?v=dmZtRntO1QI**
21. **https://www.youtube.com/watch?v=Kbta_BXZ4Vs&t=73s**

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Project-Based Learning (PBL): Students gain knowledge by working on complex, real-world projects over time.

Example: Building prototypes, developing community solutions, research presentations.

2. Flipped Classroom: Students learn theoretical content at home (videos, readings) and engage in problem-solving or discussions in class.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE Theory component will be 30 marks and CIE Practical component will be 20 marks.

The CIE Theory component consists of IA tests for 25 marks and Continuous Comprehensive Assessments (CCA) for 5 marks. The CIE Practical component for continuous assessments will be for 15 marks through rubrics and for lab tests will be for 5 marks.

- To qualify and become eligible to appear for SEE, in the **CIE theory component**, a student must score at least **40% of 30 marks**, i.e., **12 marks**.
- To qualify and become eligible to appear for SEE, in the **CIE Practical component**, a student must secure **a minimum of 40% of 20 marks**, i.e., **08 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE (and SEE is at least 40 out of 100 marks)**.

Continuous Comprehensive Assessments(CCA):

CCA will be conducted for a total of 5 marks. It is recommended to include any one learning activity aimed at enhancing the holistic development of students. This activity should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1: (Marks- 5)

CIE Practical component:

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The summation of all the experiments marks to be scaled down to 15 marks.

The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 5 marks. For laboratory test, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

Performance Indicator (CO/PO Mapping)	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 - PO1, PO2, PO3, PO11)	Analyze / Clearly explains the deep understanding of material properties and their impact on electronics/IoT performance.	Explains understanding of material properties and their impact on electronics/IoT performance with minimal gaps.	Basic understanding of material properties with limited applications.	Misinterprets material functions or uses incorrect applications.	Fails to explain material properties and their impact on electronics/IoT performance.
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO4, PO11)	Clearly analyzes nanomaterials and quantum dots for innovative applications for electronic systems.	Analyzes nanomaterials and quantum dots with some clarity, identifying relevant applications in electronic systems.	Provides a basic analysis of nanomaterials and quantum dots, with limited connection to their applications in electronic systems.	Demonstrates minimal understanding of nanomaterials and quantum dots; struggles to link them to electronic system applications.	Fails to analyze nanomaterials and quantum dots; shows no understanding of their relevance to electronic systems.
Performance Indicator 3 (CO3 - PO1, PO2, PO3, PO11)	Effectively evaluates the use of functional polymers and hybrid composites in various electronic applications	Evaluates the use of functional polymers and hybrid composites with moderate clarity and relevance to electronic applications.	Provides a basic or partial evaluation of functional polymers and hybrid composites, with limited connection to electronic applications.	Demonstrates minimal evaluation of functional polymers and hybrid composites.	Fails to evaluate functional polymers and hybrid composites.
Performance Indicator 4 (CO4 - PO1, PO2, PO3, PO4, PO11)	Effectively interprets the electrode systems and electrochemical sensors for real-time monitoring in diverse sectors.	Interprets electrode systems and electrochemical sensors with reasonable clarity for real-time monitoring.	Provides a basic or partial interpretation of electrode systems and electrochemical sensors.	Demonstrates minimal understanding of electrode systems or electrochemical sensors	Fails to interpret electrode systems and electrochemical sensors.
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO11)	Clearly Assess and comprehensive understanding of corrosion mechanisms and e-waste management strategies to enhance electronic device life and environmental safety.	Assesses corrosion mechanisms and e-waste strategies with moderate clarity.	Provides a basic assessment of corrosion and e-waste management.	Demonstrates minimal assessment of corrosion mechanisms or e-waste strategies.	Fails to assess corrosion mechanisms or e-waste management strategies.

Rubrics for CIE – Continuous assessment:

Performance Indicator (CO/PO Mapping)	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 - PO1, PO2, PO3, PO11)	Analyze / Clearly explains the deep understanding of material properties and their impact on electronics/IoT performance.	Explains understanding of material properties and their impact on electronics/IoT performance with minimal gaps.	Basic understanding of material properties with limited applications.	Misinterprets material functions or uses incorrect applications.	Fails to explain material properties and their impact on electronics/IoT performance.
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO4, PO11)	Clearly analyzes nanomaterials and quantum dots for innovative applications for electronic systems.	Analyzes nanomaterials and quantum dots with some clarity, identifying relevant applications in electronic systems.	Provides a basic analysis of nanomaterials and quantum dots, with limited connection to their applications in electronic systems.	Demonstrates minimal understanding of nanomaterials and quantum dots; struggles to link them to electronic system applications.	Fails to analyze nanomaterials and quantum dots; shows no understanding of their relevance to electronic systems.
Performance Indicator 3 (CO3 - PO1, PO2, PO3, PO11)	Effectively evaluates the use of functional polymers and hybrid composites in various electronic applications	Evaluates the use of functional polymers and hybrid composites with moderate clarity and relevance to electronic applications.	Provides a basic or partial evaluation of functional polymers and hybrid composites, with limited connection to electronic applications.	Demonstrates minimal evaluation of functional polymers and hybrid composites.	Fails to evaluate functional polymers and hybrid composites.
Performance Indicator 4 (CO4 - PO1, PO2, PO3, PO4, PO11)	Effectively interprets the electrode systems and electrochemical sensors for real-time monitoring in diverse sectors.	Interprets electrode systems and electrochemical sensors with reasonable clarity for real-time monitoring.	Provides a basic or partial interpretation of electrode systems and electrochemical sensors.	Demonstrates minimal understanding of electrode systems or electrochemical sensors	Fails to interpret electrode systems and electrochemical sensors.
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO11)	Clearly Assess and comprehensive understanding of corrosion mechanisms and e-waste management strategies to enhance electronic device life and environmental safety.	Assesses corrosion mechanisms and e-waste strategies with moderate clarity.	Provides a basic assessment of corrosion and e-waste management.	Demonstrates minimal assessment of corrosion mechanisms or e-waste strategies.	Fails to assess corrosion mechanisms or e-waste management strategies.

Rubrics for SEE / CIE Test:

Performance Indicator (CO/PO Mapping)	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 - PO1, PO2, PO3, PO11)	Analyze / Clearly explains the deep understanding of material properties and their impact on electronics/IoT performance.	Explains understanding of material properties and their impact on electronics/IoT performance with minimal gaps.	Basic understanding of material properties with limited applications.	Misinterprets material functions or uses incorrect applications.	Fails to explain material properties and their impact on electronics/IoT performance.
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO4, PO11)	Clearly analyzes nanomaterials and quantum dots for innovative applications for electronic systems.	Analyzes nanomaterials and quantum dots with some clarity, identifying relevant applications in electronic systems.	Provides a basic analysis of nanomaterials and quantum dots, with limited connection to their applications in electronic systems.	Demonstrates minimal understanding of nanomaterials and quantum dots; struggles to link them to electronic system applications.	Fails to analyze nanomaterials and quantum dots; shows no understanding of their relevance to electronic systems.
Performance Indicator 3 (CO3 - PO1, PO2, PO3, PO11)	Effectively evaluates the use of functional polymers and hybrid composites in various electronic applications	Evaluates the use of functional polymers and hybrid composites with moderate clarity and relevance to electronic applications.	Provides a basic or partial evaluation of functional polymers and hybrid composites, with limited connection to electronic applications.	Demonstrates minimal evaluation of functional polymers and hybrid composites.	Fails to evaluate functional polymers and hybrid composites.
Performance Indicator 4 (CO4 - PO1, PO2, PO3, PO4, PO11)	Effectively interprets the electrode systems and electrochemical sensors for real-time monitoring in diverse sectors.	Interprets electrode systems and electrochemical sensors with reasonable clarity for real-time monitoring.	Provides a basic or partial interpretation of electrode systems and electrochemical sensors.	Demonstrates minimal understanding of electrode systems or electrochemical sensors	Fails to interpret electrode systems and electrochemical sensors.
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO11)	Clearly Assess and comprehensive understanding of corrosion mechanisms and e-waste management strategies to enhance electronic device life and environmental safety.	Assesses corrosion mechanisms and e-waste strategies with moderate clarity.	Provides a basic assessment of corrosion and e-waste management.	Demonstrates minimal assessment of corrosion mechanisms or e-waste strategies.	Fails to assess corrosion mechanisms or e-waste management strategies.

Suggested rubrics for Practical continuous assessment:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge(2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best(4)	Student is capable of discussing single design with its merits and de-merits(3)	Student is capable of explaining the design (1-2)
Implementation (8) (PO3 &PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation.(3-4)	Student is capable of implementing the design. (1-2)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases.(4)	Student will be able to run the code for few cases and analyze the output(3)	Student will be able to run the program but not able to analyze the output(1-2)
Demonstration (8) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)

Note: Can add Engineering & IT tool usage based on the nature of the course

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration

- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Applied Chemistry for Smart Systems (CSE stream)		Semester	I/II
Course Code	**1BCHES102/202**	CIE Marks	**50**
Teaching Hours/Week (L:T:P:S)	**3:0:2:0**	SEE Marks	**50**
Total Hours of Pedagogy (Theory and Lab hours)	**60**	Total Marks	**100**
Credits	**04**	Exam Hours	**03**
Examination type (SEE)	Descriptive		

Course outcome (Course Skill Set)

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

CO1: Understand the structure, synthesis, and applications of functional materials in memory and display devices.

CO2: Analyze quantum materials, conducting polymers, and their roles in energy and electronic systems.

CO3: Evaluate next-generation energy systems, fuel cells, and green hydrogen technologies.

CO4: Apply concepts of sensors, corrosion control, and green materials in sustainable electronics and e-waste management.

Module-1 Functional Materials for Memory and Display Systems

Memory Devices: Introduction, organic semiconductors; types of organic semiconductors used in memory devices, p-type semiconductor-pentacene and n- type semiconductor -perfluoropentacene, difference between organic and inorganic memory devices, construction, working and advantages of pentacene semiconductor chip.

Resistive RAM (ReRAM) Materials: Introduction, synthesis of TiO_2-RAM nanomaterial by sol-gel method, properties and its applications.

Display Systems: Introduction, liquid crystals (LCs)- classification, properties and its applications in Liquid Crystal Displays (LCDs), construction, working principle and applications of LEDs, OLEDs, Active Matrix Organic Light Emitting Diodes (AMOLEDs) and Quantum Light Emitting Diodes (QLEDs).

Number of Hours**: 08**

Module-2 Quantum Materials and Polymers
Quantum Dots: Introduction, size dependent properties -quantum confinement effect, surface-to-volume ratio & band gap, synthesis and applications of Cd-Se Quantum dots by wet chemical method, quantum dot sensitized solar cells (QDSSCs)-construction, working principle and applications. **Polymer**: Introduction, molecular weight of polymers - number and weight average molecular weight of polymers, numerical problems, structure-property relationship of polymers, synthesis and properties of nylon-12 advantages in 3D printing applications, synthesis and properties of PVC and PMMA for device applications. **Conducting polymers**- Introduction, synthesis of polyaniline, conductions mechanism and its engineering applications. Number of Hours**: 08**
Module-3 Sustainable Chemistry for Energy Devices
Batteries: Introduction, basic overview of Nernst equation, concentration cell and numerical problems, classification of batteries, construction, working and applications of Li-Ion battery. **Next-Generation Energy Systems:** Introduction, construction and working of sodium ion battery and redox flow battery for EV applications. Construction and working of ultra-small asymmetric super capacitor and its applications in IoT/wearable devices. **Clean Energy Chemistry:** Introduction, fuel cell, difference between fuel cell and battery, construction, working principle, applications and limitations of solid-oxide fuel cell (SOFCs) and solar photovoltaic cell (PV cell). Production of green hydrogen by photocatalytic water splitting using TiO_2 method and its advantages. Number of Hours: **08**
Module-4 Chemical Sensors and Corrosion Control
Sensors: Introduction, terminologies- Transducer, Actuators and Sensors, working principle and applications- conductometric sensor and colorimetric sensor, electrochemical gas sensors for the detection of NOx & SOx in air sample, Biosensor-principle and working mechanism for detection of glucose in biofluids. **Corrosion:** Introduction, electrochemical theory of corrosion, types-differential metal and differential aeration corrosion, corrosion control- Galvanization and anodization, vapour corrosion inhibitors for protecting computer circuit boards, corrosion penetration rate (CPR)- definition, importance and numerical problems. Number of Hours: **08**

Module-5 Green Materials and E-Waste Management

Green Chemistry: Introduction, properties and applications of green solvents for server heat management, biosynthesis and properties of glycerol trioleate ester for server and IT infrasrtrure applications. Green synthesis of ZnO nanoparticles for magnetic Radio Frequency Identification (RFID) & Internet of Nano Things (IONT) system applications

Biomaterials: Introduction, synthesis and properties of polylactic Acid (PLA) and polyethylene glycol (PEG) for touch screen applications, synthesis and properties of Alginate Hydrogel for Brain-Computer Interfaces (BCIs) applications.

E-waste: Introduction, sources, composition of e-waste, effects of e-waste on environment and human health, Artificial intelligence in e-waste management and its applications, extraction of gold from e-waste by bioleaching method, direct recycling method of lithium-ion batteries.

Number of Hours: **08**

PRACTICAL COMPONENTS OF IPCC

FIXED SET OF EXPERIMENTS

1. Estimation of total hardness of water by EDTA method.
2. Determination of chemical oxygen demand (COD) of industrial effluent sample.
3. Estimation of iron in TMT bar by diphenyl amine indicator method.
4. Determination of alkalinity of given boiler water sample.
5. Green synthesis of copper nanoparticles for conductive ink applications.
6. Estimation of acid mixture by conductometric sensor (Conductometry).
7. Estimation of iron in rust sample by Potentiometric sensor (Potentiometry).
8. Determination of pKa of vinegar using pH sensor (Glass electrode).
9. Estimation of copper present in e-waste by optical sensor (Colorimetry).
10. Smartphone-Based colorimetric estimation of total phenolic content in coffee products.
11. Data analysis of pka of a week acid and its interpretation using origin software.
12. Chemical structure drawing using software: Chem Draw/ Chem Sketch.

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. Engineering Chemistry, Suba Ramesh, Vairam, Ananda Murthy, 2011, Wiley India, ISBN: 9788126519880.
2. Engineering Chemistry, Shubha Ramesh et.al., Wiley India, 1st Edition, 2011, ISBN: 9788126519880.
3. Chemistry For Engineering Students by Dr B S Jai Prakash , Prof R Venugopal, Dr Shivakumaraiah.

Reference books / Manuals:

1.Semiconducting Materials and Devices-Deepak Verma, ISBN: 978 9394777712,

2.Organic Thin Film Transistor Applications: Materials to Circuits-Brajesh K. Kaushik et al. ISBN 10: 9781498736534

3. High Quality Liquid Crystal Displays and Smart Devices – Ishihara, Kobayashi & Ukai (2019,IET), ISBN: 9781785619397

4. Quantum Dots and Polymer Nanocomposites: Synthesis, Chemistry, and Applications- yotishkumar Parameswaranpillai, Poushali Das, Sayan Ganguly, Publisher: CRC Press, 2022,ISBN 13: 978 1032210148

5. Green Carbon Quantum Dots: Environmental Applications; Vijay Kumar, Pardeep Singh, Devendra Kumar Singh (India), Springer Nature Singapore, Oct 2024, ISBN 13: 978 9819762026.

6. Conducting Polymers, Fundamentals and Applications: Including Carbon Nanotubes and Graphene: Prasanna Chandrasekhar (IIT Delhi alumnus), Springer, 2019 (2nd ed.), ISBN 13: 978 3030098858.

Web links and Video Lectures (e-Resources):

1.https://youtu.be/1TGTVQbMlIc
2. https://www.youtube.com/watch?v=IzWONUYlQ5E&t=56s
3. https://youtu.be/3j0jLuOs0v4
4. https://youtu.be/CeZxn8CyM6Q
5. https://youtu.be/om0gppRTKoU
6. https://youtu.be/_ubwkG7uCFA
7. https://youtu.be/0Eokkhdppg E?si=L6Znx5yXYjI9EVlw
8. https://youtu.be/hT2yCPnNEoI
9. https://www.youtube.com/watch?v=EE35ICGthR8
10. https://www.youtube.com/live/CMyIb58vd4Q
11. https://www.youtube.com/watch?v=YsZcSnqV9lg
12. https://youtu.be/xrsK9FUdvRE?si=prlzf7fRocxxygJr
13. https://youtu.be/OEDapr-9lNE?si=CYdVhq3d5ffzdXUC
14. https://youtu.be/QNKPaZkWC9Q?si=PyI4sQUL75340I9i
15. https://youtu.be/0Citdpy92EE
16. https://youtu.be/zaNdJ9I21YA

17. https://youtu.be/YAW7nMf8j0A
18. https://www.youtube.com/watch?v=FXGNQqdRBzc
19. https://www.youtube.com/watch?v=KvmqgAYO0MI
20. https://www.youtube.com/watch?v=SvlrAFDHOLc
21. https://youtu.be/kUCVBhSka2Q
22. https://www.youtube.com/watch?v=Ic5TEuKxj8M
23. https://www.youtube.com/watch?v=ATn92XwdgC4
24. https://www.youtube.com/watch?v=ldlniZfA2X4
25. https://www.youtube.com/watch?v=C0K1XRT1myg
26. https://www.youtube.com/watch?v=iVcSgej7-K8

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Project-Based Learning (PBL): Students gain knowledge by working on complex, real-world projects over time.

Example: Building prototypes, developing community solutions, research presentations.

2. Flipped Classroom: Students learn theoretical content at home (videos, readings) and engage in problem solving or discussions in class.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE Theory component will be 30 marks and CIE Practical component will be 20 marks.

The CIE Theory component consists of IA tests for 25 marks and Continuous Comprehensive Assessments (CCA) for 5 marks. The CIE Practical component for continuous assessments will be for 15 marks through rubrics and for lab tests will be for 5 marks.

- To qualify and become eligible to appear for SEE, in the **CIE theory component**, a student must score at least **40% of 30 marks**, i.e., **12 marks**.
- To qualify and become eligible to appear for SEE, in the **CIE Practical component**, a student must secure **a minimum of 40% of 20 marks**, i.e., **08 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments(CCA):

CCA will be conducted for a total of 5 marks. It is recommended to include any one learning activity aimed at enhancing the holistic development of students. This activity should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1: (Marks- 5)

CIE Practical component:

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The summation of all the experiments marks to be scaled down to 15 marks.

The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 5 marks. For laboratory test, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

Performance Indicator (CO/PO Mapping)	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 - PO1, PO2, PO3, PO5, PO11)	Provides a comprehensive and insightful analysis of the structural, electrical, and optical properties of functional materials, with advanced applications in memory and display technologies.	Analyzes key properties of functional materials and explains their applications in memory and display systems.	Demonstrates a basic understanding of material properties and gives general applications in memory or display technologies.	Shows limited analysis of material properties; applications in memory and display systems are mentioned with minimal explanation.	Fails to analyze properties or applications of functional materials in memory and display technologies
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO5, PO11)	Demonstrates deep and clear understanding of the properties, behavior, and technological relevance of quantum materials and polymers.	Shows solid understanding of key concepts related to quantum materials and polymers.	Demonstrates a basic understanding of quantum materials and polymers.	Shows limited or unclear understanding of quantum materials or polymers.	Fails to demonstrate understanding of quantum materials and polymers.
Performance Indicator 3 (CO3 - PO1, PO2, PO3, PO6, PO11)	Effectively applies sustainable chemistry principles with innovative approaches to the design and development of energy storage and conversion devices.	Applies key sustainable chemistry principles in the development of energy storage and conversion systems.	Demonstrates basic application of sustainable chemistry concepts; shows general understanding of their role in energy device.	Provides minimal application of sustainable chemistry, weak link to energy storage and conversion devices.	Fails to apply sustainable chemistry principles; no relevance to energy storage or conversion device.
Performance Indicator 4 (CO4 - PO1, PO2, PO3, PO4, PO5, PO11)	Demonstrates advanced ability to design and critically evaluate chemical sensors and corrosion control methods with clear applicability to both industrial and environmental systems.	Clearly designs and evaluates chemical sensors and corrosion control methods, showing appropriate understanding of their industrial and environmental relevance.	Shows basic design and evaluation of chemical sensors or corrosion control methods with limited application details and minimal technical depth.	Provides minimal or unclear design or evaluation; weak understanding of applications in industrial or environmental contexts.	Fails to design or evaluate relevant sensors or corrosion control methods; lacks understanding of industrial and environmental applications
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO4, PO6, PO11)	Thoroughly assesses a wide range of green materials and proposes innovative, effective strategies for e-waste reduction and management.	Clearly evaluates green materials and implements appropriate strategies for e-waste reduction and management with a solid understanding of sustainability concerns.	Demonstrates a basic assessment of green materials and outlines general e-waste management strategies, though lacking in depth.	Shows limited understanding of green materials or provides weak strategies for e-waste reduction with minimal practical relevance.	Fails to assess green materials or suggest meaningful e-waste management strategies & lacks awareness of sustainability.

Rubrics for CIE – Continuous assessment:

Performance Indicator (CO/PO Mapping)	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 - PO1, PO2, PO3, PO5, PO11)	Provides a comprehensive and insightful analysis of the structural, electrical, and optical properties of functional materials, with advanced applications in memory and display technologies.	Analyzes key properties of functional materials and explains their applications in memory and display systems.	Demonstrates a basic understanding of material properties and gives general applications in memory or display technologies.	Shows limited analysis of material properties; applications in memory and display systems are mentioned with minimal explanation.	Fails to analyze properties or applications of functional materials in memory and display technologies
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO5, PO11)	Demonstrates deep and clear understanding of the properties, behavior, and technological relevance of quantum materials and polymers.	Shows solid understanding of key concepts related to quantum materials and polymers.	Demonstrates a basic understanding of quantum materials and polymers.	Shows limited or unclear understanding of quantum materials or polymers.	Fails to demonstrate understanding of quantum materials and polymers.
Performance Indicator 3 (CO3 - PO1, PO2, PO3, PO6, PO11)	Effectively applies sustainable chemistry principles with innovative approaches to the design and development of energy storage and conversion devices.	Applies key sustainable chemistry principles in the development of energy storage and conversion systems.	Demonstrates basic application of sustainable chemistry concepts; shows general understanding of their role in energy device.	Provides minimal application of sustainable chemistry, weak link to energy storage and conversion devices.	Fails to apply sustainable chemistry principles; no relevance to energy storage or conversion device.
Performance Indicator 4 (CO4 - PO1, PO2, PO3, PO4, PO5, PO11)	Demonstrates advanced ability to design and critically evaluate chemical sensors and corrosion control methods with clear applicability to both industrial and environmental systems.	Clearly designs and evaluates chemical sensors and corrosion control methods, showing appropriate understanding of their industrial and environmental relevance.	Shows basic design and evaluation of chemical sensors or corrosion control methods with limited application details and minimal technical depth.	Provides minimal or unclear design or evaluation; weak understanding of applications in industrial or environmental contexts.	Fails to design or evaluate relevant sensors or corrosion control methods; lacks understanding of industrial and environmental applications
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO4, PO6, PO11)	Thoroughly assesses a wide range of green materials and proposes innovative, effective strategies for e-waste	Clearly evaluates green materials and implements appropriate strategies for e-waste reduction and management with a solid understanding	Demonstrates a basic assessment of green materials and outlines general e-waste management strategies, though lacking in depth.	Shows limited understanding of green materials or provides weak strategies for e-waste reduction with minimal practical relevance.	Fails to assess green materials or suggest meaningful e-waste management strategies & lacks awareness of sustainability.

	reduction and management.	of sustainability concerns.			

Rubrics for SEE / CIE Test:

Performance Indicator (CO/PO Mapping)	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 - PO1, PO2, PO3, PO5, PO11)	Provides a comprehensive and insightful analysis of the structural, electrical, and optical properties of functional materials, with advanced applications in memory and display technologies.	Analyzes key properties of functional materials and explains their applications in memory and display systems.	Demonstrates a basic understanding of material properties and gives general applications in memory or display technologies.	Shows limited analysis of material properties; applications in memory and display systems are mentioned with minimal explanation.	Fails to analyze properties or applications of functional materials in memory and display technologies
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO5, PO11)	Demonstrates deep and clear understanding of the properties, behavior, and technological relevance of quantum materials and polymers.	Shows solid understanding of key concepts related to quantum materials and polymers.	Demonstrates a basic understanding of quantum materials and polymers.	Shows limited or unclear understanding of quantum materials or polymers.	Fails to demonstrate understanding of quantum materials and polymers.
Performance Indicator 3 (CO3 - PO1, PO2, PO3, PO6, PO11)	Effectively applies sustainable chemistry principles with innovative approaches to the design and development of energy storage and conversion devices.	Applies key sustainable chemistry principles in the development of energy storage and conversion systems.	Demonstrates basic application of sustainable chemistry concepts; shows general understanding of their role in energy device.	Provides minimal application of sustainable chemistry, weak link to energy storage and conversion devices.	Fails to apply sustainable chemistry principles; no relevance to energy storage or conversion device.
Performance Indicator 4 (CO4 - PO1, PO2, PO3, PO4, PO5, PO11)	Demonstrates advanced ability to design and critically evaluate chemical sensors and corrosion control methods with clear applicability to both industrial and environmental systems.	Clearly designs and evaluates chemical sensors and corrosion control methods, showing appropriate understanding of their industrial and environmental relevance.	Shows basic design and evaluation of chemical sensors or corrosion control methods with limited application details and minimal technical depth.	Provides minimal or unclear design or evaluation; weak understanding of applications in industrial or environmental contexts.	Fails to design or evaluate relevant sensors or corrosion control methods; lacks understanding of industrial and environmental applications
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO4, PO6,	Thoroughly assesses a wide range of green materials and	Clearly evaluates green materials and implements appropriate	Demonstrates a basic assessment of green materials and outlines general e-	Shows limited understanding of green materials or provides weak	Fails to assess green materials or suggest meaningful e-waste

PO11)	proposes innovative, effective strategies for e-waste reduction and management.	strategies for e-waste reduction and management with a solid understanding of sustainability concerns.	waste management strategies, though lacking in depth.	strategies for e-waste reduction with minimal practical relevance.	management strategies & lacks awareness of sustainability.

Suggested rubrics for Practical continuous assessment:

Performance Indicators	**Excellent**	**Very Good**	**Good**	**Satisfactory**
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge(2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best(4)	Student is capable of discussing single design with its merits and de-merits(3)	Student is capable of explaining the design (1-2)
Implementation (8) (PO3 &PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation.(3-4)	Student is capable of implementing the design. (1-2)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases.(4)	Student will be able to run the code for few cases and analyze the output(3)	Student will be able to run the program but not able to analyze the output(1-2)
Demonstration (8) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)

Note: Can add Engineering & IT tool usage based on the nature of the course

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Introduction to AI and Applications		Semester	I/II
Course Code	**1BAIA103/203**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Explain the concepts and types of artificial intelligence.
CO2: Illustrate basic machine learning methods for regression, classification and clustering.
CO3: Identify real-world applications across different disciplines.
CO4: Make use of prompt engineering techniques to interact with generative AI tools.
CO5: Outline recent trends in artificial intelligence and machine learning.

Module-1

Introduction to Artificial Intelligence: Artificial Intelligence, How Does AI Work?, Advantages and Disadvantages of Artificial Intelligence, History of Artificial Intelligence, Types of Artificial Intelligence, Weak AI, Strong AI, Reactive Machines, Limited Memory, Theory of Mind, Self-Awareness, Is Artificial Intelligence Same as Augmented Intelligence and Cognitive Computing, Machine Learning and Deep Learning.

Machine Intelligence: Defining Intelligence, Components of Intelligence, Differences Between Human and Machine Intelligence, Agent and Environment, Search, Uninformed Search Algorithms, Informed Search Algorithms: Pure Heuristic Search, Best-First Search Algorithm (Greedy Search).

Knowledge Representation: Introduction, Knowledge Representation, Knowledge-Based Agent, Types of Knowledge.

Textbook 1: Chapter 1 (1.1-1.5), Chapter 3 (3.1-3.7.2), Chapter 4 (4.1-4.4)

Number of Hours: 08

Module-2

Introduction to Prompt Engineering, Introduction to Prompt Engineering, The Evolution of Prompt Engineering, Types of Prompts, How Does Prompt Engineering Work?, Comprehending Prompt Engineering's Function in Communication, The Advantages of Prompt Engineering, The Future of LLM Communication.

Prompt Engineering Techniques for ChatGPT, Introduction to Prompt Engineering Techniques, Instructions Prompt Technique, Zero, One, and Few Shot Prompting, Self-Consistency Prompt.

Prompts for Creative Thinking: Introduction, Unlocking Imagination and Innovation.

Prompts for Effective Writing: Introduction, Igniting the Writing Process with Prompts.

Textbook 2: Chapters 1, 3, 4 & 5 Number of Hours: 08

Module-3

Machine Learning: Techniques in AI, Machine Learning Model, Regression Analysis in Machine Learning, Classification Techniques, Clustering Techniques, Naïve Bayes Classification, Neural Network, Support Vector Machine (SVM).

Textbook 1: Chapter 2 (2.1-2.8) Number of Hours: 08

Module-4

Trends in AI: AI and Ethical Concerns, AI as a Service (AIaaS), Recent trends in AI, Expert System, Internet of Things, Artificial Intelligence of Things (AIoT).

Textbook 1: Chapter 8 (8.1, 8.2, 8.4), Chapter 9 (9.1- 9.3) Number of Hours: 08

Module-5

Robotics, Robotics-an Application of AI, Drones Using AI, No Code AI, Low Code AI.

Textbook 1: Chapter 8 (8.3), Chapter 1 (1.7, 1.8, 1.10, 1.11)

Industrial Applications of AI: Application of AI in Healthcare, Application of AI in Finance, Application of AI in Retail, Application of AI in Agriculture, Application of AI in Education, Application of AI in Transportation, AI in Experimentation and Multi-disciplinary research.

Textbook 3: Chapter 3, Chapter 5 (5.1)

Number of Hours: 08

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Textbooks:

1. Reema Thareja, Artificial Intelligence: Beyond Classical AI, Pearson Education, 2023.
2. Ajantha Devi Vairamani and Anand Nayyar, Prompt Engineering: Empowering Communication, 1st Edition, CRC Press, Taylor & Francis Group, 2024. (DOI: https://doi.org/10.1201/9781032692319).
3. Saptarsi Goswami, Amit Kumar Das and Amlan Chakrabarti, "AI for Everyone – A Beginner's Handbook for Artificial Intelligence", Pearson, 2024.

Reference books / Manuals:

1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach* (4th Edition), Pearson Education, 2023.
2. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, *Artificial Intelligence*, McGraw Hill Education.
3. Tom Taulli, *Prompt Engineering for Generative AI: ChatGPT, LLMs, and Beyond*, Apress, Springer Nature.
4. Nilakshi Jain, Artificial Intelligence: Making A System Intelligent, First Edition, Wiley.

Web links and Video Lectures (e-Resources):

1. Elements of AI – *https://www.elementsofai.com*
2. CS50's Introduction to Artificial Intelligence with Python – Harvard *https://cs50.harvard.edu/ai/*
3. Google Machine Learning Crash Course – *https://developers.google.com/machine-learning/crash-course*
4. Learn Prompting (Open-Source Guide) – *https://learnprompting.org*
5. Google AI – Learn with Google AI *https://ai.google/education/*
6. Coursera – Machine Learning by Andrew Ng (Stanford University) *https://www.coursera.org/learn/machine-learning*
7. OpenAI Prompt Engineering Guide (for ChatGPT) *https://platform.openai.com/docs/guides/gpt-best-practices*
8. Prompt Engineering for Developers – DeepLearning.AI + OpenAI *https://www.deeplearning.ai/short-courses/chatgpt-prompt-engineering-for-developers/*
9. Ethics in AI – Google Responsible AI Practices *https://ai.google/responsibilities/responsible-ai-practices/*
10. Google Teachable Machine (Train AI models visually without code) https://teachablemachine.withgoogle.com

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching

- Simulation and Virtual Labs
- ICT-Enabled Teaching
- Tool Demonstration

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course outcomes and promote higher-order thinking and application-based learning.

Learning Activity -1: Practical Assignment on Creating Effective Prompts (Marks- 25)

INSTRUCTIONS:

1. Students must demonstrate the solutions to the course instructor and submit the record containing prompt creation (procedure), prompt execution and results with observations.
2. Course instructor must evaluate the student performance as per the rubrics.

Sl. No	Activity on Creating Effective Prompts
Note: To conduct the activity students can use any of the AI tools such as ChatGPT.	
1	**Basic Prompt writing:** Create two different prompts to ask an AI about the topic "Electricity." The first prompt should be vague, and the second prompt should be clear and specific. Compare the responses you get and describe which prompt gave a better answer and why.
2	**Zero-Shot Prompting**: Create a prompt that asks an AI to explain Ohm's Law without giving any example or background. Evaluate how well the AI explains the concept based on your prompt alone.
3	**One-Shot and Few-Shot Prompting:** Provide the AI with a single example of how to calculate the resistance in a simple circuit. Then write your own prompt asking the AI to solve a similar resistance calculation. After that, add two more examples to your prompt and observe any changes in the AI's response quality.
4	**Chain-of-Thought Prompting:** Develop a prompt that guides the AI step-by-step through calculating current flow in a circuit using Ohm's Law with resistors in series. Then, ask a final question for the AI to solve. Analyze how breaking down the reasoning steps impacts the accuracy of the answer.
5	**Prompt Refinement:** Start with an ambiguous prompt related to the "Water Cycle." Test the AI's response, note the confusion or errors, and then refine your prompt to make it clearer and more specific. Repeat this process twice and record how the AI's responses improve with each refinement. **Role-Based Prompting:** Create three prompts asking the AI to explain "Newton's Laws of Motion," each with a different role instruction: (a) as an expert engineer, (b) as a high school teacher, (c) as a beginner. Compare the tone, detail, and style of the responses.
6	**Creative Engineering Problem Prompts:** Craft a prompt that asks the AI to brainstorm ideas for designing a low-cost water purification system suitable for rural areas. Encourage creativity by adding phrases like **"limited resources"** and **"sustainability"**.

7	**Ethical Prompt Design Discussion:** Identify a biased prompt related to job descriptions (e.g. language with respect to a gender). Rewrite the prompt to remove bias and create a neutral, inclusive version. Explain why this revision is more ethical.
8	**Simulated Customer Support Chatbot:** Develop a prompt that instructs the AI to play the role of a technical support agent helping a customer troubleshoot a failure in an electronic circuit. Include instructions to keep the tone friendly and professional and to ask diagnostic questions.
9	**Multi-Language Prompting:** Develop a prompt that asks the AI to translate a simple engineering glossary (5 technical terms) from English to your native language. Then modify the prompt to request additional explanations of these terms in the translated language.
10	Review a curated set of different prompt types (e.g., for summarization, information extraction, paraphrasing, question answering) from a "Prompt Gallery." For each prompt type, match it with a real-world task (e.g., summarizing a lecture note, extracting names from a project report). Test at least three prompt templates on an AI tool or by role-play (students simulate being the AI), with varied wording. Record the outcomes and discuss which prompt (or template) was most effective for each task, and explain why you think it worked best. Reflect on how changing small parts of a prompt can alter model response quality, completeness, or accuracy.
11	Choose a real engineering challenge or societal problem relevant to your field (e.g., "Reducing plastic waste in campus cafeterias" or "Optimizing solar panel placement on campus rooftops"). Draft an initial prompt that asks an AI to propose practical solutions. Share the AI's (or peer's) answer in small groups and identify aspects that are missing, vague, or not actionable. Refine your prompt based on feedback (e.g., specify constraints, ask for step-by-step solutions, or require a list of pros and cons). Repeat the process one more time, refining again for further clarity or specificity. Document the entire prompt-refinement process and share the best solution generated, along with a brief analysis of how prompt improvements led to better responses.

Rubrics for Learning Activity (Creating Effective Prompts):

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Appropriate Use of Prompting Technique [CO4] [PO1, PO5]	Demonstrates precise and creative application of the intended prompting technique (e.g., zero-shot, few-shot, role-based) with full alignment to objectives.	Correctly applies the prompting technique with minor gaps or missed opportunities.	Uses the prompting technique, but with partial understanding or inconsistent application.	Limited understanding of the technique; incorrect or weak application.	No evidence of correct prompting technique use.
Analysis & Comparison of Responses [CO1] [PO2, PO4]	Provides thorough, insightful, and well-supported analysis of AI responses, comparisons highlight key strengths and weaknesses.	Provides clear analysis with relevant comparisons, though slightly less detailed.	Provides basic analysis with limited insight, comparisons are present but shallow.	Minimal analysis, comparisons are weak or incomplete.	No meaningful analysis or comparison.
Creativity & Problem-Solving [CO3, CO5] [PO3, PO11]	Demonstrates outstanding creativity and innovation in crafting prompts, especially for problem-solving or design tasks.	Demonstrates creativity and some innovation; solutions are practical.	Shows moderate creativity; prompts are functional but not innovative.	Minimal creativity; prompts are repetitive or unimaginative.	No creativity or problem-solving is evident.
Ethical Awareness & Inclusivity [CO-5] [PO7]	Identifies biases clearly and revises prompts to be fully ethical, inclusive, and culturally sensitive.	Identifies some biases and revises prompts to improve inclusivity.	Attempts bias identification, but revisions are incomplete or partly effective.	Minimal effort is made to address bias; inclusivity not fully considered.	No consideration of bias or ethics is used in prompts.
Clarity & Specificity of Prompts, Documentation & Reflection [CO1, CO4] [PO8, PO9, PO11]	Prompts are self-explanatory, specific, and well-structured for the intended activity; no ambiguity is present. Documentation is complete, well-organized, and includes deep reflection on improvements across iterations.	Prompts are clear and mostly specific; minor ambiguity is present. Documentation is complete with some reflection on prompt refinement.	Prompts are somewhat clear but could be more specific; moderate ambiguity. Documentation is present but lacks detail or depth in reflection.	Prompts are vague and lack clarity; high ambiguity. Incomplete documentation, reflection is minimal.	Prompts are unclear, incomplete, or irrelevant to the activity. No documentation or reflection provided as per schedule

INTRODUCTION TO MECHANICAL ENGINEERING		Semester	I/II
Course Code	**1BESC104D/204D**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3-0-0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	50
Credits	3	Exam Hours	3
Examination type (SEE)	**Theory**		

Course outcomes

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

1. Recognize the significance of mechanical engineering principles to solve the problems of social relevance.
2. Understand the working of I.C. engines, power transmission elements and future mobility vehicles.
3. Discuss the properties and applications of engineering materials, composite materials and smart materials.
4. Describe the working principles and applications of various manufacturing processes.
5. Explain the advances in mechanical engineering.

Module-1

Introduction: Streams in mechanical engineering and their relevance/significance, role of mechanical engineers in solving the real case problems (with examples), careers in mechanical engineering.

Realization of some of the engineering solutions through principles of mechanical engineering(with a schematic diagram):

Energy conversion: Introduction and basic working principles of Pelton Turbine and Centrifugal pump.

Vehicle systems: Identification of parts of vehicle systems such as steering system, brake system, gear system, working principle of Power steering.

Flying machines: Classification, basic parts involved in drone making, working principle of Drones.

Refrigeration and air conditioning principles.

Number of Hours:8

Module-2

Engines: Introduction, petrol engine, diesel engines, Working of four Stroke engines, applications.

Insight into Future Mobility: Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of EVs and Hybrid vehicles.

Power Transmission systems: Classification of gears, simple & compound gear trains, concepts of automatic and CVT transmission.

Number of Hours:8

Module-3

Engineering materials: Introduction, Classification, Ferrous and Non-Ferrous metals: Types, Properties and their applications.

Composite materials: Introduction, Constituents of a composite, Classification, Types of Matrix and Reinforcement materials, Advantages, Disadvantages and Applications of composite materials.

Smart materials: Introduction, Types - Piezoelectric materials, MR fluids, Shape memory alloys and Advantages, Disadvantages and Applications.

Number of Hours:8

Module-4

Manufacturing overview, classification of manufacturing processes, process selection criterion.
Principles of Welding, soldering, brazing.
Introduction to machine tools – lathe, drilling and milling machine.
Lathe operations: Turning, facing, knurling,
Drilling machine operations: Drilling, reaming, tapping.
Milling machine operations: End milling, face milling.
Introduction to CNC, components, advantages and applications.
Basic principles of 3D printing.

Number of Hours:8

Module-5

Advances in mechanical engineering
Automation technology: Definition of automation, types of automation, basic elements of automation.
Mechatronic systems: Definition of mechatronics, elements of mechatronics systems, examples.
Elementary sensors: Working principle and applications of Potentiometer, capacitive sensor and optical encoders.
Integrated system: Need for integration of technologies, ADAS (Advanced Driver Assistance System).

Number of Hours:8

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Textbooks:

1. Elements of Mechanical Engineering, K R Gopala Krishna, Subhash Publications, 2008
2. An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, Third Edition, 2012

Reference books / Manuals:

1. Manufacturing Technology- Foundry, Forming and Welding, P.N.Rao Tata McGraw Hill 3rd Ed., 2003.
2. William D. Callister, Materials Science & Engineering, An Introduction, John Wiley & Sons Inc, 2010.
3. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill Education; 4th edition, 2017.
4. Robotics, Appu Kuttan KK K. International Pvt Ltd, volume 1
5. Groover M. P.(2008). Automation, production systems, and computer integrated manufacturing, 3rd ed. Prentice Hall.
6. Dr SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A Practical Approach", ETI Labs

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/112104526
- https://nptel.ac.in/courses/112104616
- https://nptel.ac.in/courses/112104769
- https://theconstructor.org/practical-guide/pelton-turbine-parts-working-design-aspects/2894/
- https://www.mechstudies.com/centrifugal-pump/
- https://cfdflowengineering.com/working-principle-and-components-of-drone/
- https://youtu.be/i1ojp09VXHY
- https://www.theengineerspost.com/automatic-transmission/
- https://learnmech.com/continuously-variable-transmission-components-working-types/

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

- Flipped Classroom
- Simulation and Virtual Labs
- Partial Delivery of course by Industry experts
- ICT-Enabled Teaching
- Video demonstration

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA shall be conducted for 25 marks. It is evaluated through the learning activity which is aimed at enhancing the holistic development of students. The activity should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity : Case Study Presentation (Marks - 25)

Rubrics for Learning Activity:

Case Study Presentation (25 Marks)

Case Study topic should relate to key learning area from the syllabus and allow exploration of practical applications, challenges, and innovations relevant to engineering education and industry.

Performance Indicators	Excellent	Good	Satisfactory	Needs Improvement	Poor
Understanding of Case (5 Marks) (PO 1)	Demonstrates deep understanding **(5)**	Good understanding **(4)**	Adequate understanding. **(3)**	Limited understanding **(2)**	No clear understanding. **(0-1)**
Analysis & Critical Thinking (10 Marks) (PO 2)	Thorough, logical analysis with strong reasoning and innovative insights. **(9-10)**	Clear analysis with mostly logical reasoning. **(7-8)**	Basic analysis with some reasoning gaps. **(5-6)**	Weak analysis; mostly descriptive without reasoning. **(3-4)**	No clear analysis or reasoning. **(0-2)**
Documentation & Presentation Skills (5 Marks) (PO 9)	Documentation is complete, accurate, well-structured, follows all formatting guidelines. Well-structured, clear, confident delivery; excellent visuals. **(5)**	Documentation is mostly complete and accurate, well-organized, follows formatting guidelines with minor deviations. Good structure, clear delivery; visuals mostly effective. **(4)**	Documentation covers most required elements but has some inaccuracies or omissions. Average structure; delivery clear but lacks engagement. **(3)**	Documentation is incomplete with noticeable inaccuracies. Poor organization; visuals unclear. **(2)**	Documentation is largely missing or irrelevant, lacks structure. Unclear, disorganized presentation. **(0-1)**
Q&A Handling (5 Marks) (PO 9)	Confident, accurate, and concise responses. **(5)**	Good responses with minor gaps. **(4)**	Adequate responses; some uncertainty. **(3)**	Weak or hesitant responses. **(2)**	Unable to answer questions. **(0-1)**

PYTHON PROGRAMMING		Semester	I/II
Course Code	**1BPLC105B/205B**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 + 24 (Practical)	Total Marks	100
Credits	4	Exam Hours	3
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Develop scripts using primitive language constructs of python.
CO2: Identify the methods to manipulate primitive python data structures.
CO3: Make use of Python standard libraries for programming.
CO4: Build scripts for performing file operations.
CO5: Illustrate the concepts of Object-Oriented Programming as used in Python.

Module-1

The way of the program: The Python programming language, what is a program? What is debugging? Syntax errors, Runtime errors, Semantic errors, Experimental debugging.

Variables, Expressions and Statements: Values and data types, Variables, Variable names and keywords, Statements, Evaluating expressions, Operators and operands, Type converter functions, Order of operations, Operations on strings, Input, Composition, The modulus operator.

Iteration: Assignment, Updating variables, the for loop, the while statement, The Collatz 3n + 1 sequence, tables, two-dimensional tables, break statement, continue statement, paired data, Nested Loops for Nested Data.

Functions: Functions with arguments and return values.

Chapters: 1.1-1.7, 2.1-2.12, 3.3, 4.4, 4.5

Number of Hours:8

Module-2

Strings: Working with strings as single things, working with the parts of a string, Length, Traversal and the for loop, Slices, String comparison, Strings are immutable, the in and not in operators, A find function, Looping and counting, Optional parameters, The built-in find method, The split method, Cleaning up your strings, The string format method.

Tuples: Tuples are used for grouping data, Tuple assignment, Tuples as return values, Composability of Data Structures.

Lists: List values, accessing elements, List length, List membership, List operations, List slices, Lists are mutable, List deletion, Objects and references, Aliasing, cloning lists, Lists and for loops, List parameters, List methods, Pure functions and modifiers, Functions that produce lists, Strings and lists, list and range, Nested lists, Matrices.

Chapter: 5.1, 5.2, 5.3

Number of Hours: 8

Module-3

Dictionaries: Dictionary operations, dictionary methods, aliasing and copying.

Numpy: About, Shape, Slicing, masking, Broadcasting, dtype.

Files: About files, writing our first file, reading a file line-at-a-time, turning a file into a list of lines, Reading the whole file at once, working with binary files, Directories, fetching something from the Web.

Chapter: 5.4, 6.1-6.5, 7.1-7.8

Number of Hours:8

Module-4

Modules: Random numbers, the time module, the math module, creating your own modules, Namespaces, Scope and lookup rules, Attributes and the dot Operator, Three import statement variants.
Mutable versus immutable and aliasing
Object oriented programming: Classes and Objects — The Basics, Attributes, Adding methods to our class, Instances as arguments and parameters, Converting an instance to a string, Instances as return values.

Chapter: 8.1-8.8, 9.1, 11.1

Number of Hours: 8

Module-5

Object oriented programming: Objects are mutable, Sameness, Copying.
Inheritance: Pure functions ,Modifiers, Generalization, Operator Overloading, Polymorphism.
Exceptions: Catching Exceptions, Raising your own exceptions.

Chapter: 11.2.2-11.2.4, 11.3.2-11.3.9, 12.1, 12.2

Number of Hours:8

PRACTICAL COMPONENTS OF IPCC

PART – A: FIXED SET OF EXPERIMENTS

1. a. Develop a python program to read 2 numbers from the keyboard and perform the basic arithmetic operations based on the choice. (1-Add, 2-Subtract, 3-Multiply, 4-Divide).
   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 sequence of length (N). Read N from the console.
   b. Write a python program to create a list and perform the following operations
   - Inserting an element
   - Removing an element
   - Appending an element
   - Displaying the length of the list
   - Popping an element
   - Clearing the list
3. a. Read N numbers from the console and create a list. Develop a program to print mean, variance and standard deviation with suitable messages.
   b. Read a multi-digit number (as chars) from the console. Develop a program to print the frequency of each digit with a suitable message.
4. Develop a program to print 10 most frequently appearing words in a text file. [Hint: Use a dictionary with distinct words and their frequency of occurrences. Sort the dictionary in the reverse order of frequency and display the dictionary slice of the first 10 items.
5. Develop a program to read 6 subject marks from the keyboard for a student. Generate a report that displays the marks from the highest to the lowest score attained by the student. [Read the marks into a 1-Dimesional array and sort using the Bubble Sort technique].
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. Develop a function named DivExp which takes TWO parameters a, b, and returns a value c (c=a/b). Write a suitable assertion for a>0 in the function DivExp and raise an exception for when b=0. Develop a suitable program that reads two console values and calls the function DivExp.
8. Define a function that takes TWO objects representing complex numbers and returns a new complex number with the sum 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.
9. Text Analysis Tool: Build a tool that analyses a paragraph: frequency of each word, longest word, number of sentences, etc.
10. Develop Data Summary Generator: Read a CSV file (like COVID data or weather stats), convert to dictionary form, and allow the user to run summary queries: max, min, average by column.
11. Develop Student Grade Tracker: Accept multiple students' names and marks. Store them in a list of tuples or dictionaries. Display summary reports (average, topper, etc.).
12. Develop a program to display contents of a folder recursively (Directory) having sub-folders and files (name and type).

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers- How to think like a computer scientist: learning with python 3. Green Tea Press, Wellesley, Massachusetts,2020 https://media.readthedocs.org/pdf/howtothink/latest/howtothink.pdf

Reference books / Manuals:

1. Al Sweigart," Automate the Boring Stuff with Python, 2nd Edition: Practical Programming for Total Beginners",2nd Edition, No Starch Press, 2022. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
2. Kyla McMullen, Elizabeth Matthews and June Jamrich Parsons, Programming with Python, Cengage, 2023.

Web links and Video Lectures (e-Resources):

https://www.learnbyexample.org/python/

https://www.learnpython.org/

https://pythontutor.com/visualize.html#mode=edit

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Chalk and talk
2. PPT presentation
3. Demonstration
4. Problem-Based Learning (PBL)
5. Case-Based Teaching

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).
The CIE Theory component will be 25 marks and CIE Practical component will be 25 marks.

The CIE Theory component consists of IA tests for 25 marks and Continuous Comprehensive Assessments (CCA) for 5 marks. The CIE Practical component for continuous assessments will be for 15 marks through rubrics and for lab tests will be for 5 marks.

- To qualify and become eligible to appear for SEE, in the **CIE theory component**, a student must score at least **40% of 30 marks**, i.e., **12 marks**.
- To qualify and become eligible to appear for SEE, in the **CIE Practical component**, a student must secure **a minimum of 40% of 20 marks**, i.e., **08 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 5 marks. It is recommended to include any one learning activity aimed at enhancing the holistic development of students. This activity should align with course outcomes and promote higher-order thinking and application-based learning.

Learning Activity -1: (Marks- 5)

Students must identify a real-life scenario and develop a Python-based solution using fundamental programming constructs/Data structures (Below given are the sample examples).

1. E.g.: Banking System: Simulate bank accounts using classes. Implement deposit, withdraw, and balance check using class methods. Create your own utility module.
2. E-commerce Cart System: Build a class Product, extend it with Electronics, Clothing using inheritance. Create a Cart class. Handle errors like invalid quantity using custom exceptions.
3. Smart Attendance System: Use file I/O to maintain logs, dictionaries for student info, and exception handling for invalid entries.
4. Develop/Simulate snake and ladder game by choosing suitable data structures of Python.

CIE Practical component:

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The summation of all the experiments marks to be scaled down to 15 marks.

The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 5 marks. For laboratory test, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

Note: Marks obtained (25) is scaled down to 5.

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Identification of real-life problem and its relevance [CO1] [PO2]	Clearly defined and contextually relevant problem; innovative approach	Relevant and well-described problem	Partially relevant with limited context	Vague or not fully relevant problem	No identifiable or valid problem
Use of primitive constructs (variables, loops, functions, conditionals) [CO1] [PO1]	All constructs used correctly with proper logic and flow	Most constructs used properly	Basic constructs applied with some errors	Minimal construct usage with logical flaws	Incorrect or missing constructs
Manipulation of Python data structures (lists, tuples, dictionaries, sets) [CO2] [PO1]	Effective and optimized usage of Data Structures	Mostly appropriate usage	Some usage with basic understanding	Incorrect or limited use	Not used or misused entirely
Use of standard libraries and file operations (if applicable) [CO3, CO4] [PO5]	Libraries and file operations used correctly and meaningfully	Minor issues in usage	Limited or partially correct use	Attempted but faulty implementation	Not attempted or irrelevant
Code structure, modularity, and documentation [CO4] [PO9, PO11]	Modular, structured code with comments and output samples	Structured code with basic documentation	Limited comments or unclear structure	Poor documentation and readability	No documentation, disorganized code

Rubrics for CIE – Continuous assessment:

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Fundamental Knowledge: Understanding the problem statement [CO1-5] [PO1, PO2]	The student has in depth knowledge of the topics related to the problem. Student is able to completely understand the problem definition.	Student has good knowledge of some of the topics related to problem. Student is able to understand the problem definition.	Student is capable of narrating the answer but not capable to show in depth knowledge and the problem definition.	Student has not understood the concepts partially. Student is able to partially understand the problem definition	Student has not understood the concepts and the problem definition clearly.
Design of algorithm/flow chart and program [CO1-5] [PO2, PO3]	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason.	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best.	Student is capable of discussing single design with its merits and de-merits.	Student is capable of explaining the design.	Student is capable of explaining the design partially.
Implementation (Program coding) with suitable tools [CO1-5] [PO5, PO8]	Student is capable of implementing the design with best suitable language structure considering optimal solution/optimal efficiency.	Student is capable of implementing the design with best suitable language structure and should be capable of explaining it.	Student is capable of implementing the design with proper explanation.	Student is capable of implementing the design.	Student is capable of implementing the design with errors.
Program debugging and testing with suitable tools [CO1-5] [PO5, PO8]	Student is capable to compile and debug the program with no errors (syntax, semantic and logical).	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with full understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with partial understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with no understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with assistance.
Results & interpretation /analysis [CO1-5] [PO4]	Student is able to run the program on various cases and compare the result with proper analysis.	Student is able to run the program for all the cases.	Student is able to run the code for few cases and analyze the result.	Student is able to run the program but not able to analyze the result.	Student is able to run the program but not able to verify the correctness of the result.
Demonstration and documentation [CO1-4] [PO8, PO9, PO11]	Demonstration and lab record is well-organized, with clear sections.	Demonstration and lab record is organized, with clear sections, but some	Demonstration and lab record lacks clear organization or structure. Some sections are	Demonstration and lab record is poorly organized, with missing or unclear sections.	Demonstration and lab record is poorly organized, with missing sections. Record

	The record is well structured with suitable formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	sections are not well-defined. The record is structured with formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	unclear or incomplete. The record is partially structured with formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	The record is not properly structured with suitable formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	not submitted on time. The record is not structured with minimum formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).

Rubrics for CIE Test:

Component & CO-PO Mapping	Excellent (5)	Good (4)	Fair (3)	Marginal (2)	Unsatisfactory (1)
Fundamental Knowledge (2) [CO1, CO2] [PO1]	The student has well depth knowledge of the topics related to the problem & course	Student has good knowledge of some of the topics related to problem & course	Student has average knowledge of some of the topics related to problem & course	Student is capable of narrating the answer but not capable to show in depth knowledge	Student has not understood the concepts clearly
Understanding of problem definition (1) [CO1, CO2] [PO2]	Student is able to completely understand the problem definition	Student is able to understand the problem definition but not clearly	Student has a basic understanding of the problem definition that is partial or superficial	Student is able to Shows minimal or unclear understanding of the problem definition	Student is not able to understand the problem definition
Design and Implementation (3) [CO1, CO2] [PO3]	Student is capable of design and implementing with best suitable construct for the given problem definition	Student is capable of design and implementing with some construct for the given problem definition	Student is capable of design and implementing the core part of the construct for the given problem definition	Student is partially capable of design and implementing with some algorithm for the given problem definition	Student is not capable of design and implementing
Result & Analysis (2) [CO1, CO2] [PO4]	Student is able to run the program on various data inputs and compare the result with proper inference.	Student will be able to run the program on various data inputs and fair knowledge in comparing the result with proper inference	Student will be able to run the code for few data/datasets and analyze the output.	Student will be able to run the code for few data inputs but not analyze the output.	Student will be not able to run the program and not able to analyze the result.
Communication (Viva voce) (2) [CO3] [PO8, PO9]	Good Verbal & nonverbal communication skills with precise and correct terminologies/ answers.	Good verbal Communication skills with precise and correct terminologies/ answers.	Average Communication but with precise and correct terminologies/ answers.	Average Communication but with imprecise and incorrect terminologies/ answers	Poor Communication (Minimal interaction/answers)

INTRODUCTION TO C PROGRAMMING		Semester	I/II
Course Code	**1BPLC205E/105E**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:02:0	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 + 24 (Practical)	Total Marks	100
Credits	4	Exam Hours	3
Examination type (SEE)	Theory		

Course outcomes (Course Skill Set)

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

CO1: Explain the fundamental structure of a C program and primitive constructs.
CO2: Apply decision-making and iterative control structures to solve simple computational problems.
CO3: Develop programs using arrays and string operations to solve real-world problems.
CO4: Construct user-defined functions to modularize the solution to the given problems.
CO5: Build programs using structures and pointers for complex data representation and access.

Module-1

Flowchart and Algorithms: Art of Programming through Algorithms & Flowcharts.
Overview of C: History of C, Importance of C, Basic Structure of C Programs, Programming Style, Compiling and Executing a 'C' Program.
Constants, Variables and Data Types: Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Assigning Values to Variables, Defining Symbolic Constants, Declaring a Variables as Constants and Volatile, Input/Output Statements in C.

Textbook: Chapter 1. 6, 2.1, 2.2, 2.8, 2.9, 2.10, Chapter 3.2 to 3.14, Chapter 5.1 to 5.5

Number of Hours: 8

Module-2

Operators: Introduction to Operators, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Precedence of Arithmetic Operators.
Decision Making, Branching, Looping: Introduction, Decision Making with IF Statement, Simple IF Statement, The IF..ELSE Statement, Nesting of IF..ELSE Statements, The ELSE IF Ladder, The Switch Statement, The ?: Operator, The GOTO Statement, WHILE, DO, FOR, Jumps in LOOPS.

Textbook: Chapter 4.1 to 4.7, 4.12, Chapter 6.1 to 6.9, Chapter 7.1 to 7.5 Number of Hours: 8

Module-3

Arrays and Strings: Introduction, Declaration and Initialization of One-dimensional and Two-Dimensional Arrays, Declaring and Initializing String Variables, Example programs using arrays ,Reading Strings from Terminal, Writing Strings to Screen, Arithmetic Operations on Characters, Comparison of Two Strings, String-handling Functions.

Textbook: Chapter 8.1 to 8.6, Chapter 9.2 to 9.5, 9.7, 9.8 Number of Hours: 8

Module-4

User-defined Functions: Introduction, Need for User-defined Functions, A Multi-functional Program, Elements of User-defined Functions, Definition of Function, Return Values and their Types, Function Calls, Function Declaration, No Arguments and no Return Values, Arguments but no Return Values, Nesting of Functions.

Textbook: Chapter 10.1 to 10.8, 10.10 to 10.14

Number of Hours:8

Module-5

Structures and Pointers: Introduction, Defining a Structure, Declaring and Accessing Structure Variables and Members, Structure Initialization, Copying and Comparing Structure Variables, Array of Structures, Arrays within Structures.
Pointers: Introduction, Understanding Pointers, Accessing the Address of Variable, Declaring pointer variables, initialization of pointers, accessing variables through its pointer.

Textbook: Chapter 11.1 to 11.6, 11.8, 11.19, Chapter 12.1 to 12.6

Number of Hours:8

PRACTICAL COMPONENT OF IPCC

1. Develop a program to calculate the temperature converter from degree to Fahrenheit.
2. Develop a program to find the roots of quadratic equations.
3. Develop a program to find whether a given number is prime or not.
4. Develop a program to find key elements in an array using linear search.
5. Given age and gender of a person, develop a program to categorise senior citizen (male & female).
6. Generate Floyd's triangle for given rows.
7. Develop a program to find the transpose of a matrix.
8. Develop a program to concatenate two strings, find length of a string and copy one string to other using string operations.
9. Develop a modular program to find GCD and LCM of given numbers.
10. Develop a program to declare the structure of employees and display the employee records with higher salary among two employees.
11. Develop a program to add two numbers using the pointers to the variables**.**
12. Develop a program to find the sum of digits of a given number.
13. Develop a program to perform Matrix Multiplication.
14. Develop a program to create an array of structures to store book details and check whether a specific book, as requested by the user, is available or not.

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Textbooks:

1. Programming in ANSI C, 9e, E Balaguruswamy, Tata McGraw Hill Education.

Reference books / Manuals:

1. PROGRAMMING IN C, Reema Thareja, Oxford University, Third Edition, 2023**.**
2. The 'C' Programming Language, Brian W. Kernighan and Dennis M. Ritchie, Second Edition, Prentice Hall of India, 2015

Web links and Video Lectures (e-Resources):

1. elearning.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.

- https://www.tutorialspoint.com/what-is-an-algorithm-and-flowchart-in-c-language
- https://www.tutorialspoint.com/cprogramming/c_data_types.htm
- https://www.tutorialspoint.com/cprogramming/c_operators.htm
- https://www.ccbp.in/blog/articles/decision-making-statements-in-c
- https://www.tutorialspoint.com/cprogramming/c_arrays.htm
- https://www.geeksforgeeks.org/variables-in-c/
- https://www.w3schools.com/c/c_arrays.php
- https://www.programiz.com/c-programming/c-strings
- https://www.programiz.com/c-programming/c-pointers
- https://www.scaler.com/topics/c/structures-c/

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Flipped Classroom
2. Problem-Based Learning (PBL)
3. Case-Based Teaching
4. Simulation and Virtual Labs
5. ICT-Enabled Teaching

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).
The CIE Theory component will be 30marks and CIE Practical component will be 20 marks.

The CIE Theory component consists of IA tests for 25 marks and Continuous Comprehensive Assessments (CCA) for 5 marks. The CIE Practical component for continuous assessments will be for 15 marks through rubrics and for lab tests will be for 5 marks.

- To qualify and become eligible to appear for SEE, in the **CIE theory component**, a student must score at least **40% of 30 marks**, i.e., **12 marks**.
- To qualify and become eligible to appear for SEE, in the **CIE Practical component**, a student must secure **a minimum of 40% of 20 marks**, i.e., **08 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 5 marks. It is recommended to include any, one learning activity aimed at enhancing the holistic development of students. This activity should align with course outcomes and promote higher-order thinking and application-based learning.

Learning Activity -1: Programming Assignment (Marks- 5)

INSTRUCTIONS:

1. Course instructor will refer to HackerRank or any other platform to derive the questions for problem-solving.
2. Course Instructor must identify programming problems from these sections: Statements (control), Arrays, Strings, Structures & Unions and Functions.
3. Courser instructor will assign question ONE from each section to the students for design of algorithm/flowchart, program and coding/execution.
4. Students must demonstrate the solutions to the course instructor and submit the record containing algorithm/flowchart, program, debugging/execution and results with observations.
5. Course instructor must evaluate the student performance as per the rubrics.

Rubrics for Learning Activity (Based on the nature of learning activity, Develop the rubrics for each activity):

Note: Marks obtained (25) is scaled down to 5.

Rubrics for Learning Activity:

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Clarity & Simplicity of algorithm/program [CO1] [PO9]	Algorithm/Programs are self-explanatory, specific, and well-structured for the intended activity; no ambiguity is present.	Programs are clear and mostly specific; minor ambiguity is present.	Programs are somewhat clear but could be more specific; moderate ambiguity.	Programs are vague and lack clarity; high ambiguity.	Programs are unclear, incomplete, or irrelevant to the activity.
Appropriate Use of language constructs and design of algorithm/program [CO2-5] [PO1, PO3]	Demonstrates precise and creative usage of the language construct and structured programming	Correctly applies the language construct with minor gaps or missed opportunities.	Uses the language construct, but with partial understanding or inconsistent usage.	Limited understanding of the language construct; incorrect or weak usage.	No evidence of correct/relevant language construct use.
Compilation, Debugging, Analysis & Comparison of Results for various cases. [CO2-5] [PO2, PO4, PO5]	Provides clear and correct results with analysis for multiple cases; comparisons among cases highlight key strengths and weaknesses.	Provides correct results with analysis for multiple cases, though slightly less detailed.	Provides correct results with limited analysis; comparisons are present but shallow.	Provides correct results. Minimal analysis: comparisons are weak or incomplete.	Results are partially correct. No meaningful analysis or comparison.
Creativity, efficiency of	Demonstrates outstanding	Demonstrates creativity and	Shows moderate creativity;	Minimal creativity:	No creativity or problem-

Problem-Solving/program [CO2-5] [PO3, PO11]	creativity and innovation in writing programs, especially for problem-solving or design tasks.	some innovation; Program solutions are practical.	programs are functional but not innovative.	programs are repetitive or unimaginative.	solving/Programming is evident.
Documentation & Reflection [CO1-5] [PO8/PO9/PO11]	Documentation is complete, well-organized, and includes deep reflection on improvements across iterations.	Documentation is complete with some reflection on program refinement.	Documentation is present but lacks detail or depth in reflection.	Incomplete documentation; reflection is minimal.	No documentation or reflection provided as per schedule.

Rubrics for CIE – Continuous assessment:

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Fundamental Knowledge: Understanding the problem statement [CO1] [PO1, PO2]	The student has in depth knowledge of the topics related to the problem. Student is able to completely understand the problem definition.	Student has good knowledge of some of the topics related to problem. Student is able to understand the problem definition.	Student is capable of narrating the answer but not capable to show in depth knowledge and the problem definition.	Student has not understood the concepts partially. Student is able to partially understand the problem definition	Student has not understood the concepts and the problem definition clearly.
Design of algorithm/flow chart and program [CO2-5] [PO2, PO3]	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason.	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best.	Student is capable of discussing single design with its merits and de-merits.	Student is capable of explaining the design.	Student is capable of explaining the design partially.
Implementation (Program coding) with suitable tools [CO2-5] [PO5, PO8]	Student is capable of implementing the design with best suitable language structure considering optimal solution/optimal efficiency.	Student is capable of implementing the design with best suitable language structure and should be capable of explaining it.	Student is capable of implementing the design with proper explanation.	Student is capable of implementing the design.	Student is capable of implementing the design with errors.

Program debugging and testing with suitable tools [CO2-5] [PO5, PO8]	Student is capable to compile and debug the program with no errors (syntax, semantic and logical).	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with full understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with partial understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with no understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with assistance.
Results & interpretation /analysis [CO1-5] [PO4]	Student is able to run the program on various cases and compare the result with proper analysis.	Student is able to run the program for all the cases.	Student is able to run the code for few cases and analyze the result.	Student is able to run the program but not able to analyze the result.	Student is able to run the program but not able to verify the correctness of the result.
Demonstration and documentation [CO1-5] [PO8, PO9, PO11]	Demonstration and lab record is well-organized, with clear sections. The record is well structured with suitable formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	Demonstration and lab record is organized, with clear sections, but some sections are not well-defined. The record is structured with formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	Demonstration and lab record lacks clear organization or structure. Some sections are unclear or incomplete. The record is partially structured with formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	Demonstration and lab record is poorly organized, with missing or unclear sections. The record is not properly structured with suitable formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	Demonstration and lab record is poorly organized, with missing sections. Record not submitted on time. The record is not structured with minimum formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).

Rubrics for CIE Test:

Component & CO-PO Mapping	Excellent (5)	Good (4)	Fair (3)	Marginal (2)	Unsatisfactory (1)
Fundamental Knowledge (2) [CO1] [PO1]	The student has well depth knowledge of the topics related to the problem & course	Student has good knowledge of some of the topics related to problem & course	Student has average knowledge of some of the topics related to problem & course	Student is capable of narrating the answer but not capable to show in depth knowledge	Student has not understood the concepts clearly
Understanding of problem definition (1) [CO2+-5] [PO2]	Student is able to completely understand the problem definition	Student is able to understand the problem definition but not clearly	Student has a basic understanding of the problem definition that is partial or superficial	Student is able to Shows minimal or unclear understanding of the problem definition	Student is not able to understand the problem definition
Design and Implementation (3) [CO2-5] [PO3]	Student is capable of design and implementing with best suitable construct for the given problem definition	Student is capable of design and implementing with some construct for the given problem definition	Student is capable of design and implementing the core part of the construct for the given problem definition	Student is partially capable of design and implementing with some algorithm for the given problem definition	Student is not capable of design and implementing
Result & Analysis (2) [CO2-5] [PO4]	Student is able to run the program on various data inputs and compare the result with proper inference.	Student will be able to run the program on various data inputs and fair knowledge in comparing the result with proper inference	Student will be able to run the code for few data/datasets and analyze the output.	Student will be able to run the code for few data inputs but not analyze the output.	Student will be not able to run the program and not able to analyze the result.
Communication (Viva voce) (2) [CO1-5] [PO8, PO9]	Good Verbal & nonverbal communication skills with precise and correct terminologies/ answers.	Good verbal Communication skills with precise and correct terminologies/ answers.	Average Communication but with precise and correct terminologies/ answers.	Average Communication but with imprecise and incorrect terminologies/ answers	Poor Communication (Minimal interaction/answers)

COMMUNICATION SKILLS		Semester	I / II
Course Code	**1BENG106/206**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15 hours +15 hours	Total Marks	100
Credits	01	Exam Hours	02
Examination type (CIE+SEE)			

COURSE OUTCOMES

- **CO1:** Build essential verbal, non-verbal, and phonetic communication skills for clarity and effectiveness.
- **CO2:** Use interpersonal skills in group discussions, presentations, and professional interactions.
- **CO3:** Apply formal writing, email etiquette, and creative content development for employability.
- **CO4:** Communicate effectively in digital platforms, following netiquette and academic integrity.
- **CO5:** Prepare job applications, resumes, and perform confidently in interviews.

UNIT 1 COMMUNICATION SKILLS (3 Hours)

Glimpses of Essential English for Engineers (General Overview). Communication Skills: Process, Verbal and Non-Verbal, Proxemics, Chronemics and Barriers. **Writing**: Word Classification – Parts of Speech, Sentence structures. **Speaking & Listening:** Listening to English Pronunciation – English Phonemes – Intelligible Accent – Speech Organs- Syllable Structures, Stress, Intonation, and Practice.

Teaching Methodology	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	**Quiklrn.com**
Digital Tools	ALL 44 sounds of English in 75 minutes - https://www.youtube.com/watch?v=QxQUapA-2w4&t=51s. AI-based grammar and writing tools (e.g., Grammarly, ChatGPT, Quillbot) to analyze and classify parts of speech. AI-based pronunciation tools (Google Speech-to-Text) for real-time feedback
Reading Material	"**The Chimney Sweeper" by William Blake** Martin Luther King Jr's "I Have a Dream" Speech
Assessment Techniques and Tools	**Role Play**: Formal/informal scenarios, **Group Discussion (GD), Case Studies Analysis**: Identify barriers and suggest solutions, **Mini-Presentation**: Focused on proxemics. Observation Rubric (for body language, tone, time cues), (Sample Rubric, please refer the annexure), Video Recording + Self-evaluation Sheet.

UNIT 2 INTERPERSONAL SKILLS (3 Hours)

Speaking: Role Play Exercises Based on Workplace Contexts, Introducing Oneself - PEP Talks- Personal Empowerment, Participating in Group Discussion and Debates, Giving Technical Presentation. **Reading:** Reading the Interview of an Achiever (Skimming and Scanning) (Case Studies). **Writing:** Writing a Short Biography of an Achiever Based on given reflections, **Grammar:** Sentence patterns. **Vocabulary** Development: Idioms and Phrases.

Teaching Methodology	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	**Quiklrn.com**
Digital Tools	Google Meet / Zoom + AI Transcription- Practice group discussions with live transcription. Grammarly - Highlights grammar issues with explanations. **Oxford Learner's Dictionaries** (https://www.oxfordlearnersdictionaries.com/) - Includes etymology, pronunciation, synonyms/antonyms.
Assessment Techniques and Tools	Group discussion performance (listening, turn-taking, clarity) Technical presentations (confidence, structure, clarity) Role plays (relevance, tone, spontaneity) Case Studies Oral communication rubric (clarity, relevance, tone, confidence, non-verbal cues), **Activity**: Read a short **interview of an achiever** (e.g., A. P. J. Abdul Kalam, Sudha Murthy) **LMS (Learning Management Systems)**: Moodle or Google Classroom for submissions and reflections. **Video Submissions**: Students submit videos of role plays or presentations for asynchronous review.

UNIT 3 ENGLISH FOR EMPLOYABILTY (3 Hours)

Writing: Formal Letter writing (Enquiry, Order, and Complaint). Tenses – Reported Speech-Voice - Email Etiquettes, Structure, Writing and Responding to Emails. Paragraph Writing (Descriptive, Argumentative, Expository, Short Story, and Narrative), Blog Writing. **Reading**: Proof Reading (Spelling, Punctuation, Grammar). Error Identification Exercises. **Speaking:** Questions & Requests (non-Wh questions and Question tags).

Pedagogy	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	**Quiklrn.com**
Digital Tools	Grammarly – Check grammar, tone, spelling Canva – Free templates to create posters, ads, infographics Adobe Express – Visual storytelling and ad design
Assessment Techniques and Tools	**Paragraph Writing -** Descriptive, Argumentative, Expository, Short Story, Narrative - Paragraph rubric (structure, logic, vocabulary, grammar) Writing - **Tool**: Digital submission + rubric for content originality, reader engagement, clarity. **Speaking Skills -** Oral assessment rubric (intonation, clarity, accuracy) Email simulator (Google Forms/Canvas/Docs template)

UNIT 4 ENGLISH IN DIGITAL WORLD (3 Hours)

Writing: Framing of search terms / keywords in search engines/ Commands for search on open AIs - Tools to support synchronous communication such as webinar platforms, and asynchronous communication such as forums and social media - Online communication - Types – pros and cons of online communication. Acceptable online roles and behaviours – Netiquettes - Etiquettes of social media. Problems and opportunities in handling digital resources -Tools to check grammar. **Writing:** Citing information accurately from source material - Plagiarism – Infringement, Importance of academic integrity.

Pedagogy	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	**Quiklrn.com**
Digital Tools	Google Meet - Integrated with Gmail, free for students Google Classroom - Forum, assignments, comments
Assessment Techniques and Tools	Write a short essay (150–200 words) on the **problems and opportunities.** Evaluation rubric (structure, coherence, grammar). Grammar assessment rubric (before vs after comparison, understanding of corrections).

UNIT 5 APPLYING FOR JOBS (3 Hours)

Listening: TED Talks. **Speaking:** Mock Interview, Telephone Interviews. **Reading:** Reading a Job Interview- language used in formal professional settings, formal vs. informal tone, non-verbal communication cues, Statement of Purpose, Company Profile and Completing Comprehension Exercises **Writing:** Job Applications and Resumes **Grammar:** Conditional Clauses, Modal verbs **Vocabulary Development:** Technical Vocabulary, Purpose Statement.

Pedagogy **Language Lab**	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	**Quiklrn.com**
Assessment Techniques and Tools	Listening to professional talks, analyzing tone and structure - https://www.ted.com/talks Non-verbal cues in professional reading - https://www.youtube.com/c/Mindsight Grammar AI practice - https://quillbot.com/grammar-check
Assessment Techniques and Tools	TED Talk worksheet - Listening rubric (comprehension, inference, note-taking), Reading comprehension tests, Resume & Application rubric (content, layout, tone, language), Grammar MCQs / Editing worksheet, Scenario-based MCQs or roleplay, Vocabulary worksheet

Extra Reading

1. Kumar, A. R. (2008). *English for engineers and technologists*. Orient BlackSwan.

2. Raman, M., & Sharma, S. (2015). *Technical communication: Principles and practice* (3rd ed.). Oxford University Press.
3. Floyd, K., & Cardon, P. W. (2019). *Business and professional communication* (3rd ed.). Principles of Scientific and Technical Writing, 1e, By Pratap K. J. Mohapatra, Sanjib Moulick, © 2025 | Published: December 23, 2024
4. Effective Technical Communication, 3e, By Ashraf M. Rizvi, Priyadarshi Patnaik, © 2024 | Published: September 12, 2024
5. Yadav, D. P. (2022). *A course in English pronunciation*. Notion Publications.

Learning Resources:

- Oxford Advance Learners Dictionary
- Cambridge English Skills Real Listening and Speaking by Miles Craven
- Communicative English for Professionals by Nitin Bhatnagar and Mamta Bhatnagar

Other Digital Resources

- Google Docs + Voice Typing - https://docs.google.com
- LearnEnglish – https://learnenglish.britishcouncil.org/
- TakeIELTS - https://www.britishcouncil.in/exam/ielts
- British Council Apps - **bbcLearnEnglishonline Grammar**
  LearnEnglish Podcasts
  IELTS Word Power
  Bbclearningenglishgrammer online
  Sounds Right (Phonemic Chart)

CURRICULUM DESIGN

Pronunciation Phonology in the upper secondary English curriculum includes: diphthongs, consonants, consonant clusters, word stress, strong and weak forms of pronunciation, ellipsis, assimilation, linking, sentence stress, rhythm and intonation.

Vocabulary. Ther target vocabulary of around 600-800 vocabulary items at level 3. Upon completion of the unit, students must know around 2,500 vocabulary items.

Grammar Communicative competences at level 3 including relative clauses, conditional sentences (type 1 and 2), compound and complex sentences, simple present, present continuous, present perfect, past simple, past continuous, past perfect, future simple, future continuous, near future, conjunctions, modal verbs, phrasal verbs, passive voice, etc.

SPECIFIC OUTCOMES

Themes	Topics	Communicative Competences	Linguistic Knowledge
Our Academic Journey Our Technical Society Our Built and Natural Environment Our Future Innovations	Transition from school to engineering college Choosing an engineering discipline Student life and academic challenges Role of engineers in society Ethics in engineering Impact of technology on social structures Interdisciplinary collaboration Artificial intelligence and automation Emerging technologies in engineering Lifelong learning and professional development Entrepreneurship and start-ups in engineering The future of work in the tech-driven world	**Listening** Understand and identify the main points of dialogues, monologues of 330-350 words on familiar topics regularly encountered in life, work, school, etc., within the scope of the curriculum. Follow simple instructions such as recipes, how to use common utensils, etc. Listen and guess meanings (through the expressions and feelings of the speakers) in familiar monologues and conversations in everyday life Understand the main points of news programs, broadcasts, interviews, etc., on familiar topics which are clearly delivered in simple language, and with illustrative images.	**Pronunciation** Diphthongs Words with stress (specials cases) – Words without stress Sentence stress, assimilation, linking vowels with vowels Question intonation (consolidation and extension) Homophones **Vocabulary** Words related to themes and topics of higher proficiency. **Grammar** Present perfect (consolidation and extension) Past simple and past continuous Types on sentences: simple, compound and complex

Speaking

- Pronounce clearly and relatively accurately
- Words with or without stress, sentence stress, assimilation, and liaison.
- Speak and interact with fellow speakers about familiar topics, express personal views and exchange information about the topics covered in the curriculum.

Reading

- Read and comprehend the main points, specific contents of a text of 380-400 words on current and familiar topics.
- Read and understand the argument flow of texts, identify main conclusions in texts using clear language.
- Read to find and summarize short texts of everyday use such as simple letters, brochures, using words and structures from the original texts.

Writing

- Write simple connected and coherent texts of 280-300 words; write short reports based on suggestions, providing factual information and reasons for the recommendations made in the reports; collect short information from several sources and summarize it.
- Complete (write/fill) administrative forms such as resumes, letter of application for employment, etc.
- Write composition texts

Upon successful completion of the upper secondary English curriculum, students will be able to:

- Use English as a communication tool through the four skills of listening, speaking, reading and writing to meet basic and practical communication needs on familiar topics related to college, recreational activities, career, etc.
- Continue to formulate and develop basic knowledge of English, including pronunciation, vocabulary and grammar; and through English, have more extensive understanding of the landscape, people and culture of English-speaking countries and other countries in the world.
- Use English to improve the quality of learning other subjects in the general education curriculum.
- Use English for further education or immediate employment upon completion level 6.
- Use a variety of learning strategies to manage learning time, apply information technology in learning and self-learning, consolidate self-learning and self-assessment

methodology and take responsibility for learning outcomes, and form lifelong learning habits.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes*											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1									1	3		2
2										3		2
3										3		2
4									1	3		2
5									1	3		2

Course Assessment and Evaluation:

		What	To Whom	When/ Where (Frequency in the course)	Max Marks	Evidence Collected	Contributing to Course Outcomes
Direct Assessment	C I E	Internal assessment tests	Students	Two Tests (Average of the two will be computed)	25	Blue books/Answer Scripts	1 to 5
		Creative writing	Students	Assignment-1 (10) Assignment-2 (15)	15+10=25	Quiz Projects Presentations Assignment Questions and Answers	1 to 5
Indirect assessment Methods		Case Analysis	Students	-----	-----	-----	------
		Surprise Quiz		------	------	----	----
	S E E	Standard examination Students Feedback	Students	End of course (Answering 5 of 10 questions), 10 Case Studies 10 MCQs	30+10+10	Answer scripts Feedback Forms	1 to 5
		End of course Survey		End of course	-	Questionnaire	-

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

CIE and SEE Evaluation:

SL. No	Bloom's Category	Test 1	Test 2	Semester-End Examination
1	Remember	34%	34%	30%

2	Understand	55%	20%	30%
3	Apply	00%	23%	20%
4	Analyse	11%	00%	10%
5	Evaluate	00%	00%	00%
6	Create	00%	23%	10%

Course Assessment Methods:

- Continuous Assessment of Skills: Assignments/Quiz/Presentations/Projects
- Written Tests
- End Semester Examination

Sample Rubric for Presentation

Criteria	Excellent (2)	Good (1)	Needs Work (0)
Self-awareness	✓	✓	✓
Goal clarity	✓	✓	✓
Communication & delivery	✓	✓	✓
Insight into opportunities	✓	✓	✓
Realistic challenges	✓	✓	✓

Sample Rubric

Grammar & Writing Rubric (for Essays/Reports/Emails)

Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (1-2)
Clarity and Structure	Well-organized, coherent, clear transitions	Organized with minor lapses in clarity	Understandable but lacks coherence	Difficult to follow, lacks structure
Language Use	Professional, precise, varied vocabulary	Clear, mostly appropriate language	Some awkward phrasing or repetitive vocabulary	Frequent errors, unclear language
Grammar and Punctuation	Virtually no errors	Few minor errors	Several errors affecting readability	Multiple errors impacting readability
Relevance & Depth	Thorough, detailed analysis	Solid analysis with minor gaps	Basic analysis, lacks depth	

Model Question Paper
Course – Communication Skills

i) Answer the 10 marks MCQ compulsory questions from Part A. Each question carries one mark.
ii) Answer compulsory 10 marks case study questions Part B.
iii) Answer any five questions from Part C selecting one question from each unit. 6 marks each.

Q. No.		PART-A	CO's	LO	Marks
		Multiple choice questions. (Compulsory)			
1.		**Choose the correct option for the following.**	CO_{1-5}	LO_1	10X1=10
	a.	**What is the primary purpose of communication in engineering?** A) To entertain B) To inform and collaborate C) To confuse others D) To express personal opinions			
	b.	**Which of the following is considered a barrier to effective communication?** A) Clear articulation B) Technical jargon C) Active listening D) Open-ended questions			
	c.	**In terms of English pronunciation, which of the following is true for engineers?** A) Pronunciation is not important in technical communication. B) Clear pronunciation is essential for avoiding misunderstandings. C) Engineers should only focus on writing skills. D) Accents should be completely eliminated.			
	d.	**How many syllables are in the word "engineering"?** A) 2 B) 3 C) 4 D) 5			
	e.	**Which of the following prepositions correctly completes the sentence: "The report is due _____ Friday"?** A) in B) on C) at D) for.			
	f.	**What is the past tense of the verb "to communicate"?** A) Communicate B) Communicating C) Communicated D) Communicates			
	g.	**Which of the following is an example of mother tongue influence in English communication?** A) Using idiomatic expressions B) Mispronouncing words due to native language sounds C) Employing technical vocabulary correctly D) Using varied sentence structures			
	h.	**In reading comprehension, which skill is most important for engineers when reviewing technical documents?** A) Skimming for general ideas B) Memorizing all details C) Scanning for specific information D) Ignoring unfamiliar technical terms			
	i.	**Which of the following vocabulary words is most relevant to project management?** A) Ambiguous B) Deadline C) Casual D) Informal			
	j.	**When using tenses, which sentence is correct?** A) The engineer designs the project last year. B) The engineer design the project next year. C) The engineer will design the project next year. D) The engineer designed the project next year.			

Part – B (Co1-5) L3

Case Studies *(2 × 5 = 10 Marks)*
(Answer both the questions. Each carry 5 marks.)

Case Study 1 – Communication Barriers
You are working in a multinational company where your team includes members from different cultural backgrounds. During a meeting, some members misinterpret instructions due to differences in communication styles and accents.

- **Identify at least three barriers to communication in this scenario.**
- **Suggest three solutions to overcome them.**

Case Study 2 – Workplace Scenario
In a technical presentation, a student uses too many slides filled with text, speaks in a monotonous tone, and rarely makes eye contact with the audience.

- **Identify the issues with the presentation delivery.**
- **Suggest improvements for verbal and non-verbal communication.**

PART-C

Answer <u>ANY FIVE</u> questions selecting <u>ONE full</u> question from each unit. (6X5=30)

		UNIT – I			
1.		How can engineers ensure that their communication is considerate of the diverse backgrounds of their team members? Give two strategies you would implement.	CO1	LO_2	(6)
2.		How do interpersonal skills complement technical skills in the engineering field? Provide examples of how these skills can work together in a project.	CO1	LO_2	(6)
		UNIT – II			
3.		How does incorrect intonation impact the meaning of a sentence in technical discussions or job interviews? Illustrate with examples.	CO2	LO_2	(6)
4.		Discuss the role of intelligible pronunciation in making communication clearer. Identify English sounds that are often mispronounced by non-native.	CO2	LO_2	(6)
		UNIT – III			
5.		**Use the following idioms with their figurative meanings and construct workplace place -related sentences:**	CO3	LO6	(6)
		a. Hit the nail on the head b. Back to the drawing board c. In hot water d. Think outside the box e. A blessing in disguise f. Burn the midnight oil			
6.		**Complete the sentences by filling in the blanks with suitable <u>prepositions and articles</u>.** a. The team submitted the proposal _____ manager before the end of the day. b. She placed the confidential file _____desk in the conference room.	CO3	LO2	(6)

		c. Our office is located _____ corner of Main Street and Park Avenue. d. He arrived _____meeting room just a few minutes late. e. We will launch the new product _____second quarter of the financial year. f. There was an error _____final report, which needs immediate correction.			
		UNIT – IV			
7.		**Complete the sentences by forming the correct word (noun, verb, adjective, or adverb) from the word given in brackets**. a. The manager gave a very _____ presentation on the new project. *(inform)* b. His _____ in the final decision was minimal. *(involve)* c. The engineers worked _____ to meet the product launch deadline. *(efficient)* d. The software update led to a significant _____ in system performance. *(improve)* e. She handled the client's complaint with great _____. *(professional)* f. Innovation and creativity are key to _____ in a competitive market. *(succeed)*	CO4	LO2	(6)
8.		Fill in the blanks with the correct **tense of the verb** in brackets. a. By the time the meeting started, the manager _____ (prepare) all the necessary documents. b. I _____ (work) on this report since morning, and I still have two sections to complete. c. The team _____ (complete) the task before the deadline yesterday. d. While we _____ (discuss) the new project, the client walked in unexpectedly. e. She usually _____ (respond) to emails within an hour. f. If the supplier delivers on time, we _____ (be) ready for the launch next week.	CO4	LO2	(6)
		UNIT – V			
9.		Identify three common challenges engineers face during oral presentations and propose practical strategies to overcome them.	CO5	LO2	(6)
10.		How can voice modulation and body language enhance the effectiveness of a public speech in a technical seminar? Give examples.	CO5	LO2	(6)

Indian Constitution and Engineering Ethics

Course Code	**1BICO107/207**	**CIE Marks**	**100**
Teaching Hours/Week (L: T:P: S)	**1:0:0**	**SEE Marks**	**---**
Total Hours of Pedagogy	**01Hours/Week**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**-**

Course objectives: This course will enable the students

1. To know about the basic structure of the Indian Constitution.
2. To know the Fundamental Rights (FRs), DPSP's, and Fundamental Duties (FD's) of our constitution.
3. To know about our Union Government, political structure & codes, and procedures.
4. To know the State Executive & Elections system of India.
5. To learn the Amendments and Emergency Provisions, other important provisions given by the constitution.

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: Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological tools.

(i) Direct instructional method (Low/Old Technology), (ii) Flipped classrooms (High/advanced Technological tools), (iii) Blended learning (Combination of both), (iv) Enquiry and evaluation based learning, (v) Personalized learning, (vi) Problems based learning through discussion.

Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adapted so that the delivered lesson can progress the students In theoretical applied and practical skills.

Module - 1

Introduction to Indian Constitution: The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly. The Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of India Constitution.

Module - 2

FR's, FD's and DPSP's: Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

Module - 3

Union Executive : Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.

Module - 4

State Executive & Elections, Amendments and Emergency Provisions: State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (How and Why) and Important Constitutional Amendments till today. Emergency Provisions.

Module-5

Professional Ethics: Ethics & Values. Types of Ethics. Scope & Aims of Professional & Engineering Ethics. Positive and Negative Faces of Engineering Ethics. Clash of Ethics, Conflicts of Interest. The impediments to Responsibility. Trust & Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.

Course outcome (Course Skill Set) :

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

CO1	Analyse the basic structure of Indian Constitution.
CO2	Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution.
CO3	know about our Union Government, political structure & codes, procedures.
CO4	Understand our State Executive & Elections system of India.
CO5	Remember the Amendments and Emergency Provisions, other important provisions given by the constitution.

Assessment Structure:
The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

1. To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
2. To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.

3. Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1: (Marks- ___)

Learning Activity -2 (optional): (Marks- ___)

Suggested Learning Resources:

Textbook:

1. **"Constitution of India" (for Competitive Exams)** - Published by Naidhruva Edutech Learning Solutions, Bengaluru. – 2022.
2. "**Engineering Ethics**", M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Prentice –Hall, 2004.

Reference Books:

1. **"Samvidhana Odu" - for Students & Youths by Justice HN Nagamohan Dhas, Sahayana, kerekon.**
2. **"Constitution of India, Professional Ethics and Human Rights"** by Shubham Singles, Charles E. Haries, and et al: published by Cengage Learning India, Latest Edition – 2019.
3. "**Introduction to the Constitution of India**", (Students Edition.) by Durga Das Basu (**DD Basu**): Prentice –Hall, 2008.
4. **"The Constitution of India"** by Merunandan K B: published by Merugu Publication, Second Edition, Bengaluru.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator- 1 (CO/PO Mapping)					
Performance Indicator-2 (CO/PO Mapping)					
...					
Performance Indicator-n (CO/PO Mapping)					

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

"Jnana Sangama" Macche Belagavi - 590018

Innovation & Design Thinking Lab		Semester	1
Course Code:	**1BIDTL158**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**0:0:2**	**SEE Marks**	**50**
Total Hours of Pedagogy	**2 (Full day of Saturday may be allotted)**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	
Examination type (SEE)	**Practical/Presentation/Seminar**		

Course Outcome (Course Skill Set) -

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

1. Empathize with community problems and define meaningful challenges.
2. Apply design thinking principles and multidisciplinary skills to develop user-centric solutions.
3. Build and test basic prototypes using tools available in the Atal Idea/Tinkering Lab or Makers Space.
4. Pitch socially relevant ideas with scalable models.
5. Collaborate effectively in diverse teams.

Week 1, 2 & 3: Orientation and Team Formation

Week -1&2: Introduction to Social Entrepreneurship**,** Innovation and Design Thinking

Group discussion on What is **Innovation** vs **Invention**. Why **Design Thinking** is important. Brief about **5 stages**: Empathize – Define – Ideate – Prototype – Test.

Week -3: Innovation warm-up activities, forming interdisciplinary teams, Instructions about Next week activities

Week 4–5: Empathy and Field Exploration

Week-4&5: Field (any public places of student's interest Eg- Village, Government Office, Industry. R&D institute, NGO etc) visits, stakeholder interviews and interaction. Recording all interaction through handwritten in activity book prescribed by the University.

Week 6, 7 and 8: Problem Definition

Week-6: Documentation, categorization and Group discussion on interactions and problems/challenges.

Week-7&8: Problem framing using "How Might We" approach, Identification of social problems and user insights through affinity Clustering and Problem Tree. Mention of clearly defined challenge statements.

Week 9, 10 &11: Ideation Sprint

Week-9&10: Presentation by teams on Defined Problems, Brainstorming interactions and Mind Mapping.

Week-10: Idea Filtering - Shortlist of creative, eco -friendly and feasible ideas. Selection of one Suitable IDEA for next process, Designing/Structuring of Prototype model.

Week 12, 13 &14: Rapid Prototyping using Atal Idea Lab/Makers Space
Week-12&13: Building low-fidelity and working models using tools like Arduino, 3D printers,: Digital fabrication, electronics kits and recycled materials **Week-14:** User testing, Feedback collection, Iteration - Observation Notes, Feedback Forms (Designing a business model for impact and scalability, if possible) Preparation of Draft of social venture plan
Week 15 &16: Final Demo and Social Pitch
Innovation showcase, Poster display, Project pitching to jury ***Presentation of the project with impact with assessment, prototype, and sustainability plan***
Teaching-Learning Process (Innovative Delivery Methods) **1.Activity Based Learning** **2.Group discussion, Presentations.** **3. one faculty member shall be assigned to group of 60 students or one division.** **4. Each group shall contain Min. 4 and Max. 6 students.** **5. Nature of the group shall be multidisciplinary. (Group shall be formed by selecting students from all branches)**

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.

Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Internal Evaluation (CIE) –

CIE Marks allocation Parameters for Social Entrepreneurship, Innovation & Design Thinking using Atal Idea/Tinkering Lab or Maker Space

CIE Parameters (50 Marks)

Sl. No.	CIE Component/Week	Marks	Description
1	Orientation Activities & Communication Skills	5	Participation in Week 1–3 orientation, communication and teamwork skill-building exercises.
2	Empathy & Field Exploration Documentation	10	Quality and completeness of field visit reflections, stakeholder interviews, and activity book.
3	Problem Definition and Framing	10	Clarity of challenge statements, use of "How Might We", Affinity Mapping, Problem Trees.
4	Ideation & Mind Mapping	5	Participation in brainstorming, mind mapping, idea filtering sessions.
5	Prototype Development & Iteration	10	Quality and creativity of prototype/model, user testing, feedback collection, iterations.
6	Final Presentation & Pitch	5	Project pitching, poster presentation, storytelling and scalability model.
7	Teamwork, Journal, and Engagement	5	Peer and mentor evaluation of participation, teamwork, journal updates.
8	Total CIE marks	50	Final CIE marks to be considered

***Minimum to Qualify for SEE: 20 out of 50 in CIE**

Semester End Examination (SEE) –

SEE to be conducted in batches where the students will exhibit their projects along with the presentation and Viva -voce. – 100 Marks

"SEE shall be conducted by one Internal and one External Examiner"

Sl. No.	Evaluation Parameter	Marks	Details
1	Prototype / Solution Demonstration	30	Working functionality, creativity, use of lab tools, relevance to the problem.
2	Final Presentation / Social Pitch	20	Clarity, storytelling, problem-solution fit, communication, visual aids.
3	Business Model or Sustainability Plan	10	Feasibility, cost-effectiveness, scalability, and alignment with SDGs.
4	Viva Voce	20	Individual understanding, contribution, tools used, learning outcomes.
5	Documentation Report / Portfolio	20	Project report, reflection, team activity log, stakeholder input summaries.

Submission Requirements:

- Handwritten activity book with CIE marks and Final project report (Typed or Handwritten).
- Final presentation ppt/pdf (hard and soft copy).
- Prototype or working model [physical or conceptual (shall be drawn/sketched clearly on card sheet paper)].
- Peer/team feedback and reflection entries (if applicable).

QUANTUM PHYSICS AND ELECTRONIC SENSORS		Semester	1/2
Course Code	**1BPHEC102/202**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40	Total Marks	100
Credits	40 hours theory and 10-12 hours of practical sessions	Exam Hours	3 hours
Examination type (SEE)	DESCRIPTIVE		

Course outcome (Course Skill Set)

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

1. Apply fundamental principles of quantum mechanics to analyze microscopic physical systems and predict quantized energy states and tunneling phenomena.
2. Analyze electrical conduction mechanisms in metals and semiconductors using classical and quantum models, and interpret carrier concentration and Fermi energy calculations.
3. Evaluate superconductivity phenomena including Meissner effect, Cooper pair formation, and Josephson junction behavior for advanced material applications.
4. Describe light-matter interaction, laser operations, optical modulators, and photonic devices to illustrate principles of photonics in sensor technologies.
5. Demonstrate the principles, characteristics, and applications of semiconductor and optical devices, sensors, and transducers used in electronic and photonic systems.

Module-1

Quantum Physics:

de Broglie Hypothesis, Heisenberg's Uncertainty Principle and its application (Broadneing of Spectral Lines), Principle of Complementarity, Wave Function, Time independent Schrödinger wave equation (Derivation), Physical significance of a wave function and Born Interpretation, Expectation value and its physical significance, Eigen functions and Eigen values, Particle inside one dimensional infinite potential well, Role of higher dimensions (Qualitative), Waveforms and Probabilities, Particle inside a finite potential well and quantum tunneling, Numerical Problems.

Text Book : 1 and 2 Number of Hours: 8

Module-2

Electrical Properties of Metals and Semiconductors

Failures of classical free electron theory, Mechanisms of electron scattering in solids, Matheissen's rule, Assumptions of auantum free electron theory, Density of states, Fermi Dirac statistics, Fermi energy, Variation of Fermi factor with temperature and energy, Expression for carrier concentration, Derivation of electron concentration in an intrinsic semiconductor, Expression for electron and hole concentration in extrinsic semiconductor, Fermi level for intrinsic (with derivation) and extrinsic semiconductor (no derivation), Hall effect, Numerical Problems.

Text Books : 1, 3 Reference Books : 2, 3 Number of

Module-3

Superconductivity

Zero resistance state, Persitent current, Meissner effect, Critical temperature, Critical current (Silsbee Effect) – Derivation for a cylindrical wire using ampere's law, Critical field, Formation of Cooper pairs - Mediation of phonons, Two-fluid model, BCS Theory - Phase coherent state, Limitations of BCS theory, examples of systems with low and high electron-phonon coupling, Type-I and Type-II superconductors, Formation of Vortices, Explanation for upper critical field, Josephson junction, Flux quantization, DC and AC SQUID, Charge Qubit, Numerical Problems.

Text Books: 1, 2, Reference Book: 4, 8 Number of Hours:8

Module-4

Photonics :

Interaction of radiation with matter – Einstein's A and B coefficients, Prerequisites for lasing actions, Types

of LASER – Semiconductor diode LASER, Use of attenuators for single photon sources, Optical modulators – Pockel's effect, Kerr effect, Photodetectors – Photomultiplier tube, Single Photon Avalanche Diode, Optical fiber, Derivation of Numerical aperture, V-number, Number of modes, losses in optical fiber, Mach-Zehnder interferometer, Numerical problems.

Text Books: 1, 2, Reference Book: 7 Number of Hours:8

Module-5

Semiconductor devices and Sensors

Direct and indirect band gap, Band gap engineering, Zener Diode, LED, PhotoDiode, Photo Transistor, Light dependent resistor, Resistance temperature detectors (high, medium, low), Sensing mechanisms, Piezo electric Sensors, Metal Oxide Semiconductor (MOS) sensors, Hall sensor, Superconducting Nanowire Single Photon Detector, Numerical Problems.

Text Book : 4, Reference Book : 1 Number of Hours:8

PRACTICAL COMPONENTS OF IPCC

PART – A: FIXED SET OF EXPERIMENTS

1. Determination of wavelength of LASER using Diffraction Grating.
2. Determination of acceptance angle and numerical aperture of the given Optical Fiber.
3. Determination of resistivity of a semiconductor by Four Probe Method
4. Determination of dielectric constant of the material of capacitor by Charging and Discharging method.
5. Study the Characteristics of a Photo-Diode and to determine the power responsivity / Verification of inverse square law of light.
6. Determination of Plank's Constant using LEDs.
7. Determination of Fermi Energy of Copper.
8. Interference by the division of amplitude (Air-wedge/Newton's Rings)
9. Black-Box Experiment
10. Construction and Analyzing Electronic circuits (Expeyes Simulator / circuitlab)
11. Verification of Inverse Square Law of Intensity of Light.
12. I-V Characteristics of a Bipolar Junction Transistor.
13. Resonance in LCR circuit
14. Energy Gap of a Semiconductor

(One Simulation Experiment is compulsory and must be conducted either in the Computer Laboratory for the entire batch or using dedicated systems within the Physics Laboratory as part of the experimental cycles.)

PART – B: OPEN ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. **Engineering Physics, Satyendra Sharma and Jyotsna Sharma, Pearson, 2018.**
2. **Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBS Publishers and Distributers Pvt. Ltd.**
3. **Solid State Physics, S. O. Pillai, New Age International**
4. **Basic Electronics, B L Theraja, Multi-color Edition, S Chand, 2006**

Reference books / Manuals:

1. **Engineering Physics , S Mani Naidu, Pearson, Fourteenth Impression, 2024.**
2. **Beiser, A. (2002). Concepts of Modern Physics (6th ed.). McGraw-Hill Education..**
3. **Griffiths, D. J. (2018). Introduction to Quantum Mechanics (2nd or 3rd ed.). Pearson.**
4. **Tinkham, M. (2004). Introduction to Superconductivity (2nd ed.). Dover Publications.**
5. **Mishra, P. K. (2009). Superconductivity – Basics and Applications. Ane Books.**
6. **Ghatak, A., & Thyagarajan, K. (2005). Optical Electronics. Oxford University Press.**
7. **Saleh, B. E. A., & Teich, M. C. (2019). Fundamentals of Photonics (3rd ed.). Wiley**
8. **Nielsen, M. A., & Chuang, I. L. (2010). Quantum Computation and Quantum Information (10th Anniversary ed.). Cambridge University Press.**

Web links and Video Lectures (e-Resources):

1. NPTEL – Quantum Mechanics I (IIT Madras): https://nptel.ac.in/courses/115106066
2. NPTEL – Physics: Introductory Quantum Mechanics (NOC): https://archive.nptel.ac.in/courses/115/104/115104096
3. Solid State Physics – NPTEL (IIT Madras) https://nptel.ac.in/courses/115106127
4. A Brief Course on Superconductivity – NPTEL IIT Guwahati (Prof. Saurabh Basu)
5. Playlist Introduction Video: https://www.youtube.com/watch?v=SHoGV-sezNI
6. Full playlist available via the YouTube channel description or archive link.
7. Concepts in Magnetism and Superconductivity – NOC (IIT Kharagpur)Series start (Lecture 1): https://digimat.in/nptel/courses/video/115105131/L01.html
8. Introduction to Photonics – NPTEL (IIT Madras, Prof. Balaji Srinivasan) Lecture 03 to Lecture 12 cover: Direct video link (start Lecture 03): https://nptel.ac.in/courses/108106135/03
9. Semiconductor Optoelectronics – NPTEL (IIT Delhi, Prof. M. R. Shenoy)Direct video link (start relevant lecture): https://nptel.ac.in/courses/108108174/05
10. Sensors and Actuators – NPTEL (IISc Bangalore, Prof. Hardik J. Pandya) Lecture 1 – Introduction to Sensors, Transducers & Actuators, incl. Hall, RTDs, Thermistors https://digimat.in/nptel/courses/video/108108147/L01.html
11. Smart Sensors – NPTEL Lecture 34 – Covers various sensors including gas, pressure, MOS sensors, photodetectors like SNSPD https://www.youtube.com/watch?v=oRydUfgMdgA
12. Lecture 32 – Superconducting Qubits (includes Charge Qubit / Cooper-Pair Box) https://www.youtube.com/watch?v=iYo8ALJ-Mls

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. .Self Learning using AI Tools
2. Activity Based Learning
3. Gamification of Activities
4. Short Animations and Videos
5. Models and Working Models
6. Simulations and Interactive Simulations
7. Experiential Learning
8. Flipped Class Learning
9. Hybrid Learning
10. ICT Based Learning

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).
The CIE Theory component will be30 marks and CIE Practical component will be 20 marks.

The CIE Theory component consists of IA tests for 25 marks and Continuous Comprehensive Assessments (CCA) for 5 marks. The CIE Practical component for continuous assessments will be for 15 marks through rubrics and for lab tests will be for 5 marks.

- To qualify and become eligible to appear for SEE, in the **CIE theory component**, a student must score at least **40% of 30 marks**, i.e., **12 marks**.
- To qualify and become eligible to appear for SEE, in the **CIE Practical component**, a student must secure **a minimum of 40% of 20 marks**, i.e., **08 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE (and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 5 marks. It is recommended to include any one learning activity aimed at enhancing the holistic development of students. This activity should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1: (Marks- 5)

CIE Practical component:

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The summation of all the experiments marks to be scaled down to 15 marks.

The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 5 marks. For laboratory test, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 - PO1, PO2, PO5, PO11)	Explains quantum mechanical principles and quantized energy levels with clarity and depth	Explains most concepts accurately with minor gaps	Shows basic understanding but lacks connection to application	Misunderstands or inconsistently applies key quantum principles	Fails to explain or apply core quantum mechanics concepts
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO5, PO11)	Analyzes conduction models and calculates carrier concentration and Fermi levels accurately	Good interpretation with small conceptual errors	Partial understanding with simple calculation attempts	Inaccurate analysis or incomplete application of models	Unable to perform conduction analysis or interpret results
Performance Indicator 3 (CO3 - PO1, PO2, PO4, PO5, PO11)	Evaluates superconductivity and Josephson junction behavior with clear reasoning and examples	Explains effects with fair understanding and application	Recognizes phenomena but lacks detailed reasoning	Minimal interpretation or misapplication of principles	Fails to identify superconducting phenomena or applications
Performance Indicator 4 (CO4 - PO1, PO2, PO4, PO5, PO11)	Thoroughly investigates light-matter interaction and evaluates photonic devices effectively	Good device interpretation and physical explanation	Basic knowledge of devices with limited contextual clarity	Weak or inconsistent understanding of photonic systems	Lacks or misrepresents device functionality and interaction concepts
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO5, PO11)	Demonstrates strong understanding and correct use of sensors and transducers in electronic systems	Applies concepts correctly with minor gaps in logic or selection	Recognizes device function but lacks depth in analysis	Incorrect application or unclear explanation of sensors	Fails to identify or describe devices or their functions

Rubrics for CIE – Continuous assessment:

	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 - PO1, PO2, PO5, PO11)	Explains quantum mechanical principles and quantized energy levels with clarity and depth	Explains most concepts accurately with minor gaps	Shows basic understanding but lacks connection to application	Misunderstands or inconsistently applies key quantum principles	Fails to explain or apply core quantum mechanics concepts

Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO5, PO11)	Analyzes conduction models and calculates carrier concentration and Fermi levels accurately	Good interpretation with small conceptual errors	Partial understanding with simple calculation attempts	Inaccurate analysis or incomplete application of models	Unable to perform conduction analysis or interpret results
Performance Indicator 3 (CO3 - PO1, PO2, PO4, PO5, PO11)	Evaluates superconductivity and Josephson junction behavior with clear reasoning and examples	Explains effects with fair understanding and application	Recognizes phenomena but lacks detailed reasoning	Minimal interpretation or misapplication of principles	Fails to identify superconducting phenomena or applications
Performance Indicator 4 (CO4 - PO1, PO2, PO4, PO5, PO11)	Thoroughly investigates light-matter interaction and evaluates photonic devices effectively	Good device interpretation and physical explanation	Basic knowledge of devices with limited contextual clarity	Weak or inconsistent understanding of photonic systems	Lacks or misrepresents device functionality and interaction concepts
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO5, PO11)	Demonstrates strong understanding and correct use of sensors and transducers in electronic systems	Applies concepts correctly with minor gaps in logic or selection	Recognizes device function but lacks depth in analysis	Incorrect application or unclear explanation of sensors	Fails to identify or describe devices or their functions

Rubrics for SEE / CIE Test:

	Superior	**Good**	**Fair**	**Needs Improvement**	**Unacceptable**
Performance Indicator 1 (CO1 - PO1, PO2, PO5, PO11)	Explains quantum mechanical principles and quantized energy levels with clarity and depth	Explains most concepts accurately with minor gaps	Shows basic understanding but lacks connection to application	Misunderstands or inconsistently applies key quantum principles	Fails to explain or apply core quantum mechanics concepts
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO5, PO11)	Analyzes conduction models and calculates carrier concentration and Fermi levels accurately	Good interpretation with small conceptual errors	Partial understanding with simple calculation attempts	Inaccurate analysis or incomplete application of models	Unable to perform conduction analysis or interpret results
Performance Indicator 3 (CO3 - PO1, PO2, PO4, PO5, PO11)	Evaluates superconductivity and Josephson junction behavior with clear reasoning and examples	Explains effects with fair understanding and application	Recognizes phenomena but lacks detailed reasoning	Minimal interpretation or misapplication of principles	Fails to identify superconducting phenomena or applications

Performance Indicator 4 (CO4 - PO1, PO2, PO4, PO5, PO11)	Thoroughly investigates light-matter interaction and evaluates photonic devices effectively	Good device interpretation and physical explanation	Basic knowledge of devices with limited contextual clarity	Weak or inconsistent understanding of photonic systems	Lacks or misrepresents device functionality and interaction concepts
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO5, PO11)	Demonstrates strong understanding and correct use of sensors and transducers in electronic systems	Applies concepts correctly with minor gaps in logic or selection	Recognizes device function but lacks depth in analysis	Incorrect application or unclear explanation of sensors	Fails to identify or describe devices or their functions

Suggested rubrics for Practical continuous assessment:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (8) (PO3 & PO7)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation. (3-4)	Student is capable of implementing the design. (1-2)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases. (4)	Student will be able to run the code for few cases and analyze the output (3)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (8) (PO8)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)

	smooth. (7-8)			

Note: Can add Engineering & IT tool usage based on the nature of the course

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

QUANTUM PHYSICS AND APPLICATIONS		Semester	I/II
Course Code	**1BPHYS102/202**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 hours theory and 10-12 hours of practical sessions	Total Marks	100
Credits	04	Exam Hours	03
Examination type (SEE)	Descriptive		

Course outcome (Course Skill Set)

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

1. Explain the core concepts of quantum mechanics such as matter waves, uncertainty principle, wave functions, and quantization of energy, with relevance to computational applications.
2. Analyze the behavior of electrons in metals and semiconductors using classical and quantum models to derive key material properties such as conductivity and carrier concentration.
3. Evaluate the principles and characteristics of superconductivity, including Meissner's effect, critical parameters, and Cooper pair formation, and their relevance in quantum systems.
4. Interpret the interaction of radiation with matter and the operational principles of photonic devices such as lasers, optical fibers, modulators, and photodetectors.
5. Summarize the basic concepts of quantum computing including qubits, quantum gates, and quantum logic, and predict simple outcomes using theoretical circuit models.

Module-1

Quantum Mechanics:

de Broglie Hypothesis, Heisenberg's Uncertainty Principle and its application (Broadneing of Spectral Lines), Principle of Complementarity, Wave Function, Time independent Schrödinger wave equation (Derivation), Physical significance of a wave function and Born Interpretation, Expectation value and its physical significance, Eigen functions and Eigen values, Particle inside one dimensional infinite potential well, Role of higher dimensions (Qualitative), Waveforms and Probabilities, Particle inside a finite potential well and quantum tunneling, Numerical Problems.

Text Book : 1, 2 Reference Books : 1,2 Number of Hours: 8

Module-2

Electrical Properties of Metals and Semiconductors:

Failures of classical free electron theory, Mechanisms of electron scattering in solids, Matheissen's rule, Assumptions of Quantum Free Electron Theory, Density of States, Fermi Dirac statistics, Fermi Energy, Variation of Fermi Factor With Temperature and Energy, Expression for carrier concentration, Derivation of electron concentration in an intrinsic semiconductor, Expression for electron and hole concentration in extrinsic semiconductor, Fermi level for intrinsic(with derivation) and extrinsic semiconductor (no derivation), Hall effect, Numerical Problems.

Text Book : 1 and 3 Number of

Module-3

Superconductivity:

Zero resistance state, Persitent current, Meissner effect, Critical temperature, Critical current (Silsbee Effect) – Derivation for a cylindrical wire using ampere's law, Critical field, Formation of Cooper pairs - Mediation of phonons, Two-fluid model, BCS Theory - Phase coherent state, Limitations of BCS theory, Examples of systems with low and high electron-phonon coupling, Type-I and Type-II superconductors, Formation of Vortices, Explanation for upper critical field, Cooper pair Tunneling (Andreev reflection), Josephson junction, Flux quantization, DC and AC SQUID, Numerical Problems.

Text Books : 1, 3 , Reference Book: 3 Number of Hours: 8

Module-4

Photonics :

Interaction of radiation with matter – Einstein's A and B coefficients, Prerequisites for lasing actions, Types of LASER – Semiconductor diode LASER, Use of attenuators for single photon sources, Optical modulators –

Pockel's effect, Kerr effect, Photodetectors – Single Photon Avalanche Diode, Superconducting Nanowire Single Photon Detector, Optical fiber, Derivation of Numerical aperture, V-number, Number of modes, losses in optical fiber, Mach-Zehnder interferometer, Numerical problems.

Text Books: 1, 2, Reference Book: 6 Number of Hours:8

Module-5

Quantum Computing:

Moore's law - limitation of VLSI, Classical vs Quantum Computation, bit, Qubit and its properties, Bloch Sphere, Dirac notation, Brief discussion on types of qubit, Superconducting qubits, Harmonic oscillator (qualitative) – Need for anharmonicity, Charge qubit, Quantum Gates – Pauli Gates, Phase gate (S, T), Hadamard Gate, Two qubit gates – CNOT gate, Predicting the outputs of various combinations of single and two-qubit gates, Numerical Problems.

Text Book: 4 , Reference Book : 8 Number of Hours:8

PRACTICAL COMPONENTS OF IPCC

PART – A: FIXED SET OF EXPERIMENTS

1. Determination of wavelength of LASER using Diffraction Grating.
2. Determination of acceptance angle and numerical aperture of the given Optical Fiber.
3. Study the Characteristics of a Photo-Diode and to determine the power responsivity / Verification of Inverse Square Law of Light
4. Determination of Planck's Constant using LEDs.
5. Determination of Fermi Energy of Copper.
6. Determination of Energy gap of the given Semiconductor.
7. Black-Box Experiment (Identification of basic Electronic Components)
8. Resonance in LCR circuit.
9. Characteristics of a Bipolar Junction Transistor.
10. Determination of resistivity of a semiconductor by Four Probe Method.
11. Predicting the outputs of various combinations of single and two-qubit gates using QUIRK Quantum Simulator.
12. Predicting the outputs of various combinations of single and two-qubit gates using QUISKIT.
13. Air-wedge / Newtons to study the interference by the division of amplitude.
14. Data Analysis using Spread Sheet.

(One Quantum Simulation Experiment is compulsory and must be conducted either in the Computer Laboratory for the entire LAB batch or using dedicated systems within the Physics Laboratory as part of the experimental cycles.)

PART – B: OPEN ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. **Engineering Physics, Satyendra Sharma and Jyotsna Sharma, Pearson, 2018.**
2. **Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBS Publishers and Distributers Pvt. Ltd., 2018**
3. **Solid State Physics, S. O. Pillai, New Age International**
4. **Quantum Computing, Parag K Lala, McGraw Hill, 2020.**

Reference books / Manuals:

1. **Beiser, A. (2002). Concepts of Modern Physics (6th ed.). McGraw-Hill Education..**
2. **Griffiths, D. J. (2018). Introduction to Quantum Mechanics (2nd or 3rd ed.). Pearson.**
3. **Tinkham, M. (2004). Introduction to Superconductivity (2nd ed.). Dover Publications.**
4. **Mishra, P. K. (2009). Superconductivity – Basics and Applications. Ane Books.**
5. **LASERS and Non-Linear Optics, B B Loud, New Age International,**
6. **Saleh, B. E. A., & Teich, M. C. (2019). Fundamentals of Photonics (3rd ed.). Wiley**
7. **Nielsen, M. A., & Chuang, I. L. (2010). Quantum Computation and Quantum Information (10th Anniversary ed.). Cambridge University Press.**
8. **Vishal Sahani, Quantum Computing, McGraw Hill Education, 2007 Edition.**

Web links and Video Lectures (e-Resources):

1. NPTEL – Quantum Mechanics I (IIT Madras): https://nptel.ac.in/courses/115106066
2. NPTEL – Physics: Introductory Quantum Mechanics (NOC): https://archive.nptel.ac.in/courses/115/104/115104096
3. Solid State Physics – NPTEL (IIT Madras) https://nptel.ac.in/courses/115106127
4. A Brief Course on Superconductivity – NPTEL IIT Guwahati (Prof. Saurabh Basu)
5. Playlist Introduction Video: https://www.youtube.com/watch?v=SHoGV-sezNI
6. Full playlist available via the YouTube channel description or archive link.
7. Concepts in Magnetism and Superconductivity – NOC (IIT Kharagpur)Series start (Lecture 1): https://digimat.in/nptel/courses/video/115105131/L01.html
8. Introduction to Photonics – NPTEL (IIT Madras, Prof. Balaji Srinivasan) Lecture 03 to Lecture 12 cover: Direct video link (start Lecture 03): https://nptel.ac.in/courses/108106135/03
9. Semiconductor Optoelectronics – NPTEL (IIT Delhi, Prof. M. R. Shenoy)Direct video link (start relevant lecture): https://nptel.ac.in/courses/108108174/05
10. Lecture 04 – Quantum Computing Basics: https://www.youtube.com/watch?v=-fttE1SzpD8
11. Lecture 08 – Quantum Gates and Circuits Part 1: https://www.youtube.com/watch?v=nGPr1QM_XrY

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Self Learning using AI Tools
2. Activity Based Learning
3. Gamification of Activities
4. Short Animations and Videos
5. Models and Working Models
6. Simulations and Interactive Simulations
7. Experiential Learning
8. Flipped Class Learning

9. Hybrid Learning
10. ICT Based Learning

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).
The CIE Theory component will be 30 marks and CIE Practical component will be 20 marks.

The CIE Theory component consists of IA tests for 25 marks and Continuous Comprehensive Assessments (CCA) for 5 marks. The CIE Practical component for continuous assessments will be for 15 marks through rubrics and for lab tests will be for 5 marks.

- To qualify and become eligible to appear for SEE, in the **CIE theory component**, a student must score at least **40% of 30 marks**, i.e., **12 marks**.
- To qualify and become eligible to appear for SEE, in the **CIE Practical component**, a student must secure **a minimum of 40% of 20 marks**, i.e., **08 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE (and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 5 marks. It is recommended to include any one learning activity aimed at enhancing the holistic development of students. This activity should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1: (Marks- 5)

CIE Practical component:

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The summation of all the experiments marks to be scaled down to 15 marks.

The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 5 marks. For laboratory test, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 - PO1, PO2, PO5, PO11)	Clearly explains quantum principles (e.g., uncertainty, wave function) with computational relevance	Explains core principles accurately with minor conceptual gaps	Basic understanding with limited linkage to applications	Fragmented explanation with weak application context	Fails to explain quantum concepts or relevance to computation
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO5, PO11)	Accurately analyzes electron behavior using classical and quantum models for conductivity	Reasonable analysis with some misinterpretation of models	Basic recognition of conduction principles with weak analysis	Limited understanding and incorrect application of models	No meaningful analysis of conduction mechanisms
Performance Indicator 3 (CO3 - PO1, PO2, PO4, PO5, PO11)	Effectively evaluates superconducting principles and applies them in quantum contexts	Good understanding of concepts but lacks depth in application	Identifies phenomena but struggles with significance or relevance	Limited and inaccurate explanation of superconductivity	Fails to explain or apply superconductivity principles
Performance Indicator 4 (CO4 - PO1, PO2, PO4, PO5, PO11)	Demonstrates clear understanding of radiation-matter interaction and device principles	Explains device operations with minor misconceptions	Recognizes device function but lacks technical depth	Inadequate understanding of photonic principles	Unable to interpret or explain device behavior
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO5, PO11)	Accurately summarizes quantum computing concepts and predicts circuit behavior	Good explanation of quantum gates with some errors in logic application	Basic description of qubits and circuits without predictive insight	Inconsistent understanding of quantum computing logic	Fails to explain or apply quantum computing principles

Rubrics for CIE – Continuous assessment:

	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 - PO1, PO2, PO5, PO11)	Clearly explains quantum principles (e.g., uncertainty, wave function) with computational relevance	Explains core principles accurately with minor conceptual gaps	Basic understanding with limited linkage to applications	Fragmented explanation with weak application context	Fails to explain quantum concepts or relevance to computation
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO5, PO11)	Accurately analyzes electron behavior using classical and quantum models for conductivity	Reasonable analysis with some misinterpretation of models	Basic recognition of conduction principles with weak analysis	Limited understanding and incorrect application of models	No meaningful analysis of conduction mechanisms
Performance Indi-	Effectively	Good understand-	Identifies phe-	Limited and inac-	Fails to explain or

cator 3 (CO3 - PO1, PO2, PO4, PO5, PO11)	evaluates superconducting principles and applies them in quantum contexts	ing of concepts but lacks depth in application	nomena but struggles with significance or relevance	curate explanation of superconductivity	apply superconductivity principles
Performance Indicator 4 (CO4 - PO1, PO2, PO4, PO5, PO11)	Demonstrates clear understanding of radiation-matter interaction and device principles	Explains device operations with minor misconceptions	Recognizes device function but lacks technical depth	Inadequate understanding of photonic principles	Unable to interpret or explain device behavior
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO5, PO11)	Accurately summarizes quantum computing concepts and predicts circuit behavior	Good explanation of quantum gates with some errors in logic application	Basic description of qubits and circuits without predictive insight	Inconsistent understanding of quantum computing logic	Fails to explain or apply quantum computing principles

Rubrics for SEE / CIE Test:

	Superior	**Good**	**Fair**	**Needs Improvement**	**Unacceptable**
Performance Indicator 1 (CO1 - PO1, PO2, PO5, PO11)	Clearly explains quantum principles (e.g., uncertainty, wave function) with computational relevance	Explains core principles accurately with minor conceptual gaps	Basic understanding with limited linkage to applications	Fragmented explanation with weak application context	Fails to explain quantum concepts or relevance to computation
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO5, PO11)	Accurately analyzes electron behavior using classical and quantum models for conductivity	Reasonable analysis with some misinterpretation of models	Basic recognition of conduction principles with weak analysis	Limited understanding and incorrect application of models	No meaningful analysis of conduction mechanisms
Performance Indicator 3 (CO3 - PO1, PO2, PO4, PO5, PO11)	Effectively evaluates superconducting principles and applies them in quantum contexts	Good understanding of concepts but lacks depth in application	Identifies phenomena but struggles with significance or relevance	Limited and inaccurate explanation of superconductivity	Fails to explain or apply superconductivity principles
Performance Indicator 4 (CO4 - PO1, PO2, PO4, PO5, PO11)	Demonstrates clear understanding of radiation-matter interaction and device principles	Explains device operations with minor misconceptions	Recognizes device function but lacks technical depth	Inadequate understanding of photonic principles	Unable to interpret or explain device behavior

Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO5, PO11)	Accurately summarizes quantum computing concepts and predicts circuit behavior	Good explanation of quantum gates with some errors in logic application	Basic description of qubits and circuits without predictive insight	Inconsistent understanding of quantum computing logic	Fails to explain or apply quantum computing principles

Suggested rubrics for Practical continuous assessment:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (8) (PO3 & PO7)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation. (3-4)	Student is capable of implementing the design. (1-2)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases. (4)	Student will be able to run the code for few cases and analyze the output (3)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (8) (PO8)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)

Note: Can add Engineering & IT tool usage based on the nature of the course

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation

- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Computer Aided Engineering Drawing for ECE Stream		Semester	I/II
Course Code	1BCEDEC103/203	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2 :0 :2 : 0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory (Conducted in batches similar to practical's)		

Course Outcomes

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

CO 1. Generate orthographic projections of points, lines, planes, and solids manually and with computer-aided tools.

CO 2. Develop the lateral surfaces of solids for real-world applications.

CO 3. Draw isometric views and convert isometric drawings to orthographic views.

CO 4. Create basic 3D models of electronic components and parts.

Module-1

Introduction:

Significance of Engineering drawing, BIS Conventions of Engineering Drawing, Free hand sketching of engineering drawing, Scales.

Introduction to Computer Aided Drafting software, 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, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet and curves.

Orthographic Projections of Points, Lines and Planes:

Introduction to Orthographic projections, Orthographic projections of points in 1st and 3rd quadrants.

Orthographic projections of lines (Placed in First quadrant only as per BIS)

Orthographic projections of planes: triangular, square, rectangular, pentagonal, hexagonal and circular lamina (Placed in First quadrant only using change of position method).

Number of Hours: 08

Module-2

Orthographic Projection of Solids:

Orthographic projection of right regular solids (Resting on HP only and inclined to both the planes); Prisms, Pyramids, Cylinders & Cones.

Number of Hours: 08

Module-3

Section of Solids:

Introduction, Section planes, Sectional views: apparent shapes and true shapes, Sections of right regular prisms, pyramids, cylinders and cones resting with their base on HP. (Concepts only and No Problems for practice)

Development of Lateral Surfaces of Solids:

Development of lateral surfaces of right regular Prisms, Pyramids, Cylinders & Cones and their frustums and truncations. Problems on applications of development of lateral surfaces like funnels and trays.

Number of Hours: 08

Module-4

Isometric Views:

Introduction to Isometric views, Isometric projections, Isometric scale.
Isometric view of hexahedron (cube), right regular prisms, pyramids, cylinders, cones and spheres, Isometric view of combination of two simple solids, step block.

Conversion of simple isometric drawings into orthographic views: Problems on conversion of Isometric view of simple objects / engineering components into orthographic views.

Number of Hours: 08

Module-5

Electronic Components Visualisation (For CIE Only):

3D Modelling: Optical fibre cable with core and cladding, photonic crystal fibers, Antenna: Single element patch antenna, antenna array.
Sheet Metal & Surface Design: PCB Enclosures: Creation of different geometry with slots as per Standards: NMEA-0183, applying material properties for heat sink and water/dust proofing and rendering for realistic visualization.
Concept of Industrial drawing

Number of Hours: 08

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Textbooks:

1. K. R. Gopalakrishna, & Sudhir Gopalakrishna: A Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017
2. Bhatt, N.D., Engineering Drawing: Plane and Solid Geometry, 53rd Edition, Charotar Publishing House Pvt. Limited, 2023.

Reference books:

1. S. N. Lal and T. Madhusudhan, Engineering Visualisation, engage Learning India Pvt. Ltd.; First Edition, 2022
2. P.J. Shah, Computer Aided Engineering Drawing, S. Chand Publishing, 2021
3. M. B. Shah & B.C. Rana., Engineering Drawing, Pearson Education, Revised Edition, 2009
4. A K Mittal & Kapeel Dev, Electronics Engineering Drawing, Computech Publications Limited, 2025
5. John Frostad, Electronics Drafting, Goodheart-Willcox Pub; 4th Edition, 2010.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/112104172
- https://nptel.ac.in/courses/112102304
- https://nptel.ac.in/courses/112105294
- https://www.coursera.org/courses?query=3d%20modeling&utm
- https://fiberopticx.com/optical-fiber-cable-structure/
- https://www.newport.com.cn/t/photonic-crystal-fibers

Teaching-Learning Process (Innovative Delivery Methods):
The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

- Flipped Classroom
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Internal Evaluation (CIE):
CIE shall be evaluated for 50 marks as detailed below:

The final CIE (50) = Class work marks (30) + Test marks (20)

- Class work marks should comprise of continuous evaluation of Drawing work of students as and when the Modules are covered based on the weightage as shown in the following table.

Module	**Max. Marks Weightage**	**Evaluation Weightage in marks**	
		Computer display and print out (a)	**Sketching (b)**
Module 1	20	15	05
Module 2	20	15	05
Module 3	20	15	05
Module 4	20	15	05
Module 5	20	15	05
Total	**100**	**75**	**25**
Consideration of Class work		Total of [(a) + (b)] = 100 **Scaled down to 30 Marks**	

- At least one **Test** covering all the modules is to be conducted for 100 marks and evaluation to be based as per SEE pattern, and the obtained marks is to be scaled down to **20 Marks.**

Semester End Examination (SEE):

- SEE shall be conducted in batches similar to practical's and evaluated for maximum of 100 Marks. Obtained marks shall be accounted for SEE final marks, reducing it by 50%.

- Two full questions shall be set from Modules 1, 2, 3 and 4. Students need to answer one full question from each module.
- Two full questions set from each Module shall cover the entire topic of the respective module.
- Question papers shall be provided by the University for each batch as per schedule.
- SEE shall be conducted by one Internal and one External Examiner.
- Evaluation shall be carried out jointly by both the examiners.
- The student may be awarded full marks, if he/she completes a solution on computer display without sketch.
- The weightage and distribution of marks for each Module is as shown in the following table:

Module	**Max. Marks Weightage**	**Evaluation Weightage in marks**	
		Computer display and print out (a)	**Sketching (b)**
Module 1	20	15	05
Module 2	30	25	05
Module 3	25	20	05
Module 4	25	20	05
Total	**100**	**80**	**20**
Consideration of SEE Marks		**Total of (a + b) ÷ 2 = Final SEE marks**	

Computer Aided Engineering Drawing for CS Stream		Semester	I/II
Course Code	1BCEDS103/203	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2 :0 :2 : 0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory (Conducted in batches similar to practical's)		

Course Outcomes

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

CO 1. Generate orthographic projections of points, lines, planes, and solids manually and with computer-aided tools.

CO 2. Develop the lateral surfaces of solids for real-world applications.

CO 3. Draw isometric views and convert isometric drawings to orthographic views.

CO 4. Create 3D models of embedded, networking, and IoT devices.

Module-1

Introduction:

Significance of Engineering drawing, BIS Conventions of Engineering Drawing, Free hand sketching of engineering drawing, Scales.

Introduction to Computer Aided Drafting software, 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, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet and curves.

Orthographic Projections of Points, Lines and Planes:

Introduction to Orthographic projections, Orthographic projections of points in 1st and 3rd quadrants.

Orthographic projections of lines (Placed in First quadrant only as per BIS)

Orthographic projections of planes: triangular, square, rectangular, pentagonal, hexagonal and circular lamina (Placed in First quadrant only using change of position method).

Number of Hours: 08

Module-2

Orthographic Projection of Solids:

Orthographic projection of right regular solids (Resting on HP only and inclined to both the planes); Prisms, Pyramids, Cylinders & Cones.

Number of Hours: 08

Module-3

Section of Solids:

Introduction, Section planes, Sectional views: apparent shapes and true shapes, Sections of right regular prisms, pyramids, cylinders and cones resting with their base on HP. (Concepts only and No Problems for practice)

Development of Lateral Surfaces of Solids:

Development of lateral surfaces of right regular Prisms, Pyramids, Cylinders & Cones and their frustums and truncations. Problems on applications of development of lateral surfaces like funnels and trays.

Number of Hours: 08

Module-4

Isometric Views:

Introduction to Isometric views, Isometric projections, Isometric scale.
Isometric view of hexahedron (cube), right regular prisms, pyramids, cylinders, cones and spheres, Isometric view of combination of two simple solids, step block.

Conversion of simple isometric drawings into orthographic views: Problems on conversion of Isometric view of simple objects / engineering components into orthographic views.

Number of Hours: 08

Module-5

Computer Network Drawing (For CIE Only):

2D Network drawing with wired and wireless, Network topology - wired and wireless.
3D Modeling: Raspberry Pi / Arduino boards, Router & switches, IoT devices - Concept of converting to 3D printing format (stl)
Concept of Industrial drawing

Number of Hours: 08

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Textbooks:

1. K. R. Gopalakrishna, & Sudhir Gopalakrishna: A Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017
2. Bhatt, N.D., Engineering Drawing: Plane and Solid Geometry, 53rd Edition, Charotar Publishing House Pvt. Limited, 2023.

Reference books:

1. S. N. Lal and T. Madhusudhan, Engineering Visualisation, engage Learning India Pvt. Ltd.; First Edition, 2022
2. P.J. Shah, Computer Aided Engineering Drawing, S. Chand Publishing, 2021
3. M. B. Shah & B.C. Rana., Engineering Drawing, Pearson Education, Revised Edition, 2009
4. Frederick E. Giesecke, et al., Technical Drawing with Engineering Graphics, Prentice Hall, 2016

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/112104172
- https://nptel.ac.in/courses/112102304
- https://nptel.ac.in/courses/112105294
- https://www.coursera.org/courses?query=3d%20modeling&utm
- https://www.youtube.com/watch?v=zbqrNg4C98U

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

- Flipped Classroom
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Internal Evaluation (CIE):
CIE shall be evaluated for 50 marks as detailed below:

The final CIE (50) = Class work marks (30) + Test marks (20)

- Class work marks should comprise of continuous evaluation of Drawing work of students as and when the Modules are covered based on the weightage as shown in the following table.

Module	**Max. Marks Weightage**	**Evaluation Weightage in marks**	
		Computer display and print out (a)	**Sketching (b)**
Module 1	20	15	05
Module 2	20	15	05
Module 3	20	15	05
Module 4	20	15	05
Module 5	20	15	05
Total	**100**	**75**	**25**
Consideration of Class work		Total of [(a) + (b)] = 100 **Scaled down to 30 Marks**	

- At least one **Test** covering all the modules is to be conducted for 100 marks and evaluation to be based as per SEE pattern, and the obtained marks is to be scaled down to **20 Marks.**

Semester End Examination (SEE):

- SEE shall be conducted in batches similar to practical's and evaluated for maximum of 100 Marks. Obtained marks shall be accounted for SEE final marks, reducing it by 50%.
- Two full questions shall be set from Modules 1, 2, 3 and 4. Students need to answer one full question from each module.
- Two full questions set from each Module shall cover the entire topic of the respective module.
- Question papers shall be provided by the University for each batch as per schedule.
- SEE shall be conducted by one Internal and one External Examiner.
- Evaluation shall be carried out jointly by both the examiners.
- The student may be awarded full marks, if he/she completes a solution on computer display without sketch.

- The weightage and distribution of marks for each Module is as shown in the following table:

Module	**Max. Marks Weightage**	**Evaluation Weightage in marks**	
		Computer display and print out (a)	**Sketching (b)**
Module 1	20	15	05
Module 2	30	25	05
Module 3	25	20	05
Module 4	25	20	05
Total	**100**	**80**	**20**
Consideration of SEE Marks		**Total of (a + b) ÷ 2 = Final SEE marks**	

Introduction to Electrical Engineering		Semester	I/II
Course Code	1BESC104B/204B	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

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

1. Explain the generation of power and the laws used in DC circuits.
2. Analyse single-phase and three-phase circuits.
3. Describe the construction, operation and applications of DC machines.
4. Describe the construction, operation and applications of transformers and induction motors.
5. Explain electricity billing and safety measures

Module-1

Power Generation: Conventional and nonconventional energy sources. Single-line diagram of power supply system showing power station, transmission system and distribution system. Definition of power grid.

DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits. Power and energy.Problems.

Number of Hours: 08

Module-2

Single-Phase Circuits: Generation of single-phase system. Equation of AC voltage and current, average value, RMS value, form factor, peak factor and their relation [No derivations]. Voltage and current relationships in R, L and C circuits, concept of power, reactive power, apparent power and power factor, analysis of R-L, R-C and R-L-C series circuits, parallel circuits, illustrative examples.

Three-Phase Circuits: Generation of three-phase systems, star and delta (mesh) connections, relation between phase and line values of voltages and of currents of star and delta connections. Definition of balanced and unbalanced source and load. Power, reactive power and power factor. Problems with balanced loads.

Number of Hours: 08

Module-3

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

DC Motor: Principle of operation, back emf and its significance. Torque equation, types of motors, characteristics and speed control of DC shunt motor. Applications of DC motors. Simple problems.

Number of Hours:08

Module-4

Transformers: Introduction to transformers, necessity of transformer, principles of operation, constructional features of single phase transformers. EMF equation, losses, variation of losses with respect to load. Calculation of efficiency at different loads.

Three-phase induction Motors: Definition of rotating magnetic field (without derivation), Principle of operation. Constructional features of squirrel cage type and wound rotor type induction motor. Slip and its significance, problems. Applications.

Number of Hours: 08

Module-5

Domestic Wiring: Two-way and three-way control of loads.
Electricity Bill: Definition of "unit" used for consumption of electrical energy, power rating of common household appliances. Two-part electricity tariff.
Equipment Safety measures: Working principle of fuse and miniature circuit breaker (MCB), merits and demerits.
Personal safety measures: Electric shock, safety precautions to avoid shock. Earthing and types: Plate earthing and pipe earthing.

Number of Hours: 08

Suggested Learning Resources

Textbooks:

1. A text book of Electrical Technology by B.L. Theraja, S Chand and Company, reprint edition 2014.
2. Principles of Electrical Engineering & Electronics by V. K. Mehta, Rohit Mehta, S. Chand and Company Publications, 2nd edition, 2015.

Reference books

1.Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill 4th edition, 2019.0
2.Fundamentals of Electrical Engineering by Rajendra Prasad, PHI, 3rd edition, 2014.
3.Electrical Technology by E. Hughes, Pearson, 12th Edition, 2016.
4.Basic Electrical and Electronics Engineering, K.Vijayarekha, et al, Cengage. Reprint 2023.
5. Handbook of Electrical Engineering formulae, Harish C Rai, CBS Publications, 2018.

Web links and Video Lectures (e-Resources): **www.nptel.ac.in**

(1)Principle of Electrical Sciences, Prof Sanjay Agrawal, Indira Gandhi National Open University.
(2)Electricity and Electrical Wiring, Dr. Antara Mahanta Barua, Krishna Kanta Handiqui State Open University, Guwahati.

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Technology Integration, 2. Collaborative Learning, 3. Flipped Classroom, 4. Visual Based Learning

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Not- withstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.
Learning Activity -1: (Marks- 15)
Learning Activity -2 (optional): (Marks-10)

Rubrics for Learning Activity 1, Maximum marks:15 (Based on the nature of learning activity, design the rubrics for each activity)						
Activity type	**Performance Indicator**	**Excellent**	**Very Good**	**Good**	**Fair**	**Needs Improvement**
Any one of the actives mentioned in Activity -1						
Industrial Visit Report Writing (15)	**PO10.2:** Submit a comprehensive report. (15)	Submits a clear, concise, well-structured, report with relevant attachments. (15-12)	Submits a clear and structured report with sufficient attachments. (11-9)	Submits a moderate report without many attachments. (8-6)	Submits a moderate report devoid of attachments. (5-3)	Submits a report not following a sequence of events that a report generally demands. (2-1)
Case Study / Problem-Based Learning (15)	**PO2.2**: Analyse problems using first principles. (5)	Applies first principles thoroughly to produce logical, and innovative solution. (5)	Applies first principles effectively with minor mistakes. (4)	Applies first principles adequately for regular problems (3)	Applies first principles to only simple problems. (2)	Applies first principles in an inappropriate way. (1)
	PO3.1: Produce appropriate solutions (5)	Produces creative, technically sound, and sustainable solutions to almost all problems. (5)	Produces acceptable solutions to many problems. (4)	Produces satisfactory solutions only to standard problems (3)	Produces incomplete Solutions. (2)	Produces no relevant solutions. (1)
	PO11.1: Understand impact of engineering solutions in societal context (5)	Provides comprehensive solutions covering societal, health, safety, environmental and cost effective issues. (5)	Provides appreciable solutions covering only few societal issues. (4)	Recognizes basic societal impacts. Provides satisfactory solutions covering only some of the societal issues. (3)	Limited understanding of societal impacts. Provides an abridged solutions. (2)	Very limited consideration of societal impacts. Provides solutions that do not have much relevance to the context. (1)

Rubrics for Learning Activity – 2, Maximum Marks:10 (Based on the nature of learning activity, design the rubrics for each activity)						
Activity type	**Performance Indicator**	**Excellent**	**Very Good**	**Good**	**Fair**	**Needs Improvement**
Any one of the actives mentioned in Activity -2						
Assignment (10)	**PO1.1**: Apply knowledge of mathematics, science, and engineering. (5)	Applies concepts flawlessly to all the problems. (5)	Applies concepts correctly to most of the problems with minor mistakes. (4)	Applies concepts only to few problems with acceptable approach. (3)	Applies concepts only to few problems with minor mistakes. (2)	Applies concepts to few problems committing mistakes. (1)
	PO2.1: Analyse and solve engineering problems. (5)	Analyse to provide innovative solutions for all the problems. (5)	Analyse to provide correct solutions for most of the problems. (4)	Analyse to provide solutions to some of the problems. (3)	Partially analyse to give solution in few cases. (2)	Struggles to analyse problems. Offers incomplete or incorrect solution. (1)
Presentation/ Seminar (10)	**PO10.1**: Communicate effectively both in written and oral form. (5)	Presents ideas confidently, clearly, and engagingly with excellent audience interaction. (5)	Presents clearly the topic contents but falters while delivering the content. (4)	Presents the contents properly but struggles to deliver. (3)	Presents imprecise contents and finds difficulty in delivery.(2)	Presents imprecise contents and fails to deliver. (1)
	PO8.1: Demonstrate professional and ethical behaviour. (5)	Adheres to high ethical standards, shows strong professional conduct. (5)	Mostly adheres to ethical standards with minor lapses. (4)	Understands ethics but inconsistently applies them. (3)	Shows limited awareness of ethical standards (2)	Shows disregard to ethics and professionalism (1)

Introduction to Electronics and Communication Engineering		Semester	I/II
Course Code	1BESC104C/204C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

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

1. Analyse basic electronic circuits using the principles of rectifiers, voltage regulators, and amplifiers.
2. Analyse the behaviour of analog circuits including oscillators and operational amplifiers in signal generation and conditioning applications.
3. Illustrate the fundamental concepts of analog and digital modulation techniques based on their characteristics and suitability for communication systems.
4. Interpret the structure and functionality of embedded systems and digital logic components such as microcontrollers, sensors, and logic gates.
5. Apply number system conversions and Boolean algebra to design and implement basic combinational logic circuits.

Module-1

Power Supplies: Block Diagram, Rectifiers, Reservoir and Smoothing Circuits, Improved Ripple Filters, Full Wave Rectifiers, Bi Phase Rectifiers Circuits, Bridge Rectifier Circuits, Voltage Regulators, Output Resistance and Voltage Regulation, Voltage Multipliers, (Only Voltage Doubler) Switched Mode Power Supplies.

Amplifiers: Types of Amplifiers, Gain, Input and Output Resistance, Frequency Response, Bandwidth, Phase Shift, Negative Feedback.

Text 1: Page No: 117-128, 139-146 Number of Hours:8

Module-2

Oscillators: Positive Feedback, Condition for Oscillations, Ladder Network Oscillator, Wein Bridge Oscillator, Single-Stage Astable Oscillator, Crystal Controlled Oscillators (Only Concepts, Working, and Waveforms. No Mathematical Derivations)

Operational Amplifiers: Operational Amplifier Parameters, Operational Amplifier Characteristics, Operational Amplifier Configurations, Operational Amplifier Circuits.

Text 1: Page No:179-186, 165-169, 171-175 Number of Hours:8

Module-3

Analog Communication Schemes: Introduction, Modern Communication System Scheme: Information Source and Input Transducer, Transmitter, Channel or Medium, Noise, Receiver, Concept of Modulation, Concept of Radio Wave Propagation (Ground, Space, Sky), Types of Communication Systems.

Modulation Schemes: Amplitude Modulation, Angle Modulation, Advantages of Digital Communication Over Analog Communication, Multiplexing, Digital Modulation Schemes: ASK, FSK, PSK, (Explanation with Waveform)

Text 2: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 1.12, 1.15, 2.2.1, 3.2.1, 6.1, 6.11, 6.12, 6.13, 6.15, 6.16. Number of Hours:8

Module-4

Embedded Systems: Definition, Embedded Systems Vs General Computing Systems, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose of an Embedded System, Core of The Embedded System: Microprocessors, GPP Vs ASIP, Microcontrollers, Microprocessor Vs Microcontroller, DSP, RISC V/S CISC, Memory: ROM, Sensors, Actuators, LED, 7-Segment LED Display.

Text 3: 1.1, 1.2, 1.4, 1.5, 1.6, 2.1.1.1-2.1.1.6, 2.2.1, 2.3.1, 2.3.2, 2.3.3.1, 2.3.3.2. Number of Hours:8

Module-5

Boolean Algebra and Logic Circuits: Binary Numbers, Number Base Conversion- Binary, Decimal And Octal and Hexa Decimal Numbers and Vice-Versa, Complements-1's and 2's, Basic Definitions, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates.

Combinational Logic: Introduction, Design Procedure, Adders- Half Adder, Full Adder.

Text 4: 1.2, 1.3, 1.4, 1.5, 2.1, 2.3, 2.4, 2.5, 2.7, 4.1, 4.2, 4.3. Number of Hours:8

Suggested Learning Resources: (Text Book)

1. Mike Tooley "Electronic Circuits Fundamentals & Applications,"5th Edition, Elsevier, 2020.
2. S L Kakani and Priyanka Punglia, 'Communication Systems', Ist Edition, New Age International Publisher, 2017.
3. K V Shibu, 'Introduction to Embedded Systems', 2nd Edition, McGraw Hill Education (India), Private Limited, 2019.
4. Digital Logic and Computer Design, M. Morris Mano, Pearson Education, 2017, ISBN-978-93-325- 4252-5.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/122106025
- https://nptel.ac.in/courses/108105132

Teaching-Learning Process (Innovative Delivery Methods)

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching 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 with their own creative ways to solve them.
5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.

Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Evaluation (CCE):

CCE will be conducted for a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity 1: (Marks 25): Two assignments (for 10marks and 15marks) related to simulation of simple circuits (using any simulation tool such as LTSpice, KICad etc.), at RBL3, RBL4, or RBL5 levels, assignment reports should include circuit design, schematic, and simulation results.

Rubrics for Assignment

	Superior	Good	Fair	Needs Improvement	Unacceptable
Demonstrates an Understanding of Simulation Environment – 5 marks	Explains simulation concepts clearly, accurately, and with insightful connections **(5)**	Explains simulation concepts accurately with minor gaps in detail **(4)**	Shows basic understanding of simulation concepts but lacks depth or has some inaccuracies **(3)**	Understanding is limited, with frequent errors or confusion **(2)**	Shows little or no grasp of the simulation concepts **(2)**
Able to Apply Laws/Equations and Correct Methodology – 10 marks	Applies laws/equations flawlessly with correct and efficient methodology **(10)**	Applies laws/equations correctly with minor methodological lapses **(9)**	Applies laws/equations partially correctly; some steps or logic missing **(7)**	Frequent errors in applying laws/equations or methodology **(5)**	Unable to apply laws/equations or follow correct methodology **(3)**
Performs Accurate Calculations and Provides precise Answers – 10 marks	All calculations and simulations are accurate; answers precise and in correct format/units **(10)**	Minor calculation and simulation errors; answers mostly precise and correctly formatted **(9)**	Some correct calculation/simulations but noticeable errors; precision inconsistent **(7)**	Frequent calculations/simulation errors; answers often imprecise or incomplete **(6)**	Calculations/Simulations mostly incorrect; answers missing or irrelevant **(3)**

Suggested Learning Activities may include (but are not limited to):

- **Learning Activity -1:** Course Project
- **Learning Activity -2:** Open Book Test (preferably at RBL4 and RBL5 levels)
- **Learning Activity -3:** Assignment (at RBL3, RBL4, or RBL5 levels)
- **Learning Activity -4:** Any other relevant and innovative academic activity
- **Learning Activity -5:** Use of MOOCs and Online Platforms

Suggest Innovative Deliver Methods may include (but are not limited to):

- Flipped Classroom

- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Programming in C		Semester	I/II
Course Code	**1BEIT105/205**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Demonstrate fundamental concepts and language constructs of C programming.
CO2: Make use of control structures and arrays to solve basic computational problems.
CO3: Develop modular programs using user-defined functions for complex computational problems.
CO4: Construct user defined datatypes using structures, unions and enumerations to model simple real-world scenarios.
CO5: Choose suitable datatypes and language constructs to solve a given computational or real-world problem

Module-1

Introduction to Computing: Computer languages, Creating and Running Programs, System Development.

Overview of C: A Brief History of C, C Is a Middle-Level Language, C Is a Structured Language, C Is a Programmer's Language, Compilers Vs. Interpreters, The Form of a C Program, The Library and Linking, Separate Compilation, Compiling a C Program, C's Memory Map.

Expressions: The Basic Data Types, Modifying the Basic Types, Identifier Names, Variables, The Four C Scopes, Type Qualifiers, Storage Class Specifiers, Variable Initializations, Constants, Operators, Expressions.

Textbook 2: Chapter 1: 1.3, 1.4, 1.5; Textbook 1: Chapter 1, 2

Number of Hours: 08

Module-2

Console I/O: Reading and Writing Characters, Reading and Writing Strings, Formatted Console I/O, printf(), scanf().

Statements: True and False in C, Selection Statements, Iteration Statements, Jump Statements, Expression Statements, Block Statements.

Textbook 1: Chapter 8, 3

Number of Hours: 08

Module-3

Arrays and Strings: Single-Dimension Arrays, Generating a Pointer to an Array, Passing Single-Dimension Arrays to Functions, Strings, Two-Dimensional Arrays, Multidimensional Arrays, Array Initialization, Variable - Length Arrays.

Pointers: What Are Pointers?, Pointer Variables, The Pointer Operators, Pointer Expressions, Pointers and Arrays, Multiple Indirection, Initializing Pointers.

Textbook 1: Chapter 4, 5

Number of Hours: 08

Module-4

Functions: The General Form of a Function, Understanding the Scope of a Function, Function Arguments, argc and argv—Arguments to main(), The return Statement, What Does main() Return?, Recursion, Function Prototypes, Declaring Variable Length Parameter Declarations, The inline Keyword.

Pointers (Contd…): Pointers to Functions, C's Dynamic Allocation Functions.

Textbook 1: Chapter 5, Chapter 6

Number of Hours:08

Module-5

Structures, Unions, Enumerations, and typedef: Structures, Arrays of Structures, Passing Structure to Functions, Structure Pointers, Arrays and Structures within Structures, Unions, Bit-Fields, Enumerations, Using sizeof to Ensure Portability, typedef.

Textbook 1: Chapter 7

Number of Hours:08

Suggested Learning Resources:

Textbooks:

1. Schildt, Herbert. "C the complete reference", 4th Edition, Mc GrawHill.
2. Hassan Afyouni, Behrouz A. Forouzan. "A Structured Programming Approach in C", 4th Edition, Cengage.

Reference books:

1. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, 2nd Edition, Prentice Hall of India.
2. Reema Thareja, Programming in C, 3rd Edition, Oxford University Press, 2023.

Web links and Video Lectures (e-Resources):

1. elearning.vtu.ac.in/econtent/courses/video/BS/15PCD23.html
2. Introduction to Programming in C [https://onlinecourses.nptel.ac.in/noc23_cs02/preview]
3. C for Everyone: Programming Fundamentals [https://www.coursera.org/learn/c-for-everyone]
4. Computer Programming Virtual Lab [https://cse02-iiith.vlabs.ac.in/exp/pointers/]
5. C Programming: The ultimate way to learn the fundamentals of the C language [https://www.pdfdrive.com/c-programming-the-ultimate-way-to-learn-the-fundamentals-of-the-c-language-e187584209.html]
6. C Programming: The Complete Reference [https://viden.io/knowledge/programming-in-c-language/attachment/28313/c-the-complete-reference-herbert-schildt-4th-edition-pdf/preview]
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843237039374336345 17_shared/overview
8. C programming Tutorial: https://www.geeksforgeeks.org/c/c-programming-language/.

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Flipped Classroom
2. Problem-Based Learning (PBL)
3. Case-Based Teaching
4. Simulation and Virtual Labs
5. ICT-Enabled Teaching

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course outcomes and promote higher-order thinking and application-based learning.

Learning Activity -1: Programming Assignment (Marks- 25)

INSTRUCTIONS:

1. Course instructor will refer to HackerRank/HackerEarth/LeetCode or any other platform to derive the questions for problem-solving.
2. Course Instructor must identify programming problems from these sections: Statements (control), Arrays, Strings, Structures & Unions and Functions.
3. Courser instructor will assign THREE questions from each section to the students for design of algorithm, program and coding/execution.
4. Students must demonstrate the solutions to the course instructor and submit the record containing algorithm, program, debugging/execution and results with observations.
5. Course instructor must evaluate the student performance as per the rubrics.

Rubrics for Learning Activity-1 (Programming Assignment):

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Clarity & Simplicity of algorithm/program [CO1] [PO9]	Algorithm/Programs are self-explanatory, specific, and well-structured for the intended activity; no ambiguity is present.	Programs are clear and mostly specific; minor ambiguity is present.	Programs are somewhat clear but could be more specific; moderate ambiguity.	Programs are vague and lack clarity; high ambiguity.	Programs are unclear, incomplete, or irrelevant to the activity.
Appropriate Use of language constructs and design of algorithm/program [CO4, CO5] [PO1, PO3]	Demonstrates precise and creative usage of the language construct and structured programming	Correctly applies the language construct with minor gaps or missed opportunities.	Uses the language construct, but with partial understanding or inconsistent usage.	Limited understanding of the language construct; incorrect or weak usage.	No evidence of correct/relevant language construct use.
Compilation, Debugging, Analysis & Comparison of Results for various cases. [CO2, C03] [PO2, PO4, PO5]	Provides clear and correct results with analysis for multiple cases; comparisons among cases highlight key strengths and weaknesses.	Provides correct results with analysis for multiple cases, though slightly less detailed.	Provides correct results with limited analysis; comparisons are present but shallow.	Provides correct results. Minimal analysis: comparisons are weak or incomplete.	Results are partially correct. No meaningful analysis or comparison.
Creativity, efficiency of Problem-Solving/program [CO2, CO3] [PO3, PO11]	Demonstrates outstanding creativity and innovation in writing programs, especially for problem-solving or design tasks.	Demonstrates creativity and some innovation; Program solutions are practical.	Shows moderate creativity; programs are functional but not innovative.	Minimal creativity; programs are repetitive or unimaginative.	No creativity or problem-solving/Programming is evident.
Documentation & Reflection [CO1, CO4, CO5] [PO8/PO9/PO11]	Documentation is complete, well-organized, and includes deep reflection on improvements across iterations.	Documentation is complete with some reflection on program refinement.	Documentation is present but lacks detail or depth in reflection.	Incomplete documentation; reflection is minimal.	No documentation or reflection provided as per schedule.

Fundamentals of Electronics and Communication Engineering		Semester	I
Course Code	1BECE105/205	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

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

1. Apply the working principles, fundamental characteristics of various semiconductor devices including diodes, transistors and operational amplifiers in basic electronic circuits.
2. Analyze basic rectifier and amplifier circuits using the principles of diodes, BJTs, and operational amplifiers.
3. Illustrate the fundamental concepts of communication systems and their applications.
4. Design basic combinational circuits using the fundamental principles of digital systems.
5. Analyze the fundamental concepts of electronic circuits, communication systems, and digital systems for their role in building basic electronic applications.

Module-1

Diodes and Their Application: Introduction, Characteristics and Parameters, Diode Approximation, DC Load Line Analysis, Half Wave Rectifier, Full Wave Bridge Rectifier, Capacitor Filter Circuit (Only Qualitative Approach), Zener Diode and Its Use in Voltage Regulation, Diode Logic Circuit.

Text 1: 2.1, 2.2, 2.3, 2.4, 2.9, 3.1, 3.2, 3.3, 3.7, 3.12. Number of Hours:8

Module-2

Bipolar Junction Transistors: Introduction, BJT Voltages & Currents, BJT Amplification, BJT Switching, Common Base Characteristics, Common Emitter Characteristics, BJT Biasing, Fixed Biasing and Voltage Divider, DC Load Line and Bias Point.

Field Effect Transistor: Junction Field Effect Transistor (N-Channel), JFET Characteristics, MOSFETS: Enhancement MOSFETs.

Case Study MOSFET as a Switch.

Text 1: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 5.1,5.2, 5.4, 9.1, 9.2, 9.5. Number of Hours:8

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: 1.2, 1.3, 1.5, 2.2, 2.3, 2.4, 2.5, 2.6, 6.5, 6.12, 6.13. Number of Hours:8

Module-4

Fundamentals Of Communication: Elements of a Communication System, Communication Channels and Their Characteristics: Wireline, Fiber Optic, Wireless Electromagnetic Channels

Introduction to Analog Modulation Types: Amplitude Modulation, Frequency and Phase Modulation, Waveforms. (Excluding Derivation and Spectral Diagrams)

Applications: AM Radio Broadcasting, Superheterodyne FM Receiver, Mobile Wireless Telephone Systems**.**

Case Study of Converting Analog Signal to Digital Signal Using PCM

Text 3: 1.2, 1.3, 3.1.

Text 4: 3.5, 4.4.1, 4.5, 18.3.1, 18.3.2. Number of Hours:8

Module-5

Digital Systems and Binary Numbers: Digital Systems, Numbering System (Binary, Octal, Decimal and Hexadecimal), Number Base Conversion – (Binary to Decimal, Hexadecimal And Vice Versa), 1's and 2's Complement Operation, Signed Binary Numbers-Arithmetic Addition and Subtraction, Binary Logic.

Boolean Algebra: Basic Definitions, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates (Excluding Extension to Multiple Inputs, Positive and Negative Edge) NAND And NOR As Universal Gates (Excluding Multilevel Presentation), Binary Adders. (Half Adder and Full Adder)

Case Study with 4-Bit Adder Simulation

Text 5: 1.1,1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 2.2,2.4, 2.5, 2.6, 2.8, 3.6, 4.5. Number of Hours:8

Suggested Learning Resources: (Text Books)

1. David A Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 30th Impression, 2025.
2. Ramakanth A Gayakwad, Op-amps and Linear Integrated Circuits, 4th Edition, Pearson Education, 2015.
3. John G. Proakis, Masoud Saleh, Fundamentals of Communication Systems, Second Edition, Pearson Educations, Inc., 2014.
4. D.P Kothari and I J Nagrath, Basic electronics, Second Edition, McGraw Hill Education Pvt ltd, 2018.
5. M.Morris Mano and Michael D.Ciletti, Digital Design - With an Introduction to the Verilog HDL, VHDL and System Verilog 6th Edition, Pearson Education Inc, 2024.

Reference Book

1. Mike Tooley, Electronic Circuits, Fundamentals & Applications, 5th Edition, Elsevier, 2020.
2. Albert Malvino, Electronic Principles, 9th Edition, McGraw Hill Publications, 2021.
3. Electronic Devices and Circuit Theory, R Nashelsky and L Nashelsky, 11th Edition, Pearson, 2012

Web links and Video Lectures (e-Resources):

- Introduction to Basic Electronics: https://nptel.ac.in/courses/122106025
- Digital Electronic Circuits https://nptel.ac.in/courses/108105132

Teaching-Learning Process (Innovative Delivery Methods)

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching 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 with their own creative ways to solve them.
5. Arrange visits to nearby industries to give brief information about the electronics manufacturing industry.
5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.

Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Note: The Case Studies provided in Modules 2, 4 and 5 are only meant to motivate the application of concepts to students and will not appear in the SEE

Continuous Comprehensive Evaluation (CCE):

CCE will be conducted for a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity 1: (Marks 25): Two assignments (for 10marks and 15marks) with circuit simulation using any simulation tool (e.g. LTSpice, KICad etc.) related to the case studies in Module 2, 4 and 5. Assignments should be at RBL3, RBL4, or RBL5 levels, assignment reports should include circuit design, schematic, and simulation results.

OR

Learning Activity 2: (Marks 25): A group Mini-project using discrete components and demonstrating MOSFET as a switch for controlling a load (e.g. motor or LED). An experimental demonstration is required and a report which includes theory of MOSFET operation as a switch, circuit design and calculations. The MOSFET part number to be provided by the faculty.

Rubrics for Assignment (scale total to 10 marks or 15 marks as required)

	Superior	Good	Fair	Needs Improvement	Unacceptable
Demonstrates an Understanding of Simulation Concepts – 10 marks	Explains simulation concepts clearly, accurately, and with insightful connections **(10)**	Explains simulation concepts accurately with minor gaps in detail **(8)**	Shows basic understanding of simulation concepts but lacks depth or has some inaccuracies **(6)**	Understanding is limited, with errors or confusion **(4)**	Shows little or no grasp of the simulation concepts **(2)**
Able to Apply Laws/Equations and Correct Methodology – 10 marks	Applies laws/equations flawlessly with correct and efficient methodology **(10)**	Applies laws/equations correctly with minor methodological lapses **(8)**	Applies laws/equations partially correctly; some steps or logic missing **(6)**	Frequent errors in applying laws/equations or methodology **(4)**	Unable to apply laws/equations or follow correct methodology **(2)**
Performs Accurate Calculations, Simulations and Provides precise Answers – 10 marks	All calculations and simulations are accurate; answers precise and in correct format/units **(10)**	Minor calculation and simulation errors; answers mostly precise and correctly formatted **(8)**	Some correct calculation/simulations but noticeable errors; precision inconsistent **(6)**	Frequent calculations/simulation errors; answers often imprecise or incomplete **(4)**	Calculations/Simulations mostly incorrect; answers missing or irrelevant **(2)**

Rubrics for Mini-project

	Superior	Good	Fair	Needs Improvement	Unacceptable
Student has a well defined problem statement and a good technical report– 5 marks	Problem statement and mini-project report are clear, specific, and well-justified with context **(5)**	Problem statement and mini-project report are clear and specific but lacks strong justification **(4)**	Problem statement and mini-project report are understandable but somewhat vague or incomplete **(3)**	Problem statement and mini-project report are unclear or too broad **(2)**	No clear problem statement provided and poor mini-project report **(1)**
The design provided by the student meets requirement– 10 marks	Design fully meets all requirements with optimal functionality **(10)**	Design meets most requirements; minor gaps in functionality **(8)**	Design meets basic requirements but with noticeable limitations **(6)**	Design meets few requirements; significant shortcomings **(4)**	Design does not meet requirements or is non-functional **(2)**
Hardware circuit set up and demonstration is as per requirements– 10 marks	Hardware setup is correct, neat, and demonstration fully meets requirements **(10)**	Setup is correct with minor issues; demonstration meets most requirements **(8)**	Setup partially correct; demonstration meets basic requirements only **(6)**	Setup has major errors; demonstration incomplete or unclear **(4)**	Setup incorrect or missing; no meaningful demonstration **(2)**

Suggested Learning Activities May Include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggest Innovative Deliver Methods May Include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Soft Skills	Semester	I/II	
Course Code	**1BSKS106/206**	**CIE Marks**	**100**
Teaching Hours/Week (L:T:P: S)	1:0:0	SEE Marks	--
Total Hours of Pedagogy	**Theory/Practical/Lab:** 15 Hours	Total Marks	100
Credits	PP	Exam Hours	--

COURSE OBJECTIVES

The competencies those are important for engineering students joining the digital age workforce or looking to become entrepreneurs are listed in 5 modules:

CO1: Apply social skills for clear communication, persuasion, self-awareness, and active listening.

CO2: Use emotional skills to build confidence, manage stress, and adapt to change.

CO3: Set ambitious goals, practice empathy, and apply creativity for problem-solving.

CO4: Demonstrate discipline, time management, and structured problem-solving.

CO5: Work in teams, negotiate, resolve conflicts, and think critically.

Module I – Social Skills (3 hours)

- **Communication:** Principles of clear and effective exchange of ideas in professional and social contexts.
- **Persuasion:** Techniques to influence and convince through logical, emotional, and ethical appeals.
- **Self-Awareness:** Identifying personal strengths, weaknesses, opportunities, and challenges (SWOC analysis).
- **Active Listening:** Paraphrasing, questioning techniques, and demonstrating attentiveness.

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during sessions build both conceptual understanding and real-world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach
Language Lab	Quicklrn.com
Experiential Learning Methods	To embed skills, participants get hands-on through: Guided reflections and explainers to connect concepts with relatable real-life situations Guided visualization to prompt reflection and self-discovery Role-plays and activities to practice behaviours in context

	Peer discussions to gain diverse perspectives.
Assessment Methods	**Formative:** Role-plays, activities, group discussions, peer feedback. **Summative:** Presentations, written reflections, problem-solving exercises.

Module II Emotional Skills I (3 hours)

- **Emotional Intelligence (EI):** Recognizing and managing emotions, empathy, relationship management, and conflict resolution.
- **Stress Management:** Identifying stress triggers, relaxation techniques, work-life balance strategies, and mindfulness practices.
- **Time Management:** Prioritization (Eisenhower Matrix), setting SMART goals, avoiding procrastination, and effective scheduling.
- **Adaptability & Resilience:** Handling change, bouncing back from setbacks, and developing a growth mindset.

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach
Language Lab	Quicklrn.com
Experiential Learning Methods	• To embed skills, participants get hands-on through: • Guided reflections and explainers to connect concepts with relatable real-life situations • Guided visualization to prompt reflection and self-discovery • Role-plays and activities to practice behaviours in context • Peer discussions to gain diverse perspectives.
Assessment Methods	**Formative:** Role-plays, activities, group discussions, peer feedback. **Summative:** Presentations, written reflections, problem-solving exercises.

Module 3 Emotional Skills II (3 hours)

- Ambition & Goal Setting: Defining personal and professional aspirations, creating SMART goals, and aligning actions with long-term vision.

- Sympathy & Empathy: Understanding emotional perspectives, differentiating between the two, and applying them in workplace and social interactions.

- Creativity & Innovation: Generating original ideas, problem-solving, and applying creative thinking techniques (mind-mapping, SCAMPER).

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach
Language Lab	Quicklrn.com
Experiential Learning Methods	• To embed skills, participants get hands-on through: • Guided reflections and explainers to connect concepts with relatable real-life situations • Guided visualization to prompt reflection and self-discovery • Role-plays and activities to practice behaviours in context • Peer discussions to gain diverse perspectives.
Assessment Methods	**Formative:** Role-plays, activities, group discussions, peer feedback. **Summative:** Presentations, written reflections, problem-solving exercises.

Module 4 Professional Skills I (3 hours)

- **Problem Solving:** Identifying root causes, analysing options, and implementing solutions using methods like 5 Whys and Fishbone Diagram.
- **Discipline:** Building consistency, accountability, and professional habits.
- **Time Management:** Prioritizing tasks (Eisenhower Matrix), scheduling, avoiding procrastination.

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach.
Language Lab	Quicklrn.com
Experiential Learning Methods	To embed skills, participants get hands-on through: Guided reflections and explainers to connect concepts with relatable real-life situations Guided visualization to prompt reflection and self-discovery Role-plays and activities to practice behaviours in context Peer discussions to gain diverse perspectives.
Assessment Methods	**Formative:** Role-plays, activities, group discussions, peer feedback. **Summative:** Presentations, written reflections, problem-solving exercises.

Module 5 Professional Skills II (3 hours)

- Collaboration & Teamwork: Working effectively in diverse teams, fostering trust, and achieving shared goals.

- Negotiation & Conflict Resolution: Strategies to resolve differences and reach win–win outcomes.
- Critical Thinking: The ability to analyze, evaluate, and synthesize information to make well-reasoned decisions.

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, peer feedback. Eclectic Approach
Language Lab	Quicklrn.com
Experiential Learning Methods	To embed skills, participants get hands-on through: Guided reflections and explainers to connect concepts with relatable real-life situations Guided visualization to prompt reflection and self-discovery Role-plays and activities to practice behaviours in context Peer discussions to gain diverse perspectives.
Assessment Methods	**Formative:** Role-plays, group discussions, peer feedback. **Summative:** Presentations, written reflections, problem-solving exercises.

Extra Reading

1. Principles of Scientific and Technical Writing, 1e, By Pratap K. J. Mohapatra, Sanjib Moulick, © 2025 | Published: December 23, 2024
2. Soft Skills, 1e, By Soma Mahesh Kumar © 2024 | Published: June 8, 2023
3. Effective Technical Communication, 3e, By Ashraf M. Rizvi, Priyadarshi Patnaik, © 2024 | Published: September 12, 2024
4. Yadav, D. P. (2022). *A course in English pronunciation*. Notion Publications.

Learning Resources:

- Oxford Advance Learners Dictionary
- Cambridge English Skills Real Listening and Speaking by Miles Craven
- Communicative English for Professionals by Nitin Bhatnagar and Mamta Bhatnagar

Digital Resources

- Google Docs + Voice Typing - https://docs.google.com
- LearnEnglish – https://learnenglish.britishcouncil.org/
- TakeIELTS - https://www.britishcouncil.in/exam/ielts
- British Council Apps - **bbcLearnEnglishonline Grammar**
  LearnEnglish Podcasts
  IELTS Word Power
  Bbclearningenglishgrammer online
  Sounds Right (Phonemic Chart)

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes*											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1									1	3		2
2										3		2
3										3		2
4									1	3		2
5									1	3		2

Assessment Plan – 100 Marks

CO Mapping & Components (100 Marks)

CO	Modules	Assessment Component	Description	Marks
CO1: Apply social skills for clear communication, persuasion, self-awareness, and active listening	Module I	Role-Play & Oral Presentation	Scenario-based role-play (persuasion, active listening) + short presentation; assessed on clarity, articulation, engagement, and non-verbal cues.	**20**
CO2: Use emotional skills to build confidence, manage stress, and adapt to change	Module II	Stress Management Activity & Reflection Journal	Guided stress-relief simulation + reflection linking EI concepts to personal experiences.	**20**
CO3: Set goals, practice empathy, and apply creativity for problem-solving	Module III	Goal-Setting & Creativity Project	SMART goal plan + creative problem-solving idea using mind-mapping or SCAMPER.	**20**
CO4: Demonstrate discipline, time management, and structured problem-solving	Module IV	Problem-Solving Exercise (Case-Based)	Apply 5 Whys/Fishbone diagram to a business/engineering problem; structured solution submission.	**20**
CO5: Work in teams, negotiate, resolve conflicts, and think critically	Module V	Group Debate/Negotiation Simulation	Teams negotiate a given scenario and defend solutions in a debate; assessed on teamwork, arguments, and conflict resolution.	**20**

Mark Distribution by Assessment Type

- **Formative (Continuous Assessment) – 50 Marks**
- **Summative (End of Course) – 50 Marks**

Bloom's Taxonomy Weightage (100 Marks)

Sl. No	Bloom's Category	Formative (Role-play, Reflection, Creativity, Case studies)	Summative (Presentation + Problem-solving)	Overall
1	Remember	20%	10%	10%
2	Understand	25%	20%	20%
3	Apply	35%	30%	30%
4	Analyse	20%	20%	20%
5	Evaluate	10%	15%	15%
6	Create	10%	10%	10%
Total		**100%**	**100%**	**100%**

Assessment Rubric – 100 Marks

CO's rubric is scaled **out of 20 marks**

CO1 – Role-Play & Oral Presentation (20 marks)

Criteria	Excellent (8)	Good (6)	Satisfactory (4)	Needs Improvement (2)	Marks
Clarity &Articulation	Speaks fluently, precise pronunciation	Minor lapses	Frequent lapses	Hesitant, unclear	4
Persuasion & Engagement	Strong persuasive appeal, engages fully	Reasonable persuasion	Weak persuasion	No strategy	4
Non-Verbal Communication	Confident posture, gestures, eye contact	Mostly confident	Minimal use	Poor body language	6
Active Listening	Accurately paraphrases, responds appropriately	Mostly accurate	Limited paraphrasing	Ignores cues	6

CO2 – Stress Management & Reflection Journal (20 marks)

Criteria	Excellent (8)	Good (6)	Satisfactory (4)	Needs Improvement (2)	Marks
Understanding of EI Concepts	Deep insight + examples	Good understanding	Basic understanding	Misunderstands	6
Application in Activity	Fully applies techniques	Mostly effective	Few techniques	No application	6

Criteria	Excellent (8)	Good (6)	Satisfactory (4)	Needs Improvement (2)	Marks
Reflection Quality	Highly personal, analytical	Some insights	Descriptive only	No reflection	4
Structure & Clarity	Well-organized	Mostly clear	Some disorganization	Poorly structured	4

CO3 – Goal-Setting & Creativity Project (20 marks)

Criteria	Excellent (8)	Good (6)	Satisfactory (4)	Needs Improvement (2)	Marks
SMART Goal Setting	All SMART criteria, inspiring	Most criteria	Some criteria	Vague	6
Creativity & Originality	Highly original	Some originality	Limited	None	6
Presentation & Visuals	Engaging, clear, strong visuals	Clear visuals	Basic visuals	Poor/no visuals	4
Feasibility & Relevance	Practical, relevant	Mostly practical	Partially relevant	Irrelevant	4

CO4 – Problem-Solving Exercise (20 marks)

Criteria	Excellent (8)	Good (6)	Satisfactory (4)	Needs Improvement (2)	Marks
Problem Analysis	Identifies all root causes	Most causes	Few causes	No clear causes	6
Application of Tools	Fully accurate	Mostly accurate	Partial	Incorrect	4
Solution Quality	Highly logical, feasible	Mostly logical	Some gaps	Illogical	4
Structure & Clarity	Clear flow	Mostly clear	Some unclear parts	Disorganized	6

CO5 – Debate/Negotiation Simulation (20 marks)

Criteria	Excellent (8)	Good (6)	Satisfactory (4)	Needs Improvement (2)	Marks
Team Collaboration	Fully cooperative	Mostly cooperative	Limited	Uncooperative	4
Argument Quality	Strong evidence-based reasoning	Mostly sound	Weak reasoning	No reasoning	6
Conflict Resolution	Balanced, win–win focus	Mostly balanced	Minimal attempt	Aggressive/avoidant	4
Critical Thinking	Insightful, anticipates counterpoints	Thoughtful	Limited depth	None	6

*** Final Marking CO1 (Criteria + Marks)**

- Understanding of EI Concepts → **5/6**
- Application in Activity → **4/6**
- Reflection Quality → **2/4**
- Structure & Clarity → **4/4**

Final Marks = 15/20

C Programming Lab		Semester	I/II
Course Code	**1BPOPL107/207**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	24	Total Marks	100
Credits	1	Exam Hours	3
Examination type (SEE)	Practical		

Course outcome

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

CO1: Develop programs in C to solve simple computational problems.
CO2: Make use of C language derived datatypes to solve simple real-world problems.
CO3: Build a document consisting of experiment setup, design, implementation and results with inferences.

Note:

1. The laboratory syllabus consists of PART-A and PART-B. While PART-A has 6 conventional experiments, PART-B has 6 typical open-ended experiments. The maximum marks for the laboratory course are 100.
2. Both PART-A and PART-B are considered for CIE and SEE.
3. Students have answer 1(one) question from PART-A and 1(one) question from PART-B.
   a. The questions set for SEE shall be from among the experiments under PART-A. It is evaluated for 70 marks out of the maximum 100 marks.
   b. The open-ended question set for SEE shall be any other open-ended question and not selected from the experiments under PART-A. It shall be evaluated for 30 marks.
4. For continuous internal evaluation, during the semester, classwork, the typical open-ended questions shall be from PART-B, and any other similar questions to enhance the skill of the students

PART – A
CONVENTIONAL EXPERIMENTS

Note: Students must write the algorithm & flowchart for PART-A questions in the Record book

1. A robot needs to find how far it must travel between two points on a 2D plane. Develop a C program to calculate the straight-line distance between the given coordinates.

2. Develop a C program that takes a student's marks as input and displays their grade based on the following criteria:
   90 and above: Grade A
   75 to 89: Grade B
   60 to 74: Grade C
   50 to 59: Grade D
   Below 50: Grade F
   Choose a suitable control structure to implement this logic efficiently.

3. Develop a C program that takes a unique identification input like PAN Number, AADHAR_Number, APAAR_Id, Driving License, Passport and checks it against a set of stored KYC records. Based on the input, display whether the individual is verified or not. Use an appropriate control structure to handle multiple possible ID matches. Assume all Unique identification are of integer type.

4. A math app needs to determine the type of roots for a quadratic equation based on user input. Develop a C program to calculate and display the roots based on the given coefficients.

5. A sensor in a robotic arm needs to calculate the angle of rotation in real-time, but the hardware doesn't support built-in trigonometric functions. Develop a C program to approximate the value of sin(x) using a series expansion method for improved performance.

6. Develop a C program that accepts a course description string and a keyword from the user. Search whether the keyword exists within the course description using appropriate string functions. If found, display: "Keyword '<keyword>' found in the course description." Otherwise, display: "Keyword '<keyword>' not found in the course description."

7. Develop a C program that takes marks for three subjects as input. Use a function to check if the student has passed (minimum 40 marks in each subject). Display the average and whether the student passed or failed.

8. In an ATM system, two account balances need to be swapped temporarily for validation. Develop a C program that accepts two balances and uses a function with pointers to swap them. Display the balances before and after swapping.

PART – B

TYPICAL OPEN-ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined, and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.

1. A college library has a digital bookshelf system where each book is assigned a unique Book ID. The bookshelf is organized in ascending order of Book IDs. Develop a C Program to quickly find whether a book with a specific Book ID is available in the shelf.

2. A sports teacher has recorded the scores of students in a 100-meter race. To prepare the result sheet, the teacher wants the scores arranged in descending order (from highest to lowest). Develop a C program to sort the scores.

3. A small warehouse tracks how many units of different products are shipped from multiple branches. Another dataset shows how much revenue each product generates per unit. Develop a C program which combines these datasets to calculate the total revenue generated by each branch.

4. A basic mobile contact manager stores first and last names separately. For displaying full names in the contact list, you need to join them manually. Additionally, the system must check the length of each full name to ensure it fits the screen. Perform these operations by developing a C program without using built-in string functions.

5. A currency exchange booth allows users to convert between two currencies. Before confirming the exchange, the system simulates a swap of the values to preview the result without actually changing the original data. In other cases, it updates the actual values. Develop a C program that implements both behaviours using Call by Value and Call by reference

6. A local library needs to store and display details of its books, including title, author, and year of publication. Design a structure that can hold these details and develop a C program to display a list of all books entered.

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Textbook:

1. Hassan Afyouni, Behrouz A. Forouzan. "A Structured Programming Approach in C", 4th Edition, Cengage.

Reference books:

1. Schildt, Herbert. "C the complete reference", 4th Edition, Mc GrawHill.
2. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, 2nd edition, Prentice Hall of India.

Web links and Video Lectures (e-Resources):

1. Introduction to Programming in C [https://onlinecourses.nptel.ac.in/noc23_cs02/preview]
2. C for Everyone: Programming Fundamentals [https://www.coursera.org/learn/c-for-everyone]
3. Computer Programming Virtual Lab [https://cse02-iiith.vlabs.ac.in/exp/pointers/]
4. C Programming: The ultimate way to learn the fundamentals of the C language [https://www.pdfdrive.com/c-programming-the-ultimate-way-to-learn-the-fundamentals-of-the-c-language-e187584209.html]
5. C Programming: The Complete Reference [https://viden.io/knowledge/programming-in-c-language/attachment/28313/c-the-complete-reference-herbert-schildt-4th-edition-pdf/preview]

Teaching-Learning Process (Innovative Delivery Methods):
The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Engineering tool usage for the conduction of experiment
2. Demonstration through ICT tools
3. Use of virtual labs (https://www.vlab.co.in/)

Assessment Structure:
The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE marks awarded shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 20 marks. For both CIE and SEE, the student is required to conduct one experiment each from both Part A and Part B.

- To qualify and become eligible to appear for SEE, in the **CIE component**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE component**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics for CIE – Continuous assessment:

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Fundamental Knowledge: Understanding the problem statement [CO1, CO2] [PO1, PO2]	The student has in depth knowledge of the topics related to the problem. Student is able to completely understand the problem definition.	Student has good knowledge of some of the topics related to problem. Student is able to understand the problem definition.	Student is capable of narrating the answer but not capable to show in depth knowledge and the problem definition.	Student has not understood the concepts partially. Student is able to partially understand the problem definition	Student has not understood the concepts and the problem definition clearly.
Design of algorithm/flow chart and program [CO1, CO2] [PO2, PO3]	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason.	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best.	Student is capable of discussing single design with its merits and de-merits.	Student is capable of explaining the design.	Student is capable of explaining the design partially.
Implementation (Program coding) with suitable tools [CO-1, CO2] [PO5, PO8]	Student is capable of implementing the design with best suitable language structure considering optimal solution/optimal efficiency.	Student is capable of implementing the design with best suitable language structure and should be capable of explaining it.	Student is capable of implementing the design with proper explanation.	Student is capable of implementing the design.	Student is capable of implementing the design with errors.
Program debugging and testing with suitable tools [CO1, CO2] [PO5, PO8]	Student is capable to compile and debug the program with no errors (syntax, semantic and logical).	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with full understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with partial understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with no understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with assistance.
Results & interpretation /analysis [CO1, CO2] [PO4]	Student is able to run the program on various cases and compare the result with proper analysis.	Student is able to run the program for all the cases.	Student is able to run the code for few cases and analyze the result.	Student is able to run the program but not able to analyze the result.	Student is able to run the program but not able to verify the correctness of the result.
Demonstration and documentation [CO3] [PO8, PO9, PO11]	Demonstration and lab record is well-organized, with clear sections.	Demonstration and lab record is organized, with clear sections, but some	Demonstration and lab record lacks clear organization or structure. Some sections are	Demonstration and lab record is poorly organized, with missing or unclear sections.	Demonstration and lab record is poorly organized, with missing sections. Record

	The record is well structured with suitable formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	sections are not well-defined. The record is structured with formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	unclear or incomplete. The record is partially structured with formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	The record is not properly structured with suitable formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	not submitted on time. The record is not structured with minimum formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).

Rubrics for SEE / CIE Test:

Component & CO-PO Mapping	Excellent (5)	Good (4)	Fair (3)	Marginal (2)	Unsatisfactory (1)
Fundamental Knowledge (2) [CO1, CO2] [PO1]	The student has well depth knowledge of the topics related to the problem & course	Student has good knowledge of some of the topics related to problem & course	Student has average knowledge of some of the topics related to problem & course	Student is capable of narrating the answer but not capable to show in depth knowledge	Student has not understood the concepts clearly
Understanding of problem definition (1) [CO1, CO2] [PO2]	Student is able to completely understand the problem definition	Student is able to understand the problem definition but not clearly	Student has a basic understanding of the problem definition that is partial or superficial	Student is able to Shows minimal or unclear understanding of the problem definition	Student is not able to understand the problem definition
Design and Implementation (3) [CO1, CO2] [PO3]	Student is capable of design and implementing with best suitable construct for the given problem definition	Student is capable of design and implementing with some construct for the given problem definition	Student is capable of design and implementing the core part of the construct for the given problem definition	Student is partially capable of design and implementing with some algorithm for the given problem definition	Student is not capable of design and implementing
Result & Analysis (2) [CO1, CO2] [PO4]	Student is able to run the program on various data inputs and compare the result with proper inference.	Student will be able to run the program on various data inputs and fair knowledge in comparing the result with proper inference	Student will be able to run the code for few data/datasets and analyze the output.	Student will be able to run the code for few data inputs but not analyze the output.	Student will be not able to run the program and not able to analyze the result.
Communication (Viva voce) (2) [CO3] [PO8, PO9]	Good Verbal & nonverbal communication skills with precise and correct terminologies/ answers.	Good verbal Communication skills with precise and correct terminologies/ answers.	Average Communication but with precise and correct terminologies/ answers.	Average Communication but with imprecise and incorrect terminologies/ answers	Poor Communication (Minimal interaction/answers)

Fundamentals of Electronics and Communication Engineering Lab		Semester	1/II
Course Code	1BBEEL107/207	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	03
Examination type (SEE)	**Practical**		

Course outcome (Course Skill Set)

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

1. Apply the operating principles of diodes, transistors, and MOSFETs to construct and test basic analog circuits.
2. Implement operational amplifier configurations such as inverting, non-inverting, integrator, and differentiator for analog signal processing applications.
3. Analyze the functionality of logic gates and combinational circuits including adders, subtractors, and code converters using digital ICs.
4. Investigate amplitude modulation to explore fundamental analog communication techniques.
5. Develop solutions to open-ended electronic design problems by selecting appropriate components, constructing circuits, and interpreting results to meet defined objectives.

Note:

1. The laboratory syllabus consists of PART-A and PART-B. While PART-A has 6 conventional experiments, PART-B has 6 typical open-ended experiments. The maximum marks for the laboratory course are 100.
2. Both PART-A and PART-B are considered for CIE and SEE.
3. Students have answer 1(one) question from PART-A and 1(one) question from PART-B.
   a. The questions set for SEE shall be from among the experiments under PART-A. It is evaluated for 70 marks out of the maximum 100 marks.
   b. The open-ended question set for SEE shall be any other open-ended question and not selected from the experiments under PART-A. It shall be evaluated for 30 marks.
4. For continuous internal evaluation, during the semester, classwork, the typical open-ended questions shall be from PART-B, and any other similar questions to enhance the skill of the students

PART – A
CORE/BASIC HARDWARE EXPERIMENTS

1. Design and Testing of Half-Wave and Full-Wave Rectifiers With and Without Filter for Determining Ripple Factor, Voltage Regulation, and Efficiency
2. Design and Testing of Bridge Rectifier With and Without Filter for Determining Ripple Factor, Voltage Regulation, and Efficiency
3. Analysis of Input and Output Characteristics of a Bipolar Junction Transistor in Common Emitter Configuration
4. Study of Transfer and Drain Characteristics of a MOSFET in Common Source Configuration
5. Investigation of Op-Amp in Inverting and Non-Inverting Modes with Gain Measurement
6. Study of Truth Tables for OR, AND, NOT, NAND, and NOR Gates Using Basic and Universal Gates

PART – B
OPEN ENDED HARDWARE EXPERIMENTS

1. Design and Testing of Clipping and Clamping Circuits to obtain desired Transfer Characteristics
2. Design and test a single stage bipolar junction transistor amplifier to obtain desired gain and bandwidth requirements.

3. Testing of Op-Amp as voltage follower and a weighted summer with waveform analysis.
4. Design and Testing of Integrator and Differentiator Circuits using Op-Amp with Waveform Analysis
5. Amplitude Modulation using Discrete Components for Given Specifications.
6. Realization of Half/ Full Adder and Subtractor using Logic Gates.

Suggested Learning Resources:

Text books:

1. David A Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 30th Impression, 2025.
2. Ramakanth A Gayakwad, Op-amps and Linear Integrated Circuits, 4th Edition, Pearson Education, 2015.
3. John G. Proakis, Masoud Saleh, Fundamentals of Communication Systems, Second Edition, Pearson Educations, Inc., 2014.
4. D.P Kothari and I J Nagrath, Basic electronics, Second Edition, McGraw Hill Education Pvt ltd, 2018.
5. M.Morris Mano and Michael D.Ciletti, Digital Design - With an Introduction to the Verilog HDL, VHDL and System Verilog 6th Edition, Pearson Education Inc, 2024.
6. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuit Theory", 11th Edition, PHI, 2016.

Web links and Video Lectures (e-Resources):

- Introduction to Basic Electronics: https://nptel.ac.in/courses/122106025
- Digital Electronic Circuits: https://nptel.ac.in/courses/108105132

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. While explaining each experiment, also focus on the application of that particular experiment in the electronics industry.
2. Students need not memorize pin diagrams, these can be provided to the student during CIE and SEE.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

.

The CIE marks awarded shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 25 marks. The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 100 marks and scaled down to 25 marks. For both CIE and SEE, the student is required to conduct one experiment each from both Part A and Part B.

- To qualify and become eligible to appear for SEE, in the **CIE component**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE component**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics for SEE / CIE test:

Performance Indicators	Superior	Good	Fair	Needs Improvement	Unacceptable
Fundamental Knowledge (4) (PO1)	The student has good in-depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has only marginally understood the concepts (1)	Student has not understood the concepts (0)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing the design with its merits and de-merits (5)	Student is able to explain the design, but not able to discuss all the merits and de-merits (4)	Student is capable of explaining the design (3)	Student has made correct assumptions but is barely capable of explaining the design (2)	Student has made wrong assumptions for the design (1)
Implementation (8) (PO3 & PO8)	Student effectively implements the design using the most suitable technique for an optimal solution, with clear and complete explanation of the approach. (7-8)	Student is able to implement the design using an appropriate technique and provides a satisfactory explanation of the steps taken (5-6)	Student is able to implement the design with a partially suitable approach and gives a basic explanation, though some steps may lack clarity. (3-4)	Student is able to implement the design with significant support, and explanation is minimal or lacks coherence. (2)	Student struggles to implement the design and is unable to provide a meaningful explanation (1)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases. (4)	Student will be able to run the code for few cases and analyze the output. (3)	Student will be able to run the program but not able to analyze the output. (2)	Both circuits set up and analysis are poor (1)
Demonstration (8) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record is organized but some sections are unclear or incomplete. (3-4)	The lab record lacks clear organization or structure (2)	The lab record is poorly organized, with missing or unclear sections. (1)

Theory - 01 Credit Course

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ - ಕನ್ನಡ ಬಲ್ಲ ಮತ್ತು ಕನ್ನಡ ಮಾತೃಭಾಷೆಯ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ

Course Title:	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ		
Course Code:	1BKSK109	CIE Marks	50
Course Type (Theory/Practical /Integrated	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	1:0:0:0	Exam Hours	01 Theory
Total Hours of Pedagogy	15 hours	Credits	01

Course objectives : ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

The course (22KSK17/27) will enable the students,

1. ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಪರಿಚಯಿಸಿವುದು.
3. ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
4. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
5. ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
2. ಇತ್ತೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು - ಅಂದರೆ ಕವಿ-ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.
3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.

ಘಟಕ -1 ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಮತ್ತು ಭಾಷೆ ಕುರಿತಾದ ಲೇಖನಗಳು (03 hours of pedagogy)

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಘಟಕ - 2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ (03 hours of pedagogy)

1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ.
2. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ – ಪುರಂದರದಾಸರು
   ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು
3. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ

ಘಟಕ -3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ (03 hours of pedagogy)

1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು
2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ
3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು

ಘಟಕ - 4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ (03 hours of pedagogy)

1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ – ಎ. ಎನ್. ಮೂರ್ತಿರಾವ್
2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ

ಘಟಕ - 5 ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ (03 hours of pedagogy)

1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ
2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ

Course outcome (Course Skill Set)

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ (22KSK17/27) ಪಠ್ಯ ಕಲಿಕೆಯ ನಂತರ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ :

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

CO1	ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಕುರಿತು ಅರಿವು ಮೂಡಿರುತ್ತದೆ.
CO2	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಕಲಿತು ಹೆಚ್ಚಿನ ಓದಿಗೆ

	ಮತ್ತು ಜ್ಞಾನಕ್ಕೆ ಸ್ಪೂರ್ತಿ ಮೂಡುತ್ತದೆ.
CO3	ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಹೆಚ್ಚಾಗುತ್ತದೆ.
CO4	ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ತಿಳಿದುಕೊಂಡು ನಾಡಿನ ಇನ್ನಿತರ ವ್ಯಕ್ತಿಗಳ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳಲು ಕೌತುಕತೆ ಹೆಚ್ಚಾಗುತ್ತದೆ.
CO5	ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

Assessment Structure:
The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. • To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks.
- Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks

Continuous Comprehensive Assessments (CCA):
CCA will be conducted for a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students.
These activities should align with course objectives and promote higher-order thinking and application-based learning.Learning Activity -1: (Marks- ___)Learning Activity -2 (optional): (Marks- ___)

University Prescribed Textbook :

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ,
ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ,
ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

ವಿಶೇಷ ಸೂಚನೆ : 1. ಮೇಲಿನ ಪಠ್ಯಕ್ರಮಕ್ಕೆ ಸೀಮಿತವಾಗಿ ಅಂತಿಮ ಪರೀಕ್ಷೆಯ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ ಇರುತ್ತದೆ.

2. ಮೇಲಿನ ಪಠ್ಯಕ್ರಮವನ್ನು ಹೊರತುಪಡಿಸಿದ ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿನ ಉಳಿದ ಪದ್ಯ & ಗದ್ಯ ಭಾಗ ಹಾಗೂ ಇತರ ಲೇಖನಗಳನ್ನು ಹೆಚ್ಚುವರಿ ಪೂರಕ ಓದಿಗಾಗಿ ಬಳಸಿಕೊಳ್ಳಬಹುದು. ಅಂತಿಮ ಪರೀಕ್ಷೆಯಲ್ಲಿ ಈ ಪಾಠಗಳಿಂದ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುವುದಿಲ್ಲ.

==========

3. ಹೆಚ್ಚಿನ ಮಾಹಿತಿ ಮತ್ತು ವಿವರಣೆಗಳಿಗೆ ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ (9900832331) ಇವರನ್ನು ಸಂಪರ್ಕಿಸಿ.

4. ಮಾದರಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ, ಕೋರ್ಸ್ ಆಯ್ಕೆ ಮಾಹಿತಿ, ಅಧ್ಯಯನ ಸಾಮಗ್ರಿ & ಬಹು ಆಯ್ಕೆ ಮಾದರಿಯ ಪ್ರಶ್ನೆಗಳ ಕೈಪಿಡಿಗಾಗಿ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್ ಸೈಟ್ ನೋಡುವುದು.

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

- ✓ Contents related activities (Activity-based discussions)
- ✓ For active participation of students instruct the students to prepare Flowcharts and Handouts
- ✓ Organising Group wise discussions Connecting to placement activities
- ✓ Quizzes and Discussions, Seminars and assignments.

Theory - 01 Credit Course

ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)

ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ - (Prescribed Textbook to Learn Kannada)

Course Title:	**ಬಳಕೆ ಕನ್ನಡ**		
Course Code:	**1BKBK109**	CIE Marks	50
Course Type (Theory/Practical /Integrated	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	1:0:0:0	Exam Hours	01 Theory
Total Hours of Pedagogy	15 hours	Credits	01

Course objectives : ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

The course (1BKBK109) will enable the students,

1. To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
2. To enable learners to Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To train the learners for correct and polite conservation.
5. To know about Karnataka state and its language, literature and General information about this state.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. **ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೋಗಿಸಬೇಕು.**
2. **ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.**
3. **ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.**
4. **ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚೆಗೆ ಡಿಜಿಟಲೀಕರಣ ಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕ್ಕೆಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.**
5. **ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.**

Module - 1

(03 hours of pedagogy)

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities, Key to Transcription
3. ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - Personal Pronouns, Possessive Forms, Interrogative words

Module - 2 (03 hours of pedagogy)

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - **Possessive forms of nouns, dubitive question and Relative nouns**
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು **Qualitative, Quantitative and Colour Adjectives, Numerals**
3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು –ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) –**Predictive Forms, Locative Case**

Module - 3 (03 hours of pedagogy)

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು - **Dative Cases, and Numerals**
2. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು -**Ordinal numerals and Plural markers**
3. ನ್ಯೂನ/ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು & ವರ್ಣ ಗುಣವಾಚಕಗಳು –**Defective/Negative Verbs & Colour Adjectives**

Module- 4 (03 hours of pedagogy)

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತು ಒತ್ತಾಯ ಆರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು **Permission, Commands, encouraging and Urging words (Imperative words and sentences)**
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು **Accusative Cases and Potential Forms used in General Communication**
3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು - Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs
4. ಹೋಲಿಕೆ (ತರತಮ) , ಸಂಬಂಧ ಸೂಚಕ, ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ- Comparitive, Relationship, Identification and Negation Words

Module - 5 (03 hours of pedagogy)

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು -Different types of Tense, Time and Verbs
2. ದ್, -ತ್, - ತು, - ಇತು, - ಆಗಿ, - ಅಲ್ಲ, - ಗ್, -ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - Formation of Past, Future and Present Tense Sentences with Verb Forms
3. **Kannada Vocabulary List :ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು -Kannada Words in Conversation**

Course outcome (Course Skill Set)

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು:

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

CO1	To understand the necessity of learning of local language for comfortable life.
CO2	To speak, read and write Kannada language as per requirement.
CO3	To communicate (converse) in Kannada language in their daily life with kannada speakers.
CO4	To Listen and understand the Kannada language properly.
CO5	To speak in polite conservation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than

35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Comprehensive Assessments (CCA):CCA will be conducted for a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.Learning Activity -1: (Marks- ___)Learning Activity -2 (optional): (Marks- ___)

University Prescribed Textbook :

ಬಳಕೆ ಕನ್ನಡ

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ,

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

ಸೂಚನೆ :

ವಿಶೇಷ ಸೂಚನೆ : 1. ಮೇಲಿನ ಪಠ್ಯಕ್ರಮಕ್ಕೆ ಸೀಮಿತವಾಗಿ ಅಂತಿಮ ಪರೀಕ್ಷೆಯ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ ಇರುತ್ತದೆ.

2. ಮೇಲಿನ ಪಠ್ಯಕ್ರಮವನ್ನು ಹೊರತುಪಡಿಸಿದ ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿನ ಉಳಿದ ಭಾಗಳನ್ನು ಹೆಚ್ಚುವರಿ ಪೂರಕ ಓದಿಗಾಗಿ ಬಳಸಿಕೊಳ್ಳಬಹುದು. ಅಂತಿಮ ಪರೀಕ್ಷೆಯಲ್ಲಿ ಈ ಪಾಠಗಳಿಂದ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುವುದಿಲ್ಲ.

==========

3. ಹೆಚ್ಚಿನ ಮಾಹಿತಿ ಮತ್ತು ವಿವರಣೆಗಳಿಗೆ ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ (9900832331) ಇವರನ್ನು ಸಂಪರ್ಕಿಸಿ.

4. ಮಾದರಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ, ಕೋರ್ಸ್ ಆಯ್ಕೆ ಮಾಹಿತಿ, ಅಧ್ಯಯನ ಸಾಮಗ್ರಿ & ಬಹು ಆಯ್ಕೆ ಮಾದರಿಯ ಪ್ರಶ್ನೆಗಳ ಕೈಪಿಡಿಗಾಗಿ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್ ಸೈಟ್ ನೋಡುವುದು.

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

- ✓ Contents related activities (Activity-based discussions)
- ✓ For active participation of students instruct the students to prepare Flowcharts and Handouts
- ✓ Organising Group wise discussions Connecting to placement activities
- ✓ Quizzes and Discussions.
- ✓ Seminars and assignments.