1st year Syllabus

INDEX

2025-26 Scheme

1st year Syllabus

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APPLIED MATHEMATICS

DIFFERENTIAL CALCULUS AND LINEAR ALGEBRA (ME)		Semester	1
Course Code	**1BMMAS101**	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	4 Credits	Exam Hours	3 Hours
Examination type (SEE)	**Theory**		

Course Outcomes (Course Skill Set) At the end of the course the students will be able to

CO1: Apply the concepts of polar coordinates, pedal equations and curvature to demonstrate geometric properties of planes curves in Cartesian and polar forms.

CO2: Apply the methods of Taylor's and Maclaurin's series expansions, L'Hospital's rule, and partial differentiation to solve problems involving indeterminate forms, Jacobians, and optimization of functions of two variables

CO3: Solve first-order ordinary differential equations such as linear, Bernoulli's, and exact equations, and simulate physical phenomena like growth and decay.

CO4: Apply linear algebra techniques including matrix transformations, rank, inverse, and system of linear equations (Gauss elimination, LU decomposition, Gauss-Seidel method) for modeling engineering systems.

CO5: Apply the concepts of eigenvalues, eigenvectors, diagonalization, and pseudoinverse to solve systems.

CO6: Demonstrate the applications of Mechanical Engineering using modern ICT tools.

Module-1: Polar Curves and Curvature (8 Hours Theory + 4 Hours Tutorial)

Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and radius of curvature - Cartesian, parametric, polar and pedal forms.
Textbook 1: Chapter 4 :4.7-4.11

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

Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms - L'Hospital's rule. Partial differentiation, total derivative – differentiation of composite functions. Jacobian. Maxima and minima for the function of two variables.
Textbook 1: Chapter 4 :4.4,4.5, Chapter 5 :5.1,5.2,5.5-5.7,5.11

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

Linear and Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factor: $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$. Orthogonal trajectories, Law of natural growth and decay.
Textbook 1: Chapter 11:11.9-11.12, Chapter 12:12.3-12.8, Textbook 2: Chapter 8: 8.17, 8.18

Module-4: Linear Algebra -1	**(8Hours Theory) + (4Hours Tutorial)**
Elementary row transformation of a matrix, Row echelon form and Rank of a matrix. Inverse of matrix by Jordan method. Consistency and Solution of system of linear equations - Gauss- elimination method, LU decomposition method and approximate solution by Gauss-Seidel method. Application to traffic flow. Textbook 1: Chapter 2 :2.7,2.10, Chapter 28 :28.6, 28.7(2) Textbook 3: Chapter 7:7.3	
Module-5: Linear Algebra -2	**(8Hours Theory) + (4Hours Tutorial)**
Eigenvalues and Eigenvectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Model matrix, Diagonalization of the matrix, inverse of a matrix by Cayley-Hamilton theorem, Characteristic and minimal polynomials of block matrices, Moore-Penrose pseudoinverse. Textbook 3: Chapter 4: 4.0, Chapter 8 :8.1, Chapter 20: 20.8, Textbook 1: Chapter 2:2.13-2.15,2.16(1), Chapter 28 :28.6	

Suggested Learning Resources: (Textbook/Reference Book):

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers,44nd Ed., 2021.
2. Seymour Lipschutz and Marc Lipson, Linear Algebra, Schaum's outlines series, 4th Ed., 2008.
3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons,10th Ed.,2018.
4. Gilbert Strang, Linear Algebra and its Applications, Cengage Publications,4thEd.,2022.

Reference books:

1. Srimanta Pal & Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 3rd Ed., 2016.
2. N. P.Bali and Manish Goyal, AText book of Engineering Mathematics, Laxmi Publications,10thEd.,2022.
3. H.K.Dass and Er.RajnishVerma, Higher Engineering Mathematics, S.Chand Publication, 3rd Ed., 2014.
4. Ray Wylie, Louis C.Barrett, Advanced Engineering Mathematics, McGrawHill Book Co., New York, 6th Ed.,2017.
5. David C Lay, Linear Algebra and its Applications, Pearson Publishers, 4thEd., 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/
- VTUe-ShikshanaProgram
- VTUEDUSATProgram
- 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: (Lab Activities for 15 Marks) Execute the following lab exercises with the aid of technological tool-Python.

Learning Activity-2: Report Writing on Application of Mathematics -The students have to present applications of mathematics related to syllabus as a group maximum of five members.(10 Marks)

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

Learning Activity Rubrics:

Learning Activity-1: Lab Activity
Mode: Execute lab exercise using Python (15 Marks)

Component & CO-PO Mapping	Outstanding (Full Marks)	Exceeds Expectations	Meets Expectations	Needs Improvement	Unsatisfactory
Mathematical Application [CO1- CO5][PO1, PO2]	Accurate application of calculus/ODE/linear algebra concepts to lab tasks. (3)	Correct with minor conceptual slips. (2.5)	Partial correctness; limited scope. (2)	Major errors in application. (1)	No relevant application. (0)
Tool Usage & Implementation [CO6][PO5]	Efficient and independent use of Python/ICT tools; flawless execution. (3)	Correct usage with minor help needed. (2.5)	Basic usage; partially correct execution. (2)	Poor usage; frequent errors in execution. (1)	No attempt or irrelevant tool use. (0)
Execution & Debugging [CO6] [PO5]	Executes all lab tasks flawlessly; independently debugs. (3)	Executes most tasks correctly; debugging with minimal support. (2.5)	Executes with partial correctness; needs guidance in debugging. (2)	Attempted execution but errors remain. (1)	Unable to execute. (0)
Analysis & Interpretation [CO1- CO6][PO5]	Results analyzed thoroughly with clear reasoning and insights. (3)	Analysis mostly correct with minor gaps. (2.5)	Limited analysis and superficial interpretation. (2)	Minimal analysis; weak interpretation. (1)	No analysis or misinterpreted results. (0)
Documentation & Reporting [CO1-CO6][PO8, PO9, PO11]	Well-structured, clear report with reflection on learning. (3)	Organized report with minor issues. (2.5)	Basic report with limited clarity. (2)	Incomplete or poorly written report. (1)	No report or irrelevant content. (0)

Marks Distribution Sheet: Learning Activity-1 (Lab, 15 Marks)

Component	**Weightage (Marks)**	**Remarks**
Tool Usage	3	Demonstrated good understanding and effective use of the required software tools; applied appropriate commands and functions efficiently.
Math Application	3	Correctly applied mathematical concepts and formulas to solve the given problem; shows conceptual clarity and logical approach.
Execution & Debugging	3	Code executed successfully with minimal errors; demonstrated proper debugging techniques and problem-solving skills.
Analysis & Interpretation	3	Accurately analyzed the output/results and provided meaningful interpretation of findings; results are logically justified.
Documentation & Reporting	3	Report is well-structured, clear, and neatly formatted; includes proper explanation, screenshots, and conclusions.

Learning Activity-2: Report Writing on Application of Mathematics (10 Marks)					
Component & CO-PO Mapping	Outstanding (Full Marks)	Exceeds Expectations	Meets Expectations	Needs Improvement	Unsatisfactory
Content & Relevance [CO1-CO5][PO1, PO2]	Content comprehensive, highly relevant, accurate, with strong mathematical insight. (3)	Content relevant and mostly accurate; minor gaps. (2.5)	Content partially relevant; some gaps. (2)	Limited relevance; frequent errors. (1)	No relevant content. (0)
Application of Mathematics [CO1-CO5][PO2]	Strong demonstration of real-world applications with clear mathematical linkage. (2)	Good application with minor errors. (1.5)	Basic application with limited scope/examples. (1)	Weak or unclear application. (0.5)	No application shown. (0)
Organization & Structure [CO1-CO5] [PO8, PO9]	Report excellently structured, logical flow with headings, subheadings, and clarity. (2)	Well-structured with minor issues in flow. (1.5)	Basic organization; lacks clarity in some sections. (1)	Poorly organized; difficult to follow. (0.5)	No structure. (0)
Language & Presentation [CO1-CO5] [P009,PO11]	Clear, precise writing with excellent formatting, figures, and visuals. (2)	Good language and formatting; minor errors. (1.5)	Average language; limited formatting. (1)	Poor writing; formatting lacking. (0.5)	Unclear or irrelevant writing. (0)

Originality & References [CO1-CO5][PO08,PO11]	Original work with proper citations and insightful reflection. (1)	Minor referencing issues; mostly original. (0.75)	Limited originality; weak references. (0.5)	Minimal originality; no proper references. (0.25)	Copied or no references. (0)

Marks Distribution Sheet: Learning Activity-2 (Report Writing, 10 Marks)

Component	**Weightage (Marks)**	**Remarks**
Content	3	The report contains relevant and well-researched information; demonstrates clear understanding of the topic with logical flow of ideas.
Application	2	Shows appropriate application of concepts or theory to practical situations; connects ideas effectively to the subject area.
Organization	2	Information is logically arranged with clear sections (introduction, body, conclusion); ideas are presented coherently and neatly formatted.
Language	2	Uses correct grammar, spelling, and academic tone; sentences are clear and well-structured for easy readability.
Originality	1	Reflects originality and personal insight; minimal or no plagiarism observed; shows creative presentation of ideas.

1st year Syllabus

DIFFERENTIAL CALCULUS AND LINEAR ALGEBRA (EEE)		Semester	1
Course Code	**1BMEAS101**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours (Theory) + 20 Hours Tutorials)	Total Marks	100
Credits	04	Exam Hours	3 Hours
Examination type (SEE)	**Theory**		

Course Outcomes (Course Skill Set)

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

CO 1. Apply the concepts of polar coordinates, pedal equations, and curvature to demonstrate geometric properties of plane curves in Cartesian and polar forms using analytical methods.

CO 2. Apply the methods of Taylor's and Maclaurin's series expansions, L'Hospital's rule, and partial differentiation to solve problems involving indeterminate forms, Jacobians, and optimization of functions of two variables.

CO 3. Solve first-order and nonlinear ordinary differential equations such as linear, Bernoulli's, and Clairaut's forms, and model physical systems like L–R and C–R circuits.

CO 4. Apply methods to solve higher-order linear ODEs with constant coefficients using operator techniques and variation of parameters and interpret their applications in L–C–R circuits.

CO 5. Compute rank, eigenvalues, and eigenvectors of matrices, solve systems of linear equations using numerical methods.

CO 6. Demonstrate the applications of Electronics and communication engineering 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.

Textbook-1: Chapter- 4.7- 4.11

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 derivatives, total derivative, differentiation of composite functions, Jacobians. Maxima and minima for functions of two variables.

Textbook-1: Chapter- 4.4, 4.5 Chapter-5: 5.1, 5.2, 5.5 – 5.7, 5.11.

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 $\frac{1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{-1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ 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.

Textbook-1: Chapter-11.9-11.12, 11.13 (1), 11.14, 12.3(1), 12.

Module-4: Ordinary differential equations of higher Order. **(8 Hours Theory + 4 Hours Tutorial)**

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

Textbook-1: Chapter-13.1-13.5, 13.6(1,2,3), 13.8(1), 13.9 Chapter-14: 14.5(2).

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

Elementary transformations of a matrix, Echelon form, rank of a matrix, consistency of system of linear equations. Gauss elimination and Gauss –Seidel method to solve system of linear equations. Eigen values and eigen vectors of a matrix, Rayleigh's power method to determine the dominant eigen value and corresponding eigen vector of a matrix. Applications: Traffic flow.

Textbook-1: Chapter-2: 2.7, 2.10, 2.13, 2.14, Chapter-28: 28.6(1), 28.7(2), 28.9.

Textbook-2: Chapter-7: 7.3

Suggested Learning Resources: (Textbook/Reference Book):

Textbooks:

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Reference books / Manuals:

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. Baliand Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
4. H.K. Das and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014.
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- https://nptel.ac.in/courses/111105160
- https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
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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: Objective problem solving: Average of two objective type assessments - GATE-based Aptitude Test for 15 marks each

Learning Activity-2: Lab activity: Execute the following lab exercises with the aid of technological tool – Python (For 10 marks).

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 iteration.
10. Determine Eigenvalues and Eigenvectors.

Learning Activity Rubrics

Learning Activity-1: Objective Problem Solving

Mode: Two objective-type assessments (15 marks each; Average= 15 marks)

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Conceptual Understanding [CO1 to CO5] [PO1]	Demonstrates complete and precise understanding of calculus/linear algebra concepts; applies them without errors.	Shows good understanding; minor conceptual errors.	Partial understanding; key points missing but some correct application.	Limited understanding; frequent conceptual errors.	No clear understanding; responses irrelevant/incorrect.

Problem-Solving & Accuracy [CO1 to CO5] [PO2]	Solutions are accurate, well-structured, and logically presented.	Mostly accurate solutions; minor steps missing.	Correct in parts but lacks full logical flow.	Attempted but mostly incorrect or poorly structured.	Incomplete or irrelevant solutions.
Application of Methods [CO1 to CO5] [PO1, PO2]	Applies appropriate methods (differentiation, vector operations, matrix methods) creatively and efficiently.	Applies suitable methods correctly but without optimization.	Applies methods mechanically, with partial correctness.	Methods applied incorrectly or inconsistently.	No evidence of method application.
Clarity of Steps & Presentation [CO1 to CO5] [PO8, PO9]	All steps shown clearly with structured reasoning.	Most steps shown; some clarity issues.	Limited steps shown; reasoning weak.	Few steps shown; reasoning unclear.	No meaningful steps shown.

Marks Distribution for Learning Activity-1 (Objective Problem Solving)

Total Marks = 15

Component	Weightage (Marks)	Remarks
Conceptual Understanding	4	Accuracy of concepts in calculus/linear algebra
Problem-Solving & Accuracy	4	Logical and correct problem-solving steps
Application of Methods	4	Correct application of methods (derivatives, matrix operations, etc.)
Clarity & Presentation	3	Clarity of reasoning and solution steps

Learning Activity-2: Lab Activity

Mode: Execute lab exercise using Python. Marks = 10

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Mathematical Application [CO1-CO5] [PO1, PO2]	Accurately applies concepts (derivatives, vector fields, eigenvalues, transformations) to tasks.	Correct application with minor errors.	Partially correct application; limited scope.	Major errors in application.	No relevant application attempted.

Tool Usage & Implementation [CO6] [PO5]	Efficient use of Python with accurate implementation of lab tasks.	Good use of Python; implementation mostly correct.	Basic usage of Python; implementation partially correct.	Poor use of Python; implementation largely incorrect.	No evidence of Python usage or implementation.
Execution & Debugging [CO6] [PO5]	Executes all lab exercises flawlessly; identifies and corrects errors independently.	Executes most exercises correctly; minor debugging required.	Executes exercises with partial correctness; needs guidance in debugging.	Execution attempted with frequent errors; debugging incomplete.	Unable to execute exercises meaningfully.
Analysis & Interpretation [CO1-CO6] [PO5]	Results analyzed thoroughly; clear interpretation with reasoning.	Results analyzed; interpretation mostly clear.	Limited analysis with partial interpretation.	Minimal analysis; weak interpretation.	No analysis or interpretation.
Documentation & Reporting [CO1-CO6] [PO8, PO9, PO11]	Well-organized report with clear structure, explanations, and reflection on learning.	Report organized with minor issues in clarity or depth.	Basic report submitted; limited clarity or depth.	Incomplete or poorly organized report.	No report submitted or irrelevant content.

Marks Distribution for Learning Activity-2 (Lab Activity)

Total Marks = 10

Component	Weightage (Marks)	Remarks
Mathematical Application	2	Application of calculus/linear algebra concepts
Tool Usage & Implementation	2	Python implementation correctness
Execution & Debugging	2	Ability to run and correct programs
Analysis & Interpretation	2	Clarity in result interpretation
Documentation & Reporting	2	Report structure and clarity

1st year Syllabus

DIFFERENTIAL CALCULUS AND LINEAR ALGEBRA (CSE)		Semester	I
Course Code	**1BMCAS101**	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
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Apply the concepts of multivariable calculus to compute derivatives, optimize functions and solve problems related to composite functions, Jacobian.

CO2: Compute and interpret gradient, divergence, and curl for scalar and vector fields, and apply vector calculus concepts to model physical phenomena.

CO3: Solve systems of linear equations using direct and iterative methods, and determine eigenvalues and eigenvectors for diagonalization of matrices.

CO4: Demonstrate the idea of linear dependence and independence of sets in the Vector Space and apply the concepts to problems in computer science engineering.

CO5: Apply the principles of linear transformations and verify properties such as rank, nullity, and invertibility to solve complex mathematical problems and interpret their significance

CO6: 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.

Textbook-1: Chapter 5: Sections 5.1,5.2,5.5-5.7,5.9,5.11.

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.

Textbook-1: Chapter 8: Sections 8.1,8.4- 8.8,8.19-8.21

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. Consi stency 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.

Textbook-1: Chapter 2: Sections 2.7,2.10,2.13,2.14,2.16 **Chapter 28: Sections 28.6(1,2)**

Textbook-2: Chapter-7: Section 7.3

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.
Textbook-3: Chapter 4: Sections 4.1 to 4.9 and 4.11 **Chapter 7: Sections-7.1,7.2,7.5**
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.
Textbook-3: Chapter 5: Sections 5.3- 5.7 **Chapter 6: Sections-6.1-6.2**
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. Seymour Lipschutz and Marc Lipson, Linear Algebra, Schaum's outlines series, 4th Ed., 2008. **Reference books:** 1. B.V. Ramana, Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017 2. Gilbert Strang, Linear Algebra and its Applications, Cengage Publications, 4th Ed., 2022. 3. N. P Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022. 4. James Stewart, Calculus, Cengage Publications, 7thEd., 2019. 5. David Poole, Linear Algebra, a modern introduction, Cengage publishers, 4th Ed., 2014. 6. David C Lay, Linear Algebra and its Applications, Pearson Publishers, 4th Ed., 2018. Gareth Williams, Linear Algebra with applications, Jones Bartlett Publishers Inc., 6th Ed., 2017.
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adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.

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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: Objective Problem Solving: Average of two objective type assessments – Gate based aptitude test for 15 marks each.

Learning Activity-2: Lab activity: Execute the following lab exercises with the aid of technological tool -Python. (for 10 marks)

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 and test for consistency.
5) Solving system of linear equations using Gauss elimination 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.

Learning Activity Rubrics

Learning Activity-1: Objective Problem Solving

Mode: Two objective-type assessments (15 marks each; Average= 15 marks)

Component & CO-PO Mapping	Outstanding	Exceeds Expectations	Meets Expectations	Needs Improvement	Unsatisfactory
Conceptual Understanding [CO1-CO5] [PO1]	Demonstrates complete and precise understanding of calculus/linear algebra concepts; applies them without errors.(4)	Shows good understanding; minor conceptual errors.(3)	Partial understanding ; key points missing but some correct application.(2)	Limited understanding; frequent conceptual errors.(1)	No clear understanding; responses irrelevant/incorrect.(0)
Problem-Solving & Accuracy [CO1-CO5] [PO2]	Solutions are accurate, well-structured, and logically presented.(4)	Mostly accurate solutions; minor steps missing.(3)	Correct in parts but lacks full logical flow.(2)	Attempted but mostly incorrect or poorly structured.(1)	Incomplete or irrelevant solutions.(0)
Application of Methods [CO1-CO5] [PO1,PO2]	Applies appropriate methods (differentiation, vector operations, matrix methods) creatively and efficiently.(4)	Applies suitable methods correctly but without optimization.(3)	Applies methods mechanically, with partial correctness.(2)	Methods applied incorrectly or inconsistently.(1)	No evidence of method application.(0)
Clarity of Steps & Presentation [CO1-CO5] [PO8,PO9]	All steps shown clearly with structured reasoning.(3)	Most steps shown; some clarity issues.(2)	Limited steps shown; reasoning weak.(1)	Few steps shown; reasoning unclear.(0.5)	No meaningful steps shown.(0)

Marks Distribution for Learning Activity-1 (Objective Problem Solving)
Total Marks = 15

Component	Weightage (Marks)	Remarks
Conceptual Understanding	4	Accuracy of concepts in calculus/linear algebra
Problem-Solving & Accuracy	4	Logical and correct problem-solving steps
Application of Methods	4	Correct application of methods (derivatives, matrix operations, etc.)
Clarity & Presentation	3	Clarity of reasoning and solution steps

Learning Activity-2: Lab activity

Mode: Execute lab exercise using Python. Marks = 10

Component & CO-PO Mapping	Outstanding.(2)	Exceeds Expectations(1.5)	Meets Expectations.(1)	Needs Improvement.(0.5)	Unsatisfactory.(0)
Mathematical Application [CO1-CO5] [PO1, PO2]	Accurately applies concepts (derivatives, vector fields, eigenvalues, and transformations) to tasks.	Correct application with minor errors.	Partially correct application; limited scope.	Major errors in application.	No relevant application attempted.
Tool Usage & Implementation [CO6] [PO5]	Efficient use of Python with accurate implementation of lab tasks.	Good use of Python; implementation mostly correct.	Basic usage of Python; implementation partially correct.	Poor use of Python; implementation largely incorrect.	No evidence of Python usage or implementation.
Execution & Debugging [CO6] [PO5]	Executes all lab exercises flawlessly; identifies and corrects errors independent.	Executes most exercises correctly; minor debugging required.	Executes exercises with partial correctness; needs guidance in debugging.	Execution attempted with frequent errors; debugging incomplete.	Unable to execute exercises meaningfully.
Analysis & Interpretation [CO1-CO6] [PO5]	Results analyzed thoroughly; clear interpretation with reasoning.	Results analyzed; interpretation mostly clear.	Limited analysis with partial interpretation.	Minimal analysis; weak interpretation.	No analysis or interpretation.

Documentation & Reporting [CO1-CO6] [PO8, PO9, PO11]	Well-organized report with clear structure, explanations, and reflection on learning.	Report organized with minor issues in clarity or depth.	Basic report submitted; limited clarity or depth.	Incomplete or poorly organized report.	No report submitted or irrelevant content.

Marks Distribution for Learning Activity-2 (Lab Activity)

Total Marks = 10

Component	Weightage (Marks)	Remarks
Mathematical Application	2	Application of calculus/linear algebra concepts
Tool Usage & Implementation	2	Python implementation correctness
Execution & Debugging	2	Ability to run and correct programs
Analysis & Interpretation	2	Clarity in result interpretation
Documentation & Reporting	2	Report structure and clarity

1st year Syllabus

MULTIVARIABLE CALCULUS AND NUMERICAL METHODS (ME)		Semester	2
Course Code	**1BMMAS201**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40Hours Theory + 20-24Hours Tutorials	Total Marks	100
Credits	4 Credits	Exam Hours	3 Hours
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

CO1: Apply the concepts of integral calculus, higher order differential equations, and vector calculus to model and solve problems in engineering applications such as area, volume, heat conduction, and field analysis.

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

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

Multiple Integrals: Definition, Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find Area and Volume by double integral.
Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Textbook 1: Chapter:7.1-7.16

Module-2: Ordinary Differential Equations of Higher Order **(8 Hours Theory + 4 Hours Tutorial)**

Higher-order ordinary differential equations 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. Applications: mass spring model.
Textbook 1: Chapter 17.8-17.12, Chapter 13.4-13.9(1,2), Chapter 14:14.2,
Textbook 2: Chapter 9: 9.13

Module-3: Vector Calculus **(8 Hours Theory + 4 Hours Tutorial)**

Scalar and vector fields. Gradient, directional derivative, divergence and curl-physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential.
Vector Integration: Line integrals, work done by a force and flux. Statement of Green's theorem and Stoke's theorem and problems without verifications.
Textbook 1: Chapter 8 :8.4,8.5,8.6,8.7(1,2),8.9,8.18(1),8.11,8.13,8.14,8.17

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

Solution of algebraic and transcendental equations: Regula-Falsi and Newton-Raphson methods. Interpolation: Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula.
Numerical integration: Trapezoidal, Simpson's1/3rd and 3/8thrules.
Textbook1:Chapter28: Chapter29:29.1-29.12,Chapter 30:30.2-,30.8

Module-4: Numerical Methods- 1	**(8 Hours Theory + 4 Hours Tutorial)**
Solution of algebraic and transcendental equations: Regula-Falsi and Newton-Raphson methods. Interpolation: Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula. Numerical integration: Trapezoidal, Simpson's1/3rd and 3/8thrules. Textbook1:Chapter28: Chapter29:29.1-29.12,Chapter 30:30.2-,30.8	
Module-5: 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, Milne's predictor- corrector formula and Adams-Bashforth predictor-corrector method. Textbook 1: Chapter 32 :32.3- 32.10	

Suggested Learning Resources: (Textbook/Reference Book):

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers,44nd Ed., 2021.
2. B.V.Ramana, HigherEngineeringMathematics,McGraw-HillEducation,11thEd., 2017
3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons,10th Ed.,2018.
4. 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. Srimanta Pal & Subodh C.Bhunia, Engineering Mathematics, Oxford University Press, 3rd Ed., 2016.
2. N. P.Baliand ManishGoyal, A Text book of Engineering Mathematics, Laxmi Publications,10thEd.,2022.
3. H.K.Dassand Er.RajnishVerma, Higher Engineering Mathematics, S.Chand Publication, 3rd Ed., 2014.
4. Ray Wylie, Louis C.Barrett, Advanced Engineering Mathematics, McGrawHill Book Co., New York, 6th Ed., 2017.
5. Steven V. Chapra and Raymond P. Canale, Applied Numerical Methods with Matlab for Engineers and Scientists, Mc Graw-Hill,3rdEd., 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, 5thEd.,2012.

Web links and Video Lectures (e-Resources):

- http://academicearth.org/
- VTUe-ShikshanaProgram
- VTUEDUSATProgram
- 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) (Gate-based Aptitude Test) Execute the following lab exercises with the aid of any modern technological tool (Matlab/Mathematica/Scilab/Python/Maxima, etc).

Learning Activity-2: The students have to present applications of mathematics related to syllabus as a group maximum of five members.

List of Lab Activities:

1) Evaluate double and triple integration and compute area and volume,
2) Solve higher order differential equations,
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,
9) Fourth order Runge -Kutta method,
10) Milne's method.

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

Activity-1	Superior (13-15)	Good (10-12)	Fair (7-9)	Needs Improvement (4-6)	Unacceptable (0-3)
Performance Indicator- 1 (CO-1/PO - 1, PO-12, Mapping)	Demonstrates complete understanding of the topic	Shows good understanding with minor errors	some key points are missing	Shows little understanding	Very poor performance
Performance Indicator-2 (CO-2/PO-1/ PO-12, Mapping)	creatively to solve problems	Participates regularly but may need occasional prompting	Demonstrates partial understanding	major misconceptions present	Inadequate performance

Activity-2	9-10	7-8	5-6	3-4	1-2
Performance Indicator-3 (CO-3/PO-5 PO-12, Mapping)	perform tasks independently	Applies knowledge correctly	limited creativity.	Unable to apply knowledge appropriately.	Identical performance

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

1st year Syllabus

CALCULUS, LAPLACE TRANSFORMS AND NUMERICAL TECHNIQUES (EEE)		Semester	2
Course Code	**1BMEAS201**	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. Areas and volume using double integration.

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

Textbook-1: Chapter-7.1,-7.16.

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.

TextBook-1: Chapter-8.4- 8.14.

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 1/3rd rule and Simpson's 3/8th rule. **Textbook-1: Chapter-28.1, 28.2(2,3), 29.1-29.12, 30.4, 30.6, 30.7, 30.8.**	
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, Milne's predictor corrector method and Adam-Bashforth predictor-corrector method. Textbook -1: Chapter-32.1-32.10	
Module-5: Laplace transforms	**(8 Hours Theory + 4 Hours Tutorial)**
Laplace transforms: Definition and Formulae of Laplace Transforms, Laplace Transforms of elementary functions. Properties–Linearity, Scaling, shifting property, differentiation in the s domain, division by t. Laplace Transforms 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 of Inverse Laplace Transforms using different methods, and applications to solve ordinary differential equations. Textbook -1: Chapter-21.1- 21.17	

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- https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2012/pages/syllabus/

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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**.
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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 (Average of two objective type assessments (GATE-based Aptitude Test) for 15 marks each) **Learning Activity-2:** Choose either lab activity or seminar for 10 marks **Lab activity**: Execute the following lab exercises with the aid of any modern technological tool (Matlab/ Mathematica/ Scilab/ Python/ Maxima, etc). **Seminars**: The students has to present applications of mathematics related to syllabus as a group maximum of four members.
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 of fourth order, 9)Laplace transform, 10)Inverse Laplace transforms.

Learning Activity-1	**Superior (13-15)**	**Good (10-12)**	**Fair (7-9)**	**Needs Improvement (4-6)**	**Unacceptable (0-3)**
Performance Indicator- 1 (CO-1/PO -1, PO-12 Mapping)	Demonstrates complete understanding of the topic	Shows good understanding with minor errors	some key points are missing	Shows little understanding	Very poor performance

Performance Indicator-2 (CO-2, CO-3 /PO-1, PO-12, Mapping)	creatively to solve problems	Participates regularly but may need occasional prompting	Demonstrates partial understanding	major misconceptions present	Inadequate performance
Learning Activity-2	**9-10**	**7-8**	**5-6**	**3-4**	**1-2**
Performance Indicator-3 (CO-3/PO-5, PO-12, Mapping)	perform tasks independently	Applies knowledge correctly	limited creativity.	Unable to apply knowledge appropriately.	Identical performance

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

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

- Course Project
- Case Study Presentation
- Programming Assignment
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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

1st year Syllabus

NUMERICAL METHODS (CSE)		Semester	2
Course Code	**1BMCAS201**	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.

Textbook-1: Chapter-1: section 1.3, Chapter-2: sections 2.1-2.3.

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.

Textbook-1: Chapter-4: sections 4.1-4.4, 4.6

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.

Textbook-3: Chapter-11: Sections 11.9-11.1 Chapter-13: Sections 13.1-13.7
Module-5: Numerical Integration and Numerical Solution of Differential Equations (8Hours Theory + 4Hours Tutorial)
Numerical integration: Trapezoidal, Simpson's 1/3rd, Simpson's 3/8th 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. **Textbook-1: Chapter-5: Sections 5.6, 5.7. Chapter-6: Sections 6.3, 6.4, 6.7** **Textbook-3: Chapter-30: Sections 30.4-30.10, Chapter-32: Sections 32.3-32.9,**
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/

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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):

ACTIVITY-1	**Superior (13-15)**	**Good (10-12)**	**Fair (7-9)**	**Needs Improvement (4-6)**	**Unacceptable (0-3)**
Performance Indicator- 1 (CO-1/PO -1, PO-12 Mapping)	Demonstrates complete understanding of the topic	Shows good understanding with minor errors	some key points are missing	Shows little understanding	Very poor performance
Performance Indicator-2 (CO-2 /PO-1, PO-12, Mapping)	creatively to solve problems	Participates regularly but may need occasional prompting	Demonstrates partial understanding	major misconceptions present	Inadequate performance
ACTIVITY-2	**9-10**	**7-8**	**5-6**	**3-4**	**1-2**
Performance Indicator-3 (CO-3/PO-5, PO-12, Mapping)	perform tasks independently	Applies knowledge correctly	limited creativity.	Unable to apply knowledge appropriately.	Identical performance

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

1st year Syllabus

PHYSICS OF MATERIALS (ME)		Semester	I/II
Course Code	**1BPMAS102/202**	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. Apply simple harmonic, damped, and forced oscillations in mechanical and electrical systems by conducting the relevant experiments.
2. Explain stress, strain, and elastic moduli concepts to evaluate elastic behavior by conducting the relevant experiments.
3. Explain thermoelectric effects and assess materials/devices for energy conversion and thermal management.
4. Use the knowledge of low-temperature physics, cryogenic production methods, and cryogenic applications.
5. Discuss material characterization techniques and instrumentation for analyzing macroscopic and microscopic properties of engineering material by conducting the relevant experiments.

Module - 1

Oscillations:

Simple harmonic motion (SHM), Differential equation for SHM, Springs: Stiffness factor and its physical significance, Series and Parallel combination of springs (Derivation), Types of springs and their applications. Theory of damped oscillations (Qualitative), Types of damping (Graphical Approach). Engineering applications of damped oscillations, Theory of forced oscillations with derivation, Resonance, Sharpness of resonance, Resonance in LCR circuits (Qualitative), Numerical problems.

Text Book : 1,2, Reference Book : 1(Forced Oscillation) Number of Hours:08

Module-2

Elasticity:

Review Stress-Strain Curve, Strain hardening and softening. Elastic Moduli, Poisson's ratio, Relation between Y, n and σ (with derivation), mention relation between K, Y and σ, limiting values of Poisson's ratio. Static and dynamic loading, Beams, Bending moment and derivation of expression, Cantilever, Torsion and Expression for couple per unit twist, Elastic materials (qualitative). Failures of engineering materials - Ductile fracture, Brittle fracture, Stress concentration, Fatigue and factors affecting fatigue (only qualitative explanation), S-N Curve (Wohler curve), Numerical problems.

Text Book : 2, Reference Book : 2

Text Book : 1 and 3 Number of Hours: 08

Module-3
Thermoelectric materials and devices: Thermo emf and thermo current, Seebeck effect, Peltier effect, Seeback and Peltier coefficients, figure of merit (Mention Expression), laws of thermoelectricity. Expression for thermo emf in terms of T_1 and T_2, Thermo couples, thermopile, Construction and working of thermoelectric generators (TEG) and Thermoelectric coolers (TEC), low, mid and high temperature thermoelectric materials, Applications: Exhaust of automobiles, Refrigerator, Space program(Radioisotope Thermoelectric Generator- RTG), Numerical Problems Text Book : 3 Reference Book : 3 Number of Hours:08
Module-4 **Cryogenics:** Introduction to Thermodynamics, Carnot's principle, Efficiency, Production of low temperature - Joule Thomson effect (Derivation with 3 cases), Porous plug experiment with theory, Thermodynamical analysis of Joule Thomson effect, Liquefaction of Oxygen by cascade process, Lindey's air liquefier, Liquefaction of Helium and its properties (superfluidity), Platinum Resistance Thermometer, Applications of Cryogenics: Aerospace, Dewar Flask, Numerical Problems Text Book : 4 Reference Book : 4,5 Number of Hours:08
Module-5
Material Characterization and Instrumentation Techniques: **Materials Properties:** Wave particle dualism, Schrodinger equation, Interpretation of wave function, Particle in an infinite 1D potential well, Quantum confinement in 0, 1, 2 and 3 Dimension (Qualitative), Density of states expressions and graphical representation, Optical properties due to quantum confinement, blue shift, absorption, florescence, Quantum tunnelling **Instrumentation Techniques**: X-Ray Diffractometer (XRD), Schrerrer equation, Atomic Force Microscope (AFM), X-ray Photoelectron Spectroscopy (XPS), Scanning Electron Microscope (SEM), Numerical Problems. Text Book : 5 Reference Book : 6 Number of Hours:08
PRACTICAL COMPONENTS OF IPCC PART – A:
PART – A: FIXED SET OF EXPERIMENTS
1. Determination of Young's modulus of the material of the given bar Uniform Bending. 2. Determination of Rigidity modulus of the Material of the wire using Torsional Pendulum. 3. Study of Forced Mechanical Oscillations and Resonance. 4. Study of the frequency response of Series & Parallel LCR circuits. 5. Determination of effective spring constant of the given springs in series and parallel combinations. 6. Verification of Newton's Law of Cooling. 7. Determination of Young's modulus of the material of the given bar using Single Cantilever. 8. Determination of Moment of Inertia of the given irregular body by setting Torsional Oscillations. 9. Determination of Grating constant using LASER Diffraction / Estimation of particle size of lycopodium

powder using Laser Diffraction

10. Experiment on Thermo-emf / Peltier Module
11. Determination of Planck's Constant using LEDs.
12. STEP Interactive Physical Simulations. (Springs, Simple Pendulum)
13. PHET Interactive Simulation (Relevant to Theory)
14. Data Analysis using Spread Sheets

Note :

a. At least ten laboratory experiments must be conducted.
b. Minimum one simulation experiment is mandatory and should be conducted either in the computer lab for the entire batch or on dedicated systems in the physics lab.

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

Text books:

1. Physics, Oscillations and Waves, Optics and Quantum Mechanics, H M Agarwal and R M Agarwal, Pearson, 2025
2. Engineering Physics, Satyendra Sharma and Jyotsna Sharma, Pearson, 2018.
3. A Text book of Engineering Physics by M.N. Avadhanulu, P G. Kshirsagar, S Chand, 2014, Revised Edition.
4. Heat Thermodynamics and Statistical Physics, Brij Lal , N Subrahmanyam , P S Hemne, S Chand and Company Limited, Multicolour Revised Edition, 2018
5. Characterization of Materials- Mitra P.K. Prentice Hall India Learning Private Limited.

Reference books / Manuals:

1. Vibrations and Waves (MIT introductory Physics Series), A P French, CBS, 2003 Edition
2. Elements of Properties of Matter, D S Mathus, S Chand, Reprint 2016
3. Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBS Publishers and Distributers Pvt. Ltd.
4. Cryogenics: A Text Book, S.S. Thipse, Alpha Science International , Limited, 2013.
5. Treatise on Heat, M N Saha and B N Srivastava, 2nd Edition, Indian Press, 1935 ; Original from, the University of California,

1. Materials Characterization Techniques-Sam Zhang, Lin Li, Ashok Kumar, CRC Press, First Edition, 2008.

Web links and Video Lectures (e-Resources):

1. Lecture Series on Physics - I: Oscillations and Waves by Prof.S.Bharadwaj, Department of Physics and Meteorology, IIT Kharagpurn: https://www.youtube.com/watch?v=gnD8Se92hfk
2. Waves and Oscillations : https://www.youtube.com/watch?v=xoJWoMQwTAw&list=PLyqSpQzTE6M9X7oRXliYM8t0aaR_N0Cs d
3. Stress- strain curves :https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
4. Stress curves: https://www.youtube.com/watch?v=f08Y39UiC-o
5. Cryogenic Engineering by Prof. M.D. Atrey , Department of Mechanical Engineering, IIT Bombay.: https://www.youtube.com/watch?v=4gGMBNEzeuc
6. Liquefaction of gases: https://www.youtube.com/watch?v=aMelwOsGpIs
7. Non-destructive testing: https://youtu.be/JGQnbwxPiFA
8. Non-destructive testing: https://youtu.be/uzogGRDSmMA
9. Materials Characterisation : https://youtu.be/SXIYzrFGmkUhttps://nptel.ac.in/courses/10810817 4/05
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 25 marks and CIE Practical component will be 25 marks. 1. The CIE Theory component consists of Two IA tests for 25 marks and the Total is reduced to Maximum of 25 marks. 2. The CIE Practical component for continuous assessments will be for 15 marks through rubrics and for lab internal Assessment will be conducted for 10 marks through rubrics. • To qualify and become eligible to appear for SEE, in the CIE theory component, a student must score at least 40% 25 marks, i.e., 10 marks. • To qualify and become eligible to appear for SEE, in the CIE Practical component, a student must secure a minimum of 40% 25 marks, i.e., 10 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 completed course if the combined total of CIE and SEE is at least 40 out of 100 marks.
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 15 marks. The summation of all the experiments marks to be scaled down to 15 marks. The laboratory test (duration 02 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 10 marks. For laboratory test, the student is required to conduct one experiment.

Rubrics for Learning Activity- CIE/SEE:

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
1. Conceptual *(CO1, CO2,CO3,CO4,CO5; PO1,PO2,PO7,PO8,PO9, PO11)*	Demonstrates in-depth and integrated understanding of core principles across the topics.	Clear understanding of key concepts; minor lapses in integration or examples.	Basic understanding of fundamental concepts, but lacks depth or linkages.	Confused understanding; struggles with accurate definition or context.	Irrelevant or incorrect concepts expressed.
2. Derivation of Equations *(CO1, CO2,CO3,CO4,CO5;*	Full, step-by-step derivations with assumptions, mathematical	Mostly correct derivations; minor step	Partial derivation; correct start but missing	Many errors; little logic or physical justification.	No attempt or irrelevant derivation.

PO1,PO2,PO7,PO8,PO9, PO11)	clarity, and physical interpretation.	omissions or notations.	or incorrect final steps.		
3. Construction & Working of Instruments *(CO1, CO2,CO3,CO4,CO5; PO1,PO2,PO7,PO8,PO9, PO11*	Clear, accurate, and labelled diagrams with detailed explanation of working principles.	Correct diagrams with slight errors; working mostly clear.	Acceptable diagrams but with missing parts or vague working.	Poorly drawn or labeled diagram; explanation unclear or incomplete.	No diagram or unrelated sketch; incorrect or no explanation.
4. Applications in Real-World Context *(CO1, CO2,CO3,CO4,CO5; PO1,PO2,PO7,PO8,PO9, PO11*	Demonstrates strong ability to relate physics principles to mechanical/industrial applications .	Appropriate applications given; real-world relevance is mostly correct.	Some understanding of applications; lacks clarity or depth.	Applications mentioned are vague, generic, or partially incorrect.	No or irrelevant application provided.
5. Problem-Solving & Accuracy *(CO1, CO2,CO3,CO4,CO5; PO1,PO2,PO7,PO8,PO9, PO11*	All steps correct; accurate use of equations, units, and logic; answers are clearly presented.	Mostly correct with minor numerical or unit issues.	Shows partial process; answer may be wrong due to formula or unit error.	Incomplete or incorrect approach; significant logic gaps.	No meaningful attempt or completely incorrect.

Suggested rubrics for Practical continuous assessment (15 marks):

Component & PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
1**. Apply Fundamental concepts of Physics** (PO1, PO2.PO11)	Demonstrates exceptional understanding of physics concepts.	The student understands most key concepts related to the experiment. Their explanations are generally correct but may miss minor details or show slight uncertainty	The student can describe the basic physics concepts and procedures but lacks depth.	The student shows incomplete or confused understanding of the physics concepts.	Misunderstands or cannot explain basic physics concepts related to the experiment.

2. Experimental planning, execution, Setup, Technical Skill, Interpretation (PO1, PO7, PO8, PO11)	Designs and executes the experiment with careful planning, showing excellent technical proficiency, setup is optimal and data interpretation is thorough and insightful.	Plans and conducts the experiment competently with reasonable technical skill, setup is appropriate and interpretation is adequate.	Conducts the experiment with sufficient technical ability, setup and data collection are generally adequate though may lack precision, interpretation is basic.	Follows instructions but with limited technical skill, setup or data collection is inconsistent, interpretation is minimal or confused.	Unable to properly set up or carry out the experiment, data collection is flawed, interpretation missing or incorrect.
3.Communication & Report writing (PO7,PO9,PO11)	Produces a well-structured, clear and professionally written report, all sections (Introduction, Methodology, Results and Conclusion) are comprehensive and logically arranged.	Report is well-organized and mostly complete, some sections may lack detail or clarity but overall coherent.	Report contains necessary sections but organization is uneven, some parts may be underdeveloped or unclear.	Report lacks organization, several key sections are missing or poorly presented.	Report is incomplete, incoherent, or missing significant portions of required content.

1st year Syllabus

QUANTUM PHYSICS AND ELECTRONIC SENSORS (EEE)		Semester	I/II
Course Code	**1BPEAS102/202**	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)	64	Total Marks	100
Credits	4	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. Discuss quantum mechanics to analyze microscopic systems, quantized states, and tunneling.
2. Analyze electrical conduction in metals and semiconductors, including carrier concentration and Fermi energy.
3. Summarize superconductivity phenomena and their applications in advanced materials.
4. Describe light–matter interaction, lasers, modulators, and photonic devices in sensor technologies.
5. Apply principles and applications of semiconductor, optical devices, sensors, and transducers in electronic and photonic systems.

Module-1

Quantum Physics:

de Broglie Hypothesis, Heisenberg's Uncertainty Principle and its application (Broadening 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 Book : 2, 3 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 in a conductor, Mention of expression for electrical conductivity, Success of quantum free electron theory of metals, Derivation of electron concentration in an intrinsic semiconductor, Expression for electron and hole concentration in extrinsic semi-conductor (Qualitative), Fermi level for intrinsic (with derivation) and extrinsic semiconductor (no derivation), Hall effect, Numerical Problems.

Text Books : 1, 3 Reference Books : 1, 9 Number of Hours: 8

Module-3
Superconductivity Zero resistance state, Persistent 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 (Qualitative), Charge Qubit, Numerical Problems. Text Books: 1, 2, Reference Books: 4, 5, 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: 6, 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) gas sensors, Hall sensor, Superconducting Nanowire Single Photon Detector, Numerical Problems. Text Book : 4, Reference Book : 1, 10 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 6. Determination of Plank's Constant using LEDs / Black-Body. 7. Determination of Fermi Energy of Copper. 8. Interference by the division of amplitude (Air-wedge/Newton's Rings) 9. Black-Box Experiment (Identification of basic Electronic Components) 10. Study the I-V Characteristics of a Bipolar Junction Transistor and hence determine α and β. 11. Resonance in LCR circuit and hence determine the coefficient of self inductance. 12. Determine the Energy Gap of the given semiconductor. 13. To study the operation of a multimeter and use it for measuring **resistance, current, voltage**, and for

testing **diodes, transistors, and continuity in conductors**.

14. Construction and Analyzing Electronic circuits using one of the following
    1. Expeyes : https://expeyes.in/
    2. Circuit Lab : https://www.circuitlab.com/
    3. Multisim : https://www.multisim.com/
    4. DCAClab : https://dcaclab.com/
    5. Falstad : https://www.falstad.com/circuit/

Note :

1. At least ten laboratory experiments must be conducted.
2. Minimum one simulation experiment is mandatory and should be conducted either in the computer lab for the entire batch or on dedicated systems in the physics lab.

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 Anniver- sary ed.). Cambridge University Press.
9. Solid State Physics, A J Dekker (2000), Indian Ed., Macmillan Publishers India, New Delhi.
10. Principles of Electronics, V K Mehta & Rohit Mehta, S Chand and Company, 7th Edition 2008.

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. Smart Sensors – NPTEL Lecture 34 – Covers various sensors including gas, pressure, MOS sensors, pho- todetectors like SNSPD https://www.youtube.com/watch?v=oRydUfgMdgA
11. 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 (IPCC): (Circular-Ref.: VTU/BGM/IPCC 2025/3748, DATED: 24TH Oct 2025)

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**. The CIE Practical component for continuous assessments will be for **15 marks** through rubrics and for lab Internal Assessment will be conducted for **10 marks** through rubrics.

- To qualify and become eligible to appear for SEE, in the **CIE theory component**, a student must score at least **40% of 25 marks**, i.e., **10 marks**.
- To qualify and become eligible to appear for SEE, in the **CIE Practical component**, a student must secure **a minimum of 40% of 25marks**, i.e., **10marks**.

- 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 **completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

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 mi- nor 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 under- standing with simple calculation attempts	Inaccurate analysis or incomplete application of models	Unable to per- form conduction analysis or interpret results
Performance Indicator 3 (CO3 - PO1, PO2, PO4, PO5, PO11)	Evaluates superconductivity and Joseph- son junction behavior with clear reasoning and examples	Explains effects with fair under- standing and application	Recognizes phenomena but lacks detailed reasoning	Minimal interpretation or misapplication of principles	Fails to identify superconductin g 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 de-vices 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 understandin g but lacks connection to application	Misunderstand s 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 under-standing with simple calculation at- tempts	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 super-conductivity and Josephson junction behavior with clear reasoning and examples	Explains effects with fair under-standing and application	Recognizes phenomen a 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 con- textual 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:

Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO5, PO11)	Demonstrates strong under-standing 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 dis- cussing more than one de- sign for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few de-signs 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 suit- able 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

1st year Syllabus

QUANTUM PHYSICS AND APPLICATIONS (CSE)		Semester	I/II
Course Code	1BPCAS102/202	**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. Apply the basic principles of quantum mechanics in the quantized energies of the system and by conducting the relevant experiments.
2. Summarize the principles of electrical properties of metals and semiconductors and analyzing through the experiments.
3. Apply the superconducting phenomena and their role in quantum systems.
4. Apply the principles of lasers and optical fibers in measuring parameters by conducting the experiments and photonic device operation.
5. Apply the basic concepts of quantum computing in developing quantum gates.

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 Hours:** 8

Module-3
Superconductivity: Zero resistance state, Persistent 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 an harmonicity, 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:
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 / Black-Body. 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 and determination of coefficient of self-induction. 9. Study the I-V Characteristics of a Bipolar Junction Transistor and hence determine α and β. 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. a) https://www.quirk-e.dev/ b) https://algassert.com/quirk 12. Predicting the outputs of various combinations of single and two-qubit gates using QISKIT.

13. Air-wedge / Newton's to study the interference by the division of amplitude.
14. Experimental Data Analysis using Spread Sheet.

Note:

15. At least ten laboratory experiments must be conducted.
16. Minimum one quantum simulation experiment is mandatory and should be conducted either in the computer lab for the entire batch or on dedicated systems in the physics lab.

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:

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. LASERS and Non-Linear Optics, B B Loud, New Age International,
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.
9. Vishal Sahani, Quantum Computing, McGraw Hill Education, 2007 Edition.
10. Solid State Physics, A J Dekker (2000), Indian Ed., Macmillan Publishers India, New Delhi.

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 25 marks and CIE Practical component will be 25 marks.

1. The CIE Theory component consists of Two IA tests for 25 marks and the Total is reduced to Maximum of 25 marks.
2. The CIE Practical component for continuous assessments will be for 15 marks through rubrics and for lab internal Assessment will be conducted for 10 marks through rubrics.
   - To qualify and become eligible to appear for SEE, in the CIE theory component, a student must score at least 40% 25 marks, i.e., 10 marks.
   - To qualify and become eligible to appear for SEE, in the CIE Practical component, a student must secure a minimum of 40% 25 marks, i.e., 10 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 completed course if the combined total of CIE and SEE is at least 40 out of 100 marks.

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 15 marks. The summation of all the experiments marks to be scaled down to 15 marks.
The laboratory test (duration 02 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 10 marks. For laboratory test, the student is required to conduct one experiment.

Rubrics for Learning Activity (CIE/SEE):

Learning Activity- CIE/SEE

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
1. Conceptual CO1, CO2, CO3, CO4, CO5 (PO1, PO2, PO7, PO8, PO9, PO11)	Demonstrates comprehensive understanding the concepts across all modules with clarity and depth.	Clear understanding of key concepts, minor lapses in integration or examples.	Basic understanding of fundamental concepts, but lacks depth or linkages.	Confused understanding; struggles with accurate definition or context.	Irrelevant or incorrect concepts expressed.
2. Derivation of Equations CO1,CO2,CO3, CO4 **(**PO1, PO2, PO7, PO8, PO9, PO11)	Provides clear, complete derivations with correct assumptions, steps, and physical significance (e.g., Schrödinger Wave equation, Fermi energy & Fermi level, Meissner effect, NA of optical fiber etc.).	Mostly correct derivations; minor step omissions or notations.	Partial derivation; correct start but missing or incorrect final steps.	Many errors; little logic or physical justification.	No attempt or irrelevant derivation.
3. Diagrams & Working of Devices CO2,CO3,CO4 **(**PO1, PO2, PO7, PO9, PO11)	Presents neat, well-labelled, and technically accurate diagrams (e.g., semiconductor laser, Josephson junction, Mach-Zehnder	Correct diagrams with slight errors; working mostly clear.	Acceptable diagrams but with missing parts or vague working.	Poorly drawn or labelled diagram; explanation unclear or incomplete.	No diagram or unrelated sketch; incorrect or no explanation.

	interferometer) with clear explanation of operation.				
4. Applications in Real-World Context CO1,CO2,CO3, CO4, CO5 (PO1, PO2, PO7, PO8, PO9, PO11)	Effectively applies physical principles to real-world and technological systems (e.g., quantum computing, superconducting sensors, optical communication).	Appropriate applications given; real-world relevance is mostly correct.	Some understanding of applications; lacks clarity or depth.	Applications mentioned are vague, generic, or partially incorrect.	No or irrelevant application provided.
5. Problem-Solving & Accuracy CO1,CO2,CO3, CO4, CO5 (PO1, PO2, PO7, PO9, PO11)	Solves numerical problems with high accuracy, uses correct equations, logical steps, units, and interpretations.	Mostly correct with minor numerical or unit issues.	Shows partial process; answer may be wrong due to formula or unit error.	Incomplete or incorrect approach; significant logic gaps.	No meaningful attempt or completely incorrect.

Suggested rubrics for Practical continuous assessment:

Component & PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
1. Apply Fundamental concepts of Physics PO1, PO2, PO11	Demonstrates exceptional understanding of physics concepts.	The student understands most key concepts related to the experiment. Their explanations are generally correct but may miss minor details or show slight uncertainty	The student can describe the basic physics concepts and procedures but lacks depth.	The student shows incomplete or confused understanding of the physics concepts.	Misunderstands or cannot explain basic physics concepts related to the experiment.
2. Experimental planning, execution , Setup, Technical Skill, Interpretation PO1, PO7, PO8, PO11	Designs and executes the experiment with careful planning, showing excellent technical proficiency, setup is optimal and data interpretation is	Plans and conducts the experiment competently with reasonable technical skill, setup is appropriate and interpretation is adequate.	Conducts the experiment with sufficient technical ability, setup and data collection are generally adequate though may lack precision, interpretation is	Follows instructions but with limited technical skill, setup or data collection is inconsistent, interpretation is minimal or	Unable to properly set up or carry out the experiment, data collection is flawed, interpretation missing or incorrect.

	thorough and insightful.		basic.	confused.	
3. Communication & Report writing PO8, PO09, PO11	Produces a well-structured, clear and professionally written report, all sections (Introduction, Methodology, Results and Conclusion) are comprehensive and logically arranged.	Report is well-organized and mostly complete, some sections may lack detail or clarity but overall coherent.	Report contains necessary sections but organization is uneven, some parts may be underdeveloped or unclear.	Report lacks organization, several key sections are missing or poorly presented.	Report is incomplete, incoherent, or missing significant portions of required content.

1st year Syllabus

APPLIED CHEMISTRY FOR ADVANCED METAL PROTECTION AND SUSTAINABLE ENERGY SYSTEMS (ME)		Semester	I / II
Course Code	**1BCMAS102/202**	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)	64	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: Interpret the terms and processes involved in scientific and engineering applications

CO2: Apply the knowledge of chemistry to solve the problems in chemistry that are pertinent in engineering applications

CO3: Analyze the appropriate chemical techniques suitable for engineering applications to reach the substantiated conclusions

CO4: Apply the techniques of quantitative chemical analysis for engineering problems through experimental skills.

Module-1: Corrosion Science and Coating Technologies

Corrosion: Introduction, electrochemical theory of corrosion, types of corrosion-differential metal and differential aeration corrosion-waterline and pitting corrosion, corrosion control- metal coating; galvanization, surface conversion coating; anodization and cathodic protection; sacrificial anode method, corrosion penetration rate (CPR) - Introduction and numerical problems.

Coating Technologies: Introduction, technological importance, electroplating - electroplating of chromium-decorative and hard chromium, electro-less plating - electroless plating of Nickel, difference between electroplating and electroless plating.

Number of Hours: 08

Module-2: Sustainable Fuels

Fuels: Introduction, calorific value, determination of calorific value using bomb's calorimeter, numerical problems on GCV and NCV. Knocking in internal combustion (IC) engines - knocking mechanism in IC engines. Anti-knocking agents - methyl tertiary butyl ether (MTBE) and ethyl tert-butyl ether (ETBE). Importance of octane and cetane rating of fuel.

Green Fuels: Introduction, power alcohol – properties, applications and its limitations, biodiesel

- synthesis by trans-esterification method, advantages and its applications. Production of green hydrogen by photocatalytic water splitting and its advantages, hydrogen storage – introduction, advantages and limitations of metal hydride and ammonia as chemical hydrogen carriers.

Number of Hours: 08

Module-3: Materials for Energy Systems
Nanomaterials: Introduction, synthesis of TiO_2 nanoparticles by sol-gel method and its uses in catalytic converter. Size-dependent properties of nanomaterial-surface area, catalytical, electrical and thermal conductivity. Graphene - Synthesis by chemical vapor deposition (CVD) method, properties and engineering applications. Role of carbon nanotubes (CNTs) in energy devices. **Energy Systems:** Batteries - Introduction, classification of batteries, characteristics-capacity, power density, shelf life and cycle life. Construction, working and applications of Li-ion battery. **Fuel cells** - Introduction, construction and working of solid oxide fuel cells (SOFCs) and its uses in auxiliary power units (APUs). Differences between fuel cell and battery. Solar photovoltaic cells (PV cells) - construction, working, advantages and limitations. **Number of Hours: 08**
Module-4: Materials for Engineering Applications
Engineering Polymers: Introduction, molecular weight of polymers - number average and weight average molecular weight, numerical problems. Synthesis, properties and engineering applications of chlorinated polyvinyl chloride (CPVC), polymethyl methacrylate (PMMA). Structure-properties relationship of polymers (Crystallinity, Strength, Elasticity and chemical resistivity]. Glass transition temperature (Tg), factor affecting Tg and its significance. **Polymer Composites:** Introduction, fiber-reinforced polymers (FRPs); Kevlar – Synthesis, properties and industrial applications. Carbon-fiber - Preparation from Polyacrylonitrile (PAN), properties and industrial applications. **3D Printing materials:** Introduction, synthesis, properties and applications of polylactic acid (PLA) resin. **Number of Hours: 08**
Module-5: Fluid Technology and Smart Sensors
Lubricants: Introduction, classification, ideal properties and applications. Lubricant testing; experimental determination of viscosity using Ostwald's viscometer. **Industrial Coolants:** Introduction, types - water and oil-based coolants, properties and industrial applications. **Industrial effluents:** Introduction, determination of COD and numerical problems. **Sensors:** Introduction, potentiometric sensor - principle and its application in the estimation of iron in steel industry effluent. Conductometric sensor - principle and its application in the estimation of acid mixture in electrochemical bath effluent. pH sensor - principle and its application in the estimation of pKa of acid electrolyte. **Number of Hours: 08**
PRACTICAL COMPONENTS OF IPCC
LIST OF EXPERIMENTS 1. Estimation of total hardness of water by EDTA method 2. Determination of chemical oxygen demand (COD) of industrial wastewater 3. Estimation of iron in steel industry effluent by diphenyl amine indicator method 4. Determination of total alkalinity of given boiler water sample 5. Determination of acid value of biofuel 6. Estimation of acid mixture in electrochemical bath effluent using conductometric sensor (Conductometry)

7. Estimation of iron in rust sample by Potentiometric sensor (Potentiometry)
8. Determination of pKa of acid electrolyte using pH sensor (Glass electrode)
9. Estimation of copper present in e-waste by optical sensor (Colorimetry)
10. Determination of viscosity coefficient of lubricant using Ostwald's viscometer
11. Green synthesis of copper nanoparticles
12. Synthesis of polylactic acid (PLA)

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

Textbooks:

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition.
2. A Textbook of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
3. A Textbook of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.

Reference books:

1. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
2. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
3. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
4. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
5. Applied Chemistry for Mechanical Engineering and Allied Branches, C Manasa, Vrushabendra B, Srikantamurthy N. ISBN: 978-93-58380-90-3, Astitva Prakashan.
6. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
7. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022
8. Polymer Science, V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, Newage Int. Publishers, 4th Edition, 2021
9. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar., Subash Publications, 5th Edition, 2014
10. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020.

Web links and Video Lectures (e-Resources):

1. https://www.vturesource.com/post/1570/News/Bomb-calorimeter-construction-working- vtu-chemistry.html?utm_source
2. https://pubs.acs.org/doi/10.1021/acsomega.3c00963?utm_source
3. https://youtu.be/qTw_p9dkiVU
4. https://youtu.be/wdCYXj-bI-U
5. https://youtu.be/Y0EkLYK5i-c
6. https://youtu.be/tzTxMF7CDd4

7. https://youtu.be/YxrpQEX9ORA
8. https://youtu.be/Gxv4r9qoRf8
9. https://youtu.be/XIjDw5Sw9c4
10. https://youtu.be/j_rNjiliBKE
11. https://youtu.be/GpbcjWstzEE
12. https://youtu.be/ygtbo5KDXeI
13. https://www.youtube.com/watch?v=ygtbo5KDXeI
14. https://youtu.be/y-7t-GdRTKA
15. https://pmc.ncbi.nlm.nih.gov/articles/PMC11085161/?utm_source
16. https://youtu.be/MeOD34QGu-I

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. Models and Working Models
4. Simulations and Interactive Simulations
5. Experiential Learning
6. Flipped Class Learning
7. Hybrid Learning
8. ICT Based Learning

Assessment Structure (IPCC): (Circular-Ref.: VTU/BGM/IPCC 2025/3748, DATED: 24th Oct 2025)

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**. The CIE Practical component for continuous assessments will be for **15 marks** through rubrics and for lab Internal Assessment will be conducted for **10 marks** through rubrics.

- To qualify and become eligible to appear for SEE, in the **CIE theory component**, a student must score at least **40% of 25 marks**, i.e., **10 marks**.
- To qualify and become eligible to appear for SEE, in the **CIE Practical component**, a student must secure **a minimum of 40% of 25marks**, i.e., **10marks**.
- 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 **completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

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, PO4, PO6, PO11)	Demonstrates an in-depth understanding of corrosion mechanisms and expertly applies appropriate surface coating techniques for effective material protection.	Shows clear understanding of corrosion processes and applies relevant surface coating Methods with reasonable effectiveness for material protection.	Provides a general understanding of corrosion mechanisms and applies Basic surface coating techniques with limited accuracy.	Displays minimal understanding of corrosion and surface coatings; application is unclear or inappropriate for material protection.	Fails to demonstrate understanding of corrosion or surface coating techniques; no evidence application of
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO6, PO11)	Demonstrates a thorough analysis of sustainable chemistry principles and critically evaluates various green energy fuels with strong justification.	Clearly analyses key sustainable chemistry concepts and evaluates green energy fuels with appropriate relevance	Shows a basic understanding of sustainable chemistry and provides a general evaluationof green fuels, But lacks depth.	Demonstrates minimal understanding of sustainable chemistry; evaluation of green fuels is weak.	Fails to analyse sustainable chemistry principles or evaluate green energy fuels.

Performance Indicator 3 (CO3 - PO1, PO2, PO3, PO11)	Thoroughly examines the synthesis methods and critically evaluates the applications of nanomaterials in advanced energy storage technologies.	Clearly examines common synthesis techniques and explains relevant application of nanomaterials in energy storage technologies.	Demonstrates a basic understanding of nanomaterial synthesis and mentions general applications in energy storage.	Provides minimal explanation of synthesis, applications and shows limited understanding of nanomaterials in energy storage.	Fails to examine synthesis and application of nanomaterials.
Performance Indicator 4 (CO4 - PO1, PO2, PO3, PO11)	Effectively applies appropriate functional materials in diverse engineering applications with clear justification.	Correctly applies functional materials in relevant engineering contexts and shows reasonable understanding of their impact.	Shows basic application of functional materials with limited understanding.	Applies functional materials inaccurately and limited connection to performance.	Fails to apply functional materials appropriately and no understanding of their use in engineering.

Rubrics for CIE – Continuous assessment:

Performance Indicator (CO/PO Mapping)	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 – PO1, PO2, PO3, PO4, PO6, PO11)	Demonstrates an in-depth understanding of corrosion mechanisms and expertly applies appropriate surface coating techniques for effective material protection.	Shows clear understanding of corrosion processes and applies relevant surface coating methods with reasonable effectiveness for material protection.	Provides a general understanding of corrosion mechanisms and applies basic surface coating techniques with limited accuracy.	Displays minimal understanding of corrosion and surface coatings; application is Unclear or inappropriate for material protection.	Fails to demonstrate understanding of corrosion or surface coating techniques; no evidence of application in engineering systems.

Performance Indicator 2 (CO2 – PO1, PO2, PO3, PO6, PO11)	Demonstrates a thorough analysis of sustainable chemistry principles and critically evaluates various green energy fuels with strong justification.	Clearly analyses key sustainable chemistry concepts and evaluates green energy fuels with appropriate relevance	Shows a basic understanding of sustainable chemistry and provides a general evaluation of green fuels, but lacks depth.	Demonstrates minimal understanding of sustainable chemistry; evaluation of green fuels is weak.	Fails to analyse sustainable chemistry principles or evaluate green energy fuels.
Performance Indicator 3 (CO3 – PO1, PO2, PO3, PO11)	Thoroughly examines the synthesis methods and critically evaluates the applications of nanomaterials in advanced energy storage technologies.	Clearly examines common synthesis techniques and explains relevant applications of nanomaterials in energy storage technologies.	Demonstrates a basic understanding of a anomaterial synthesis and mentions general applications in energy storage.	Provides minimal explanation of synthesis, applications and shows limited understanding of anomaterials in energy storage.	Fails to examine synthesis and Application of nanomaterials.
Performance Indicator 4 (CO4 – PO1, PO2, PO3, PO11)	Effectively applies appropriate functional materials in diverse engineering applications with clear justification.	Correctly applies functional materials in relevant engineering contexts and shows reasonable understanding of their impact.	Shows basic application of functional materials with limited understanding.	Applies functional materials inaccurately and limited connection to performance.	Fails to apply functional materials appropriately and no understanding of their use in engineering.

Rubrics for SEE / CIE Test:

Performance Indicator (CO/PO Mapping)	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator 1 (CO1 – PO1, PO2, PO3, PO4, PO6, PO11)	Demonstrates an in-depth understanding of corrosion mechanisms and expertly applies appropriate surface coating techniques for effective material protection.	Shows clear understanding of corrosion processes and applies relevant surface coating methods with reasonable effectiveness for material protection.	Provides a general understanding of corrosion mechanisms and applies basic surface coating techniques with limited accuracy.	Displays minimal understanding of corrosion and surface coatings; application is Unclear or inappropriate for material protection.	Fails to demonstrate understanding of corrosion or surface coating techniques; no evidence of application in engineering systems.
Performance Indicator 2 (CO2 – PO1, PO2, PO3, PO6, PO11)	Demonstrates a thorough analysis Of sustainable chemistry principles and critically evaluates various green energy fuels with strong Justification.	Clearly analyses key sustainable Chemistry concepts and evaluates green energy fuels with appropriate relevance	Shows a basic understanding of sustainable chemistry and provides a general evaluation of green fuels, but lacks depth.	Demonstrates minimal understanding of sustainable chemistry; evaluation of green fuels is weak.	Fails to analyse sustainable Chemistry principles or evaluate green energy fuels.
Performance Indicator 3 (CO3 – PO1, PO2, PO3, PO11)	Thoroughly examines the synthesis methods and critically evaluates the applications of nanomaterials in advanced energy storage technologies.	Clearly examines common synthesis techniques and explains relevant applications of nanomaterials in energy storage technologies.	Demonstrates a basic understanding of anomaterial synthesis and mentions general applications in energy storage.	Provides minimal explanation of synthesis, applications and shows limited understanding of anomaterials in energy storage.	Fails to examine synthesis and Application of nanomaterials.

Performance Indicator 4 (CO4 – PO1, PO2, PO3, PO11)	Effectively applies appropriate functional materials in diverse engineering applications with clear justification.	Correctly applies functional materials in relevant engineering contexts and shows reasonable understanding of their impact.	Shows basic application of functional materials with limited understanding.	Applies functional materials inaccurately and limited connection to performance.	Fails to apply functional materials appropriately and no understanding of their use in engineering.

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 and 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 andPO8)	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 and 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 and 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

1st year Syllabus

APPLIED CHEMISTRY FOR EMERGING ELECTRONICS AND FUTURISTIC DEVICES (EEE,ECE)		Semester	I/II
Course Code	1BCEAS102/202	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)	64	Total Marks	100
Credits	4	Exam Hours	3
Examination type (SEE)	Descriptive		

Course outcome (Course Skill Set)

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

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

CO2: Explain the concepts of nanomaterials and quantum dots materials in device applications.

CO3: Apply the knowledge of functional polymers and composites in the flexible electronic applications.

CO4: Apply experimental skills and electrochemical concepts to sensor systems.

CO5: Apply corrosion control techniques and e-waste management principles to solve engineering problems.

Module-1 Materials for Energy Devices

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

Energy Storage Devices: Introduction, classification of batteries-primary, secondary and reserve battery, characteristics - capacity, power density, shelf life & cycle life. Construction and working of lithium-ion battery and its 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 limitations of solar photovoltaic cell (PV cell). Working principle and applications of Micro- electromechanical systems (MEMS)-based energy harvesters.

Text Book:2, Reference Books: 3,5 Number of Hours**: 08**

Module-2 Nano and Quantum Dot Materials

Nano materials: Introduction, size dependent properties of nanomaterials - surface area, catalytic, optical properties and electrical conductivity. Synthesis of TiO_2 nanoparticles by sol- gel method and its uses in 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 Cd-Se Quantum Dots by hot injection method and applications in optoelectronic devices.

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

Text Book:4 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) and its uses in e-skin (electronic skin) and RFID applications. **Polymers:** Introduction, synthesis, conduction mechanism of polyaniline and its electronic devices applications. Molecular weight of polymers: Number average and weight average molecular weight of polymers-numerical problems. Synthesis and properties of Polyvinylidene Fluoride (PVDF) and its applications in E-nose devices. **Polymer Composites:** Introduction, synthesis and properties of epoxy resin-magnetite (Fe_3O_4) composite (ultrasonication method) for sensors applications. Synthesis and properties of Kevlar Fiber Reinforced Polymer (KFRP) for smart electronic devices applications. Text Book:2, 3 Number of Hours**: 08**
Module-4 Electrode System and Electrochemical Sensors
Electrode System: Introduction, types of electrodes, overview of Nernst equation, 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 numerical. **Sensing Methods:** Introduction, principle and instrumentation of colorimetric sensors; its application in the estimation of copper in PCBs. Principle and instrumentation of potentiometric sensors and its application in the estimation of iron in steel, conductometric sensors; its application in the estimation of acid mixture in the sample. Text Book:1,2, 3 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- waterline and pitting corrosion. Corrosion control- galvanization, anodization, cathodic protection and impressed current method. Corrosion penetration rate (CPR) - definition, importance and weight loss method-numerical problems. **Metal Finishing:** Introduction, technological importance of metal finishing, difference between electroplating & electroless plating, electroplating of chromium for hard and decorative coatings, electroless plating of copper on PCBs. **E-waste:** Introduction, sources of e-waste, need of e-waste management & effects of e-waste on environment and human health. Extraction of gold from e-waste from bioleaching method. Text Book:2, 3, Reference Books: 2,3 Number of Hours: **08**
LIST 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 total alkalinity of given water sample. 5. Determination of Hydrogen Peroxide in PCB Cleaner (Permanganate method) 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. Determination of Viscosity coefficient of conductive Inks
11. Smartphone-Based colorimetric estimation of total phenolic content in coffee products.
12. Green synthesis of copper nanoparticles for conductive ink applications.

Suggested Learning Resources: Text books:

- Engineering Chemistry, Suba Ramesh, Vairam, Ananda Murthy, 2011, Wiley India, ISBN: 9788126519880.
- A Textbook of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
- Engineering Chemistry: Jain & Jain, Publisher: Dhanpat Rai Publishing Company, ISBN: 978-935316118.
- The Chemistry of Nanomaterials: Synthesis, Properties and Applications: Prof. Dr. C. N. R. Rao, Prof. Dr. H.C Mult. Achim Müller, Prof. Dr. A. K. Cheetham, ISBN:9783527602476

Reference Books:

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. Self-Learning using AI Tools
2. Activity Based Learning
3. Models and Working Models
4. Simulations and Interactive Simulations
5. Experiential Learning
6. Flipped Class Learning
7. Hybrid Learning
8. ICT Based Learning

Assessment Structure:

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures 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.

Course Assessment Plan (CAP) for Theory and Practical integrated Course (TPICs)						
Continuous Internal Examinations (CIE)						
Assessment	**Max. Marks**	**Component**	**Max Marks**	**Min. Passing Marks**	**Evaluation details**	**Passing Marks**
Theory	**25**	**IA**	**25**	**10**	**Average of the two IA each of 25 marks**	**10/25**

1st year Syllabus

Practical	**25**	**CIE**	**15**	**Record /Observation Book / Conduction & Evaluation**	**10/25**	
		CIE Lab IA	**10**	**One test 50 marks & scale down to 10 Marks (DETAILS)**		
Finalization of Continuous Internal Examinations (CIE)						
Theory Marks + Lab Marks = 25 + 25 = 50 [Passing Marks (40%): 10 + 10 = 20/50]					**20/50**	
Semester End Examinations (SEE)						
Theory	**50**	**Theory SEE conducted for 100 marks & then reduced to 50 Marks [Passing % = (35%)]**			**18/50**	
Minimum marks for course completion (40 % IN THE SUM TOTAL OF CIE and SEE)					**40/100**	

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 15 Marks.

Rubrics for report evaluation:

Laboratory report/record	Conduction of Experiments	VIVA	Total
5 marks	5 marks	5 marks	25 marks

The average of all the experiments marks to be considered for CIE marks (15 marks).

The laboratory test (duration 02 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 10 marks. For laboratory test, the student is required to conduct one experiment either from volumetric or from instrumental.

Rubrics for SEE/CIE Test

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Conceptual Understanding [CO1, CO2, CO4] [PO1, PO2, PO7, PO8, PO9, PO11]	Demonstrates in-depth understanding of chemistry concepts; accurately applies principles to new situations or problems.	Shows strong conceptual understanding with minor errors in application.	Understands key ideas; applies concepts in familiar contexts only.	Limited understanding; frequent conceptual gaps.	Unable to demonstrate understanding or application.

Analytical Thinking & Problem Solving [CO3, CO4, CO5] [PO1, PO2, PO6, PO7, PO8, PO9, PO11]	Applies chemical reasoning and problem-solving effectively.	Good reasoning with mostly correct analysis; minor computational errors.	Partial reasoning with some inaccuracies .	Limited analytical effort; unclear reasoning.	No logical or analytical approach evident.
Synthesis and Application [CO2, CO3] [PO1, PO2, PO7, PO8, PO9, PO11]	Provides clear and accurate interpretation of data, mechanisms, and applications	Interprets results correctly with minor omissions.	Partial interpretation; general connection to concepts.	Misinterprets key results or mechanisms.	No interpretation or irrelevant explanation.
Construction and working mechanism [CO1, CO4] [PO1, PO2, PO7, PO8, PO9, PO11]	Integrates multiple concepts to justify solutions.	Correct application with minimal errors	Applies basic concepts; lacks integration or justification.	Limited practical application.	No meaningful application or understanding shown.
Presentation & Organization of Answers [CO1–CO5] [PO1, PO2, PO6, PO7, PO8, PO9, PO11]	Answers are well-structured, precise, with clear diagrams, equations, and logical flow.	Mostly well-structured; minor formatting or clarity issues.	Acceptable structure; missing some key steps or clarity.	Poorly structured; lacks clarity or logical sequence.	Disorganized or incomplete responses.

Rubrics for Practical Component (LAB DAM-15Marks)

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Conduction of Experiment [CO3, CO4,	Demonstrates strong understanding,	Performs correctly with minimal guidance.	Executes with partial understanding or	Requires continuous guidance;	Unable to perform experiment.

CO5] [PO1, PO2, PO6, PO7, PO8, PO9, PO11]	performs accurately and independently.		frequent guidance.	procedural errors.	
Calculations/Graph/Result Analysis [CO3, CO4, CO5] [PO1, PO2, PO6, PO7, PO8, PO9, PO11]	Accurate calculations, correct graphing, clear interpretation of results.	Minor calculation or plotting errors.	Reasonable attempt; moderate inaccuracies.	Major computational/graphical errors.	No attempt or completely inaccurate.
Laboratory Record/Report [CO3, CO4, CO5] [PO1, PO2, PO6, PO7, PO8, PO9, PO11]	Demonstrates clear Well-maintained, complete, clear observations, accurate results.	Mostly complete with minor errors or missing data.	Basic records maintained with some inaccuracies.	Incomplete or unclear presentation.	Poorly maintained or missing record.

Rubrics for LAB TEST (10Marks)

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Understanding of Experiment [CO3, CO4, CO5] [PO1, PO2, PO6, PO7, PO8, PO9, PO11]	Clearly explains aim and procedure, relevance with strong conceptual clarity.	Explains aim and procedure with minor gaps.	Basic understanding of aim and procedure.	Limited understanding; explanation unclear.	No understanding of aim or procedure.
Conduction of Experiment/ Observations & Data	Performs experiment accurately, and observations are	Performs correctly with minimal guidance and minor errors	Performs with partial understanding and some	Requires continuous guidance and incomplete or	Unable to perform the experiment and no

Collection [CO3, CO4, CO5] [PO1, PO2, PO6, PO7, PO8, PO9, PO11]	accurate, systematic, and properly recorded.	observed in data.	guidance. Reasonable errors with some inconsistencies.	poorly recorded observations.	observations recorded.
Calculations / Graph / Result Analysis [CO3, CO4, CO5] [PO1, PO2, PO6, PO7, PO8, PO9, PO11]	All calculations accurate; graph neatly plotted wherever required and results clearly interpreted.	Minor calculation errors.	Moderate errors; basic interpretation attempted.	Major errors in calculations/graph; weak interpretation	Calculation is completely incorrect.
Viva Voce [CO3, CO4, CO5] [PO1, PO2, PO6, PO7, PO8, PO9, PO11]	Answers confidently with clear reasoning and application.	Answers most questions correctly.	| Answers basic questions with limited clarity.	Struggles to answer questions.	Unable to answer questions.

1st year Syllabus

APPLIED CHEMISTRY FOR SMART SYSTEMS (CSE)		Semester	I/II
Course Code	**1BCCAS102/202**	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)	64	Total Marks	100
Credits	4	Exam Hours	3
Examination type (SEE)	Descriptive		

Course outcome (Course Skill Set)

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

CO1: Explain the synthesis, classification, and applications of functional materials used in memory and display devices.

CO2: Apply the concepts of quantum materials and conducting polymers for various engineering and device applications.

CO3: Apply the principles of next-generation energy systems, fuel cells, and green hydrogen technologies for sustainable engineering applications.

CO4: Apply experimental skills and electrochemical principles to sensor systems and corrosion control techniques.

CO5: Explain the synthesis, properties, and applications of green and bio-based 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. Differences 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 applications.

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

Text books: 2 Reference books : 1,3 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 of Cd-Se Quantum dots by wet chemical method and its applications. Construction, working principle and applications of quantum dot sensitized solar cells (QDSSCs).

Polymer: Introduction, number average and weight average molecular weight of the polymers and numerical problems. Structure-properties relationship of polymers (Crystallinity, Strength, Elasticity and chemical resistivity]. Synthesis and properties of nylon- 6,6 and its advantages in 3D printing applications. Synthesis and properties of chlorinated polyvinyl chloride (CPVC), and polymethyl methacrylate (PMMA) and their uses in device applications.

Conducting polymers- Introduction, synthesis of polyaniline, conduction mechanism and its engineering applications.

Text books: 2,3,5 Reference books : 4,6,7 Number of Hours: 08

Module-3 Sustainable Energy Systems
Energy Systems: Introduction, basic overview of Nerns't equation, construction and working of concentration cell and numerical problems. Batteries-classification of batteries, construction, working and applications of Li-Ion battery. Next-Generation Energy Devices: Introduction, construction and working of sodium ion battery for EV applications. Construction and working of ultra-small asymmetric super capacitor and its applications in IoT/wearable devices. Sustainable Energy Devices: Introduction, fuel cells, 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 photo catalytic water splitting by TiO_2 catalyst and its advantages.
Text books: 1,2,4 Reference books: 9 Number of Hours: 08
Module-4 Sensors and Corrosion Science
Sensors: Introduction, terminologies-Transducer, Actuators and Sensors. Conductometric sensor-principle, construction and its application in the estimation of acid mixture. Colorimetric sensor-principle, instrumentation and its application in the estimation of copper in PCB. Electrochemical gas sensors- principle, construction and its application in the detection of NOx and SOx in air sample. Biosensor-principle, construction and working for the detection of glucose in biofluids. Corrosion: Introduction, electrochemical theory of corrosion, types of corrosion-differential metal and differential aeration corrosion-waterline and pitting corrosion. Corrosion control- galvanization and anodization. Vapour corrosion inhibitors for protecting computer circuit boards, corrosion penetration rate (CPR)-definition and numerical problems.
Text books: 2,4,5 Reference books: 8 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. Synthesis and properties of glycerol trioleate ester and its uses in IT infrastructure applications. Green synthesis of ZnO nanoparticles and its uses in magnetic Radio Frequency Identification (RFID) and Internet of Nano Things (IONT) system applications. Biomaterials: Introduction, synthesis and properties of polylactic Acid (PLA) and polyethylene glycol (PEG) and its uses in touch screen applications. Synthesis and properties of Alginate Hydrogel and its uses in 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, extraction of gold from e- waste by bioleaching method.
Text books: 4 Number of Hours: 08
PRACTICAL COMPONENTS OF IPCC LIST 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 total alkalinity of given water sample. 5.Determination of acid value of solder flux using KOH 6. Estimation of acid mixture using conductometric sensor (Conductometry).

7. Estimation of iron in rust sample using potentiometric sensor (Potentiometry). 8 . Determination of pKa of cooling fluids using pH sensor (Glass electrode). 9 . Estimation of copper present in e-waste using optical sensor (Colorimetry). 10. Determination of viscosity coefficient of liquid coolant sample. 11. Interpretation of pka values of a cooling fluid using origin software. 12. Chemical structure drawing using software: Chem Draw/ Chem Sketch.
Suggested Learning Resources: (Textbook/ Reference Book/ Manuals): Textbooks: **1.** Engineering Chemistry, Suba Ramesh, Vairam, Ananda Murthy, 2011, Wiley India, ISBN: 9788126519880. **2.** A Textbook of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016. **3.** Engineering Chemistry: Jain & Jain, Publisher: Dhanpat Rai Publishing Company, ISBN: 978- 935316118. **4.** Engineering Chemistry, Edited by Dr.Mahesh B and Dr.Roopashree B, Sunstar Publisher,Bengaluru, ISBN978-93-85155-70-3, 2022. **5.** "Engineering Chemistry", O. G. Palanna, Tata Mc Graw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015
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- Yotish Kumar 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. 7. Polymer Science, VR Gowariker, N V Viswanathan, Jayadev, Sreedhar, New Age Int. Publishers, 4th Edition, 2021. 8. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996. 9. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar., Subash Publications, 5th Edition, 2014.

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/0EokkhdppgE?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. Self-Learning using AI Tools
2. Activity Based Learning
3. Models and Working Models
4. Simulations and Interactive Simulations
5. Experiential Learning

6. Flipped Class Learning 7. Hybrid Learning 8. ICT Based Learning
Assessment Structure: 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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures 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. The evaluation techniques/methods are listed in the table for further understanding.

Course Assessment plan(CAP) for Theory and Practical Integrated Courses(TPICs)						
Continuous Internal Examinations (CIE)						
Assessment	Max. Marks	*Component*	Max Marks	Min. passing Marks	Evaluation details	Passing Marks
Theory	25	IA	25	10	Average of the two IA each of 25 marks	10/25
Practical	25	CIE	15		Record /Observation Book / Conduction & Evaluation	10/25
		CIE Lab IA	10		One test 50 marks & scale down to 10 Marks	
Finalization of Continuous Internal Examinations (CIE)						
Theory Marks + Lab Marks = 25 + 25 = 50 [Passing Marks (40%): 10 + 10 = 20/50]						20/50
Semester End Examinations (SEE)						
Theory	50	Theory SEE conducted for 100 marks & then reduced to 50 Marks [Passing % = (35%)]				18/50
Minimum marks for course completion (40 % in the Sum total of CIE and SEE)						40/100
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 15 marks. Rubrics for report evaluation:						

LAB DAM	LAB TEST(Conduction)	VIVA	Total
15 marks	5 marks	5 marks	25 marks
The average of all the experiments marks to be considered for CIE marks (15 marks). The laboratory test (duration 02 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 10 marks. For laboratory test, the student is required to conduct one experiment either from volumetric or from instrumental.			

Rubrics for SEE/CIE Test

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Conceptual Understanding [CO1, CO2, CO4] [PO1,PO2,PO7,PO8, PO9,PO11]	Demonstrates in-depth understanding of chemistry concepts; accurately applies principles to new situations or problems.	Shows strong conceptual understanding with minor errors in application.	Understands key ideas; applies concepts in familiar contexts only.	Limited understanding; frequent conceptual gaps.	Unable to demonstrate understanding or application.
Analytical Thinking & Problem Solving [CO2, CO3] [PO1,PO2,PO6, PO7,PO11]	Applies chemical reasoning and problem-solving effectively.	Good reasoning with mostly correct analysis; minor computational errors.	Partial reasoning with some inaccuracies .	Limited analytical effort; unclear reasoning.	No logical or analytical approach evident.
Synthesis and Application [CO1, CO3,CO5] [PO1,PO2,PO6,PO7, PO11]	Provides clear and accurate interpretation of data, mechanisms, and applications	Interprets results correctly with minor omissions.	Partial interpretation; general connection to concepts.	Misinterprets key results or mechanisms.	No interpretation or irrelevant explanation.
Construction and working mechanism [CO1-CO4] [PO1,PO2,PO6,PO7, PO8,PO9,PO11]	Integrates multiple concepts to justify solutions.	Correct application with minimal errors	Applies basic concepts; lacks integration or justification.	Limited practical application.	No meaningful application or understanding shown.

Presentation & Organization of Answers [CO1–CO5] [PO1,PO2,PO6,PO7, PO8,PO9,PO11]	Answers are well-structured, precise, with clear diagrams, equations, and logical flow.	Mostly well-structured; minor formatting or clarity issues.	Acceptable structure; missing some key steps or clarity.	Poorly structured; lacks clarity or logical sequence.	Disorganized or incomplete responses.

Rubrics for Practical Component (LAB DAM-15Marks)

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Conduction of Experiment [CO4] [PO1,PO2,PO7,PO8, PO9,PO11]	Demonstrates strong understanding, performs accurately and independently.	Performs correctly with minimal guidance.	Executes with partial understanding or frequent guidance.	Requires continuous guidance; procedural errors.	Unable to perform experiment.
Calculations/Graph/ Result Analysis [CO4] [PO1,PO2,PO7,PO8, PO9,PO11]	Accurate calculations, correct graphing, clear interpretation of results.	Minor calculation or plotting errors.	Reasonable attempt; moderate inaccuracies.	Major computational /graphical errors.	No attempt or completely inaccurate.
Laboratory Record/Report [CO4] [PO1,PO2,PO7,PO8, PO9,PO11]	Demonstrates clear Well-maintained, complete, clear observations, accurate results.	Mostly complete with minor errors or missing data.	Basic records maintained with some inaccuracies.	Incomplete or unclear presentation.	Poorly maintained or missing record.

Rubrics for LAB TEST (10Marks)

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Understanding of Experiment [CO4] [PO1,PO2,PO7,PO8, PO9,PO11]	Clearly explains aim and procedure, relevance with strong conceptual clarity.	Explains aim and procedure with minor gaps.	Basic understanding of aim and procedure.	Limited understanding; explanation unclear.	No understanding of aim or procedure.

Conduction of Experiment/ Observations & Data Collection [CO4] [PO1,PO2,PO7,PO8, PO9,PO11]	Performs experiment accurately, and observations are accurate, systematic, and properly recorded.	Performs correctly with minimal guidance and minor errors observed in data.	Performs with partial understanding and some guidance. Reasonable errors with some inconsistencies	Requires continuous guidance and incomplete or poorly recorded observations.	Unable to perform the experiment and no observations recorded.
Calculations / Graph / Result Analysis [CO4] [PO1,PO2,PO7,PO8, PO9,PO11]	All calculations accurate; graph neatly plotted wherever required and results clearly interpreted.	Minor calculation errors.	Moderate errors; basic interpretation attempted.	Major errors in calculations/graph; weak interpretation	Calculation is completely incorrect.
Viva Voce [CO4] [PO1,PO2,PO7,PO8, PO9,PO11]	Answers confidently with clear reasoning and application.	Answers most questions correctly.	| Answers basic questions with limited clarity.	Struggles to answer questions.	Unable to answer questions.

EMERGING TECHNOLOGY COURSES

INTRODUCTION TO AI AND APPLICATIONS		Semester	I/II
Course Code	**1BAIET103/203**	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 Generic LLMs, 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

AssessmentStructure:

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to this course, if the student secures 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 Internal Evaluation (CIE)

Internal Assessment Test (IAT):

TWO tests will be conducted each for 25 marks, and the average of both tests will be considered for 25 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. However, this course consists of only one activity for 25 marks
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/experiment any of the AI tools such as ChatGPT, Gemini, etc..	
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	Provides clear analysis with relevant comparisons,	Provides basic analysis with limited insight, comparisons are	Minimal analysis, comparisons are weak or incomplete.	No meaningful analysis or comparison.

	responses, comparisons highlight key strengths and weaknesses.	though slightly less detailed.	present but shallow.		
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

1st year Syllabus

COMPUTER-AIDED ENGINEERING DRAWING

COMPUTER AIDED ENGINEERING DRAWING FOR ME STREAM		Semester	I/II
Course Code	**1BDMES103/203**	CIE Marks	50
Teaching Hours/Week (L:T:P:)	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 engineering 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.
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.
Module-5
Concept of Part Design (For CIE Only): 3D Modeling: Simple machine parts / engineering components. (Applying material properties and rendering for realistic visualization) Sheet Metal & Surface Design: Automotive panels, HVAC ducting 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

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. classcentral.com/subject/sheet-metal-design?utm

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**.

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	2	15	05
Module 2	2	15	05
Module 3	2	15	05
Module 4	2	15	05
Module 5	2	15	05
Total	**10**	**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	2	15	05
Module 2	3	25	05
Module 3	2	20	05
Module 4	2	20	05
Total	**100**	**80**	**20**
Consideration of SEE Marks		**Total of (a + b) ÷ 2 = Final SEE marks**	

Rubrics for class work (Manual and computer sketching):

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Computerization **(PO1 P05 & P11) (24)/ (30)**	Completes the drawing using commands accurately with correct given parameters and conditions (21-24) / (24-30)	Completes with the Minor errors; mostly correct handling of sketching commands. (16-20) / (17-23)	Acceptable performance with some parameter or handling errors. (11-15) / (10-16)	Completes with the Multiple errors; needs frequent correction. (3-10) / (3-9)	Unable to use the drawing commands independently to complete the given problem. (0-2)/ (0-2)
Manual Sketching **(PO1 & P11) (06)/ (30)**	Completes the drawing using drawing instruments accurately with correct given parameters and conditions (6) / (24-30)	Completes with the Minor errors; mostly correct handling of sketching instruments. (5-4) / (17-23)	Acceptable performance with some parameter or handling errors. (3-2) / (10-16)	Completes with the Multiple errors; needs frequent correction. (1) / (3-9)	Unable to use the sketching instruments independently to complete the drawing using the given problem. (0)/ (0-2)

1st year Syllabus

COMPUTER AIDED ENGINEERING DRAWING FOR EEE STREAM		Semester	I/II
Course Code	**1BDEES103/203**	CIE Marks	50
Teaching Hours/Week (L: T:P:)	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 engineering 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 Visualization (For CIE Only): 3D Modelling: Optical fiber 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

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. classcentral.com/subject/sheet-metal-design?utm

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

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**.

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	0
Module 2	20	15	0
Module 3	20	15	0
Module 4	20	15	0
Module 5	20	15	0
Total	**100**	**75**	**2**
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**	

Rubrics for class work (Manual and computer sketching):

Component & CO-PO Mapping	**Outstanding (5)**	**Exceeds Expectations (4)**	**Meets Expectations (3)**	**Needs Improvement (2)**	**Unsatisfactory (1)**
Computerization **(PO1 P05 & P11) (24)/ (30)**	Completes the drawing using commands accurately with correct given parameters and conditions (21-24) / (24-30)	Completes with the Minor errors; mostly correct handling of sketching commands. (16-20) / (17-23)	Acceptable performance with some parameter or handling errors. (11-15) (10-16)	Completes with the Multiple errors; needs frequent correction. (3-10) / (3-9)	Unable to use the drawing commands independently to complete the given problem. (0-2)/ (0-2)
Manual Sketching **(PO1 & P11) (06)/ (30)**	Completes the drawing using drawing instruments accurately with correct given parameters and conditions (6) / (24-30)	Completes with the Minor errors; mostly correct handling of sketching instruments. (5-4) / (17-23)	Acceptable performance with some parameter or handling errors. (3-2) / (10-16)	Completes with the Multiple errors; needs frequent correction. (1) / (3-9)	Unable to use the sketching instruments independently to complete the drawing using the given problem. (0)/ (0-2)

1st year Syllabus

COMPUTER AIDED ENGINEERING DRAWING FOR CSE STREAM		Semester	I/II
Course Code	**1BDCES103/203**	CIE Marks	50
Teaching Hours/Week (L:T:P:)	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 engineering 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
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
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. classcentral.com/subject/sheet-metal-design?utm

1st year 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.

- 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	0
Module 2	20	15	0
Module 3	20	15	0
Module 4	20	15	0
Module 5	20	15	0
Total	**100**	**75**	**2**
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**	

Rubrics for class work (Manual and computer sketching):

Component & CO-PO Mapping	**Outstanding (5)**	**Exceeds Expectations (4)**	**Meets Expectations (3)**	**Needs Improvement (2)**	**Unsatisfactory (1)**
Computerization **(PO1 P05 & P11) (24)/ (30)**	Completes the drawing using commands accurately with correct given parameters and conditions (21-24) / (24-30)	Completes with the Minor errors; mostly correct handling of sketching commands. (16-20) / (17-23)	Acceptable performance with some parameter or handling errors. (11-15) / (10-16)	Completes with the Multiple errors; needs frequent correction. (3-10) / (3-9)	Unable to use the drawing commands independently to complete the given problem. (0-2)/ (0-2)

1st year Syllabus

Manual Sketching **(PO1 & P11) (06)/ (30)**	Completes the drawing using drawing instruments accurately with correct given parameters and conditions (6) / (24-30)	Completes with the Minor errors; mostly correct handling of sketching instruments. (5-4) / (17-23)	Acceptable performance with some parameter or handling errors. (3-2) / (10-16)	Completes with the Multiple errors; needs frequent correction. (1) / (3-9)	Unable to use the sketching instruments independently to complete the drawing using the given problem. (0)/ (0-2)

ENGINEERING SCIENCE COURSES

BUILDING SCIENCES AND MECHANICS		Semester	I/II
Course Code	**1BCVES141/241**	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 outcomes

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

CO1: Explain the fundamental concepts of building science, disciplines of civil engineering, construction materials, and structural elements of buildings.
CO2: Explain the sustainability aspects of the built environment by describing the selection of green materials and interpretation of rating systems.
CO3: Apply the principles of force systems and equilibrium to determine support reactions.
CO4: Apply the concept of centroid to determine the location of centroid of simple and composite plane areas.

Module-1

Introduction to building science:

Importance and Scope of various fields of Civil Engineering: Surveying, Structural Engineering, Geotechnical Engineering, Water Resources Engineering, Transportation Engineering, Environmental Engineering, Construction Planning and Project Management. Basic Materials of Construction: Types and Uses of Bricks, Stones, Cement, Structural Steel, Wood and Concrete.

Structural Elements of a Building: Concept of Foundation, Plinth, Lintel, Chejja, Masonry wall, Column, Beam, Slab, Flooring and Staircase.

Number of Hours:08

Module-2

Sustainable Built Environment:

Emerging materials: Types and Uses of Autoclaved Aerated Concrete (AAC) blocks, Bamboo, Recycled plastics, Material selection criteria, Durability, Sustainability, Smart City concept.

Green Building: Green building materials and rating systems IGBC, LEED, GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weightage.

Number of Hours:08

Module-3

Force Systems: Concept of idealization, System of forces, Principles of transmissibility of a force, Resolution and composition of forces, Law of Parallelogram of forces, Concurrent and non-concurrent coplanar force systems, Moment of forces, Couple, Varignon's theorem: Numerical examples.

Number of Hours:08

Module-4
Equilibrium and Support Reactions Free body diagram, equations of equilibrium, Lami's Theorem, Equilibrium of Coplanar Concurrent and Non -concurrent force systems: Numerical examples. Types of loadings, beams and supports, Concept of Statically determinate and indeterminate structures (Definitions with examples only), Support reactions: Numerical examples on Statically determinate beams. **Number of Hours:08**
Module-5 **(08 Hours)**
Centroid of Plane areas: Introduction, Locating the centroid of rectangle, triangle, circle, semicircle and quadrant of a circle using method of integration, centroid of composite areas and simple built up sections: Numerical examples.
Suggested Learning Resources: (Text Book/ Reference Book/ Manuals) Text books: 1. M.N. Shesha Prakash and Ganesh B. Mogaveer, Elements of Civil Engineering and Engineering Mechanics, 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2014. 2. Rangwala, Building Construction,33rd Edition, 2016, Charotar Publishing House Pvt. Ltd., **ISBN-10 :** 9385039040, **ISBN-13 :** 978-9385039041 3. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, 3rd Edition, 2015, Laxmi Publications, ISBN: 9789380856674. 4. Kolhapure B K, Elements of Civil Engineering and Engineering Mechanics, 11th Edition, 2018, Eastern Book Promoters Belgaum [EBPB], ISBN: 5551234003896 **Reference Books:** 1. Beer F.P. and Johnston E. R., Mechanics for Engineers: Statics and Dynamics, 4th Edition, 1987, McGraw Hill, ISBN: **9780070045842** 2. Meriam J. L. and Kraige L. G, Engineering Mechanics-Statics, Vol I–6th Edition,2008, Wiley publication. 3. Irving H. Shames, Engineering Mechanics-Statics and Dynamics, 4th Edition, 2002, Prentice-Hall of India(PHI). 4. Hibbler R. C., Engineering Mechanics: Principles of Statics and Dynamics, 2017, Pearson Press, New Delhi. 5. Timoshenko S, Young D. H., Rao J. V., Sukumar Patil, Engineering Mechanics, 5th Edition, 2017,McGraw Hill Publisher, ISBN: **9781259062667** 6. Bhavikatti S S, Engineering Mechanics, 4th Edition, 2018, New Age International Publications. 7. Reddy Vijaykumar K and Suresh Kumar K, Engineering Mechanics, 3rd Edition 2013, BS Publications.
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 class 2. Chalk and talk 3. NPTEL and other videos for theory topics 4. Partial Delivery of course by Industry expert/ industrial visits 5. ICT-Enabled Teaching

6. Individual teachers can device innovative pedagogy to improve teaching-learning

Assessment Structure: (Both CIE and SEE)

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**.

Internal Assessment Test (IAT):

TWO tests will be conducted each for 25 marks and it will be averaged to 25 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: Written Assignment-1- Theory

Learning Activity -2 Written Assignment-2- Problem Solving

Learning Activity – 1: Written Assignment-1 (Theory)

Type: Descriptive theoretical assignment based on Modules 1 & 2

Mapped COs: CO1, CO2

Marks: 10

Performance Indicator	Mapped CO / PO	Superior (5)	Good (4)	Fair (3)	Needs Improvement (2)	Unacceptable (1)
Conceptual Understanding	CO1 → PO1	Demonstrates thorough understanding of all concepts with clear, accurate, and detailed explanations.	Demonstrates good understanding with minor inaccuracies.	Shows basic understanding of key concepts; explanations lack depth.	Demonstrates partial understanding; several errors.	Inadequate or no understanding of key concepts.
Content Organization and Relevance	CO1, CO2 → PO1, PO2	Well-structured and logically presented content directly relevant to the topic.	Good organization and mostly relevant content.	Content partially organized; some irrelevant portions.	Disorganized content; lacks clarity in structure.	No logical structure; irrelevant or copied content.

Critical Thinking and Interpretation	CO2 → PO3, PO4	Analytical and evaluative responses showing original thinking.	Good analysis with minor lapses.	Some analysis; mostly descriptive.	Limited analytical effort; mostly copied or paraphrased.	No analytical effort; copied or vague.
Presentation and Clarity	CO2 → PO10	Neat, clear, well-formatted, grammatically correct; diagrams well-labeled.	Mostly neat and clear with few errors.	Average clarity and formatting.	Poorly presented with several grammatical and formatting issues.	Illegible or incomplete work.

Learning Activity – 2: Written Assignment-2 (Problem Solving)

Type: Numerical and applied problem-solving based on Modules 3–5

Mapped COs: CO3, CO4

Marks: 15

Performance Indicator	Mapped CO / PO	Superior (5)	Good (4)	Fair (3)	Needs Improvement (2)	Unacceptable (1)
Application of Principles	CO3 → PO2	Accurately applies mechanics principles to all problems with correct methodology and results.	Applies principles correctly with minor calculation or interpretation errors.	Partial application, uses formulae correctly but lacks reasoning.	Incorrect approach in multiple steps; frequent conceptual errors.	Unable to apply principles; irrelevant solutions.
Problem Solving & Analytical Skills	CO3, CO4 → PO3	Excellent analytical reasoning; solves all types of problems independently.	Good reasoning; minor lapses in logical flow.	Moderate reasoning; relies on examples.	Weak reasoning; steps incomplete or unclear.	No attempt to reason or analyze.
Accuracy of Calculation and Representation	CO4 → PO4	All calculations accurate, properly represented with correct units and symbols.	Mostly accurate with few rounding or unit errors.	Some numerical inaccuracies; incomplete unit representation.	Major errors in calculations; wrong methodology.	Incorrect or missing calculations.

Clarity of Steps and Presentation	CO4 → PO10	Step-by-step derivation shown clearly; drawings neat, labeled, and precise.	Most steps shown clearly; diagrams mostly correct.	Steps partially shown; diagrams unclear.	Disorganized steps; incomplete representation.	No clear method shown; unreadable or incomplete work.

1st year Syllabus

INTRODUCTION TO ELECTRICAL ENGINEERING		Semester	I/II
Course Code	**1BEEES142/242**	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	Produces acceptable solutions to many problems. (4)	Produces satisfactory solutions only to standard	Produces incomplete Solutions. (2)	Produces no relevant solutions. (1)

		almost all problems. (5)		problems (3)		
	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)

1st year Syllabus

INTRODUCTION TO ELECTRONICS AND COMMUNICATION ENGINEERING		Semester	I/II
Course Code	**1BECES143/243**	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; 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

1st year Syllabus

INTRODUCTION TO MECHANICAL ENGINEERING		Semester	I/II
Course Code	**1BMEES144/244**	CIE Marks	Course Code
Teaching Hours/Week (L:T:P: S)	3-0-0-0	SEE Marks	Teaching Hours/Week (L:T:P: S)
Total Hours of Pedagogy	40	Total Marks	Total Hours of Pedagogy
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:

1. Recall and explain basic principles of Mechanical Engineering to understand real-life engineering systems such as energy systems, vehicle mechanisms, flying machines, and refrigeration technologies.
2. Interpret the working principles of internal combustion engines, and future mobility technologies for environmental sustainability and relate to their performance.
3. Explain the classification, properties, and applications of engineering, composite, and smart materials with relevance to modern engineering applications
4. Outline the working principles and applications of conventional and modern manufacturing processes, including metal joining, machining, CNC, and 3D printing technologies.
5. Explain automation and mechatronic systems, outline the working of basic sensors, and illustrate the need for technology integration in intelligent systems such as ADAS.

Module-1 **8 Hours**

Introduction: Streams in mechanical engineering and their relevance/significance, role of mechanical engineers in solving 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.

Module-2 **8 Hours**

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.

Module-3 **8 Hours**

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
Module-4 **8 Hours**
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.
Module-5 **8 Hours**
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.)
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 Lecture(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://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. The CIE component consists of IA tests for 25 marks (Average of Two Tests) 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 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)

1. 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, and 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)**

1st year Syllabus

ESSENTIALS OF INFORMATION TECHNOLOGY		Semester	I/II
Course Code	**1BCBES145/245**	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 outcomes (Course Skill Set)

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

CO1: Illustrate different information representation and manipulation schemes.
CO2: Make use of Information Technology (IT) infrastructure for information exchange. CO3: Apply basic software engineering concepts for Website and application development. CO4: Develop queries for quick insert, access and updating of structured information.
CO5: Identify role of cybersecurity and ethics issues in Information Technology (IT).

Module-1

Data Storage: Bits and Their Storage, Main Memory, Mass Storage, Representing Information as Bit Patterns, The Binary System, Storing Integers, Storing Fractions.

Data Manipulation: Computer Architecture, Machine Language, Program Execution, Arithmetic/Logic Instructions, Communicating with Other Devices.

Textbook 1: Chapter-1 (1.1-1.7), Chapter-2 (2.1-2.5) **Number of Hours: 8**

Module-2

Operating Systems: The History of Operating Systems, Operating System Architecture, Coordinating the Machine's Activities, Handling Competition Among Processes, Security.

Algorithms: The Concept of an Algorithm, Algorithm Representation, Algorithm Discovery.

Textbook 1: Chapter-3, Chapter-5 (5.1-5.3) **Number of Hours: 8**

Module-3

Networking and the Internet: Network Fundamentals, The Internet, The World Wide Web, Internet Protocols, Security.
Cybersecurity: Overview—What is Cybersecurity?, Brief History of Cybersecurity Events, The Basic Information Security Model, Cyber Hygiene, Teams in Cybersecurity.
Ethical Issues in Information Technology: Overview, Ownership Rules, Ethics and Online Content.

Textbook 1: Chapter-4
Textbook 2: Chapter-16, Chapter-17 **Number of Hours: 8**

Module-4
Software Engineering: The Software Engineering Discipline, The Software Life Cycle, Software Engineering Methodologies, Modularity, Tools of the Trade. Database Systems: Database Fundamentals, The Relational Model. **Textbook 1: Chapter-7 (7.1-7.5), Chapter-9 (9.1-9.2)** **Number of Hours: 8**
Module-5
Introduction to HTML and Website Development: What is HTML?, Cascading Style Sheets (CSS), Website
Design and Storyboarding, Structure of a Website. **Computer Graphics:** The Scope of Computer Graphics, Overview of 3D Graphics, Modeling, Rendering. **Textbook 2: Chapter-12.** **Textbook 1: Chapter-10 (10.1-10.4)** **Number of Hours: 8**
Suggested Learning Resources: (Text Book/ Reference Book/ Manuals): **Textbooks:** 1. J. Glenn Brookshear and Dennis Brylow, Computer Science: An Overview, 12th Edition, Pearson Education Limited, 2017. 2. Roy, Shambhavi; Daniel, Clinton; and Agrawal, Manish, "Fundamentals of Information Technology", Digital Commons at The University of South Florida (2023). https://digitalcommons.usf.edu/dit_tb_eng/19 **Reference books / Manuals:** 1. V. Rajaraman, "Introduction to Information Technology", Third Edition, PHI Learning, 2018. 2. Pelin Aksoy, Information Technology in Theory, First Edition, Cengage.
Web links and Video Lectures (e-Resources): • Information Technology: https://onlinecourses.swayam2.ac.in/cec20_cs05/preview • Computer Organization and Architecture: https://nptel.ac.in/courses/106103068 • Introduction To Internet: https://nptel.ac.in/courses/106105084
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 objectives and promote higher-order thinking and application-based learning.

Self-study (for Learning Activity, Not for SEE):

File Management, Word Processors, Introduction to Spreadsheets, Introduction to Presentation Applications.

Refer Textbook 2: Chapter-6, Chapter-8, Chapter-9, Chapter-10.

Learning Activity -1: (Marks- 25) Practical Assignment (Individual) INSTRUCTIONS:

1. Students must demonstrate the solutions to the course instructor and submit the record containing method (steps), program (if applicable), document (if applicable) and results/output.
2. Course instructor must evaluate the student performance as per the rubrics.

Problem Description:

1. Create files of specific types, changing file properties & permissions, search files based on criteria. Creating hierarchy of folders, folder paths, changing folder properties and related operations on folders. File compressions, file backup and cloud-based file management.
2. Create word file with suitable content and performs various operations related to document Revision, Proofreading and references (As listed in the Textbook).
3. Locate the templates available for a word processing application that you have access to. Search the templates for a “Resume.” Review the “Resume” template of your choice. Identify all the word processing features used in the “Resume” template. Use the “Resume” template to create your own resume. As you fill out the template, be sure to use the application to check your spelling and grammar. Verify the print layout of your resume. Save the resume and print a copy.
4. Consider the following data: Student First Name, Student Last Name, Student Age, Student Grade, Student School, Telephone Number, Sport (Volleyball, Basketball, Softball, Baseball, Soccer, or Football). Considering the data required in the list above, create a spreadsheet in a spreadsheet application you have access to.

Add at least 10 rows of data to your spreadsheet. Once you add all the data to the spreadsheet, what is the average age for all the students? What formula did you use to calculate the average age?

5. Add a chart to the above spreadsheet that illustrates the total number of students for each sport. Which sport has the highest number of students? What formula did you use to count the total number of students for each sport?
6. Use the above spreadsheet to Analyzing and Organizing Data with suitable filters, sorting, conditional formatting and pivot tables.
7. Create a presentation (power point) using a presentation application you have access to that meets the requirements of marketing of brand-new product. Apply a theme, background, and professional layout for chosen product.
8. Create a Web page with basic HTML elements (tags). Insert lists, images, drop down lists and tables.
9. Create a Personal Website and host it on a free cloud-based Web hosting. Personal Web site should cover your complete biodata and your social activities.
10. Create a relational database model (MS Access or any other) for storing information about courses taken by students. Develop suitable queries to insert data onto tables, update fields, delete rows and query relevant information from the database model.

Rubrics for Learning Activity-1 (Practical Assignment):

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Clarity & Simplicity of procedure/ method [CO1-5] [PO9]	procedure/ method is, specific, and well-structured for the intended activity; no ambiguity is present.	procedure/ methods are clear and mostly specific; minor ambiguity is present.	procedure/ methods are somewhat clear but could be more specific; moderate ambiguity.	procedure/ methods are vague and lack clarity; high ambiguity.	procedure/ methods are unclear, incomplete, or irrelevant to the activity.
Appropriate Use of elements/ techniques and design of solution [CO2-5] [PO1, PO3]	Demonstrates precise and creative usage of the features, elements and techniques	Correctly applies the features and elements with minor gaps or missed opportunities.	Uses the features and elements, but with partial understanding or inconsistent usage.	Limited understanding of the features and elements; incorrect or weak usage.	No evidence of correct/relevant features and elements use.

Complete Solution & Comparison of Results/output for various cases. [CO2-4] [PO2, PO4, PO5]	Provides clear and correct solution/results with analysis for multiple cases; comparisons among cases highlight key strengths and weaknesses.	Provides correct solution/results with analysis for multiple cases, though slightly less detailed.	Provides correct solution/results with limited analysis; comparisons are present but shallow.	Provides correct solution/results. Minimal analysis: comparisons are weak or incomplete.	Solution/results are partially correct. No meaningful analysis or comparison.
Creativity, efficiency of Problem-Solving [CO2-4] [PO3, PO11]	Demonstrates outstanding creativity and innovation in developing solution, especially for design tasks.	Demonstrates creativity and some innovation; developed solution is practical.	Shows moderate creativity; developed solution is functional but not innovative.	Minimal creativity; developed solution is repetitive or unimaginative.	No creativity or problem-solving/adequate solution is evident.
Documentation on & Analysis [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.

PROGRAMME SPECIFIC COURSES (PSC)

ELEMENTS OF MECHANICAL ENGINEERING		Semester	I / II
Course Code	**1BMEPS152/251**	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 Outcomes

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

1. Analyse the properties of steam, various engineering materials along with their classifications and applications.
2. Illustrate the basic concepts of thermodynamics, internal combustion engines And electric/hybrid vehicles.
3. Demonstrate the working and operations of machine tools and metal joining techniques.
4. Outline the configuration, anatomy, and performance parameters of robots.
5. Apply the concepts of belt and gear drives to solve basic numerical problems related to velocity ratio in gear drives.
6. Discuss the role of computer systems in manufacturing, their contribution to automation, and the applications of 3D printing and AI in mechanical engineering.

Module-1

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 in Aerospace and Automobile industries.

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

Nano materials: Introduction, Types of nano materials, Advantages, Disadvantages and Applications.

Number of Hours: 8

Module-2

Concepts of Thermodynamics: Work, Energy, Heat, Modes of Heat transfer: Conduction, Convection and Radiation. Steam: Formation of steam, Properties of Steam, Numericals related to the properties of steam. Introduction to Heat engines and Heat pumps.

Introduction to Internal Combustion engines: Working principle of Two stroke and Four stroke engines (SI & CI Engines), No Numericals.

Electric vehicles and Hybrid vehicles: Working principles, Electric and Hybrid vehicle components, Brief introduction to energy storage in Electric vehicles.

Number of Hours: 8

Module-3
Machine Tools: Lathe: Working principle, Specifications, Operations performed – Turning, Facing, Taper turning by swivelling the compound rest, Thread cutting and Knurling. Drilling Machine: Working principle, Specifications, Operations performed – Drilling, Reaming, Boring, Counterboring, Countersinking, Tapping. Milling machine: Working principle, Specifications, Operations performed – Plane milling, End milling, Slot milling, Angular milling. (Sketches of machine tools not required. Sketches to be used only for explaining the operations). Joining Processes: Introduction, Temporary and Permanent joining methods: Working principle of Soldering, Brazing and Electric Arc welding, Advantages, Limitations and Applications. **Number of Hours: 8**
Module-4
Belt drives: Introduction, Open and Cross belt drives. (No derivations and numericals), Flat belts and V belts. **Gear Drives:** Types of Gears, Velocity ratio, Gear Trains - Simple and Compound gear trains and Numericals. **Robotics:** Introduction, Generation of Robots, Asimov's laws of Robots, Robot anatomy - Links and Joints, Types of Robots, Configurations of Robots, Robot motion - Degrees of Freedom, Robot sensors: Tactile, Force, Proximity and Vision sensors, Definition of Work volume, Accuracy, Precision, Repeatability and Payload. **Number of Hours: 8**
Module-5
Computer Numerical Control (CNC): Introduction, Definition of NC and CNC Components of CNC. Definition of CAD, CAM, CAE and CIM. Automation: Definition, Types of Automation, Reasons for Automation. Additive manufacturing: Introduction, Basic principles (Steps in additive manufacturing), Additive manufacturing processes – Photopolymerization technique, Material extrusion technique and Powder based fusion technique, Automotive and Aerospace applications. Applications of AI in Mechanical Engineering: Automobile industry, manufacturing industry and Mechanical design. **Number of Hours: 8**
Suggested Learning Resources: (Textbook/ Reference Book/ Manuals): **Textbooks:** 1. K R Gopala Krishna, Elements of Mechanical Engineering, Subhash Publications, 2018. 2. S K Hajra Choudhury and Nirjhar Roy, Elements of Workshop Technology (Vol. I and II), Media Promoters and Publishers Pvt. Ltd., 2016. 3. Ganeshan. V, Internal Combustion Engines, Tata McGraw Hill, 4th Edition, 2012. 4. Rajput R.K, Thermal Engineering, Laxmi Publications (Pvt) Ltd., New Delhi. 6th Edition, 2007. 5. Mikell P. Grover, Automation Production Systems and Computer Integrated Manufacturing, PHI, 2004. 6. Husain Iqbal, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 3rd Edition, 2021.

7. Ian Gibson, David. W. Rosen, Brent Stucker, Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Springer, 2nd Edition, 2014.
8. Mikell P. Groover and Emory W. Zimmers, CAD/CAM. Zimmer & Groover CAD/CAM, 2007.

Reference books / Manuals:

1. Serope Kalpakjian and Steven R Schmid, Manufacturing Engineering and Technology, Fourth Edition, Pearson Education, Asia, 2000.
2. Radha Krishna & S. Subramanian, CAD/CAM/CIM, New Age International Publishers, 2009
3. F.L.Matthews and R.D.Rawlings, Composite materials: Engineering and Science, Woodhead Publishing Ltd. & CRC Press, 2003.
4. Mikell P.Groover and Mitchel Weiss and Roger N.Nagel Nicholas G.Odrey, Industrial Robotics technology, programming and applications, Tata McGraw Hill Edition, 2008.

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://venturebeat.com/ai/how-ai-is-impacting-the-automotive-world/
- https://www.vlcsolutions.com/blog/artificial-intelligence-in-manufacturing/
- https://skill-lync.com/blogs/technical-blogs/design-applications-of-machine-learning-and-ai-in-mechanical-engineering
- https://caeassistant.com/blog/ai-in-mechanical-engineering-video/
- https://www.neuralconcept.com/post/how-is-ai-used-in-mechanical-engineering
- https://www.youtube.com/watch?v=MKiiXubKaGM
- https://www.youtube.com/watch?v=_canCYWZPsc
- https://www.youtube.com/watch?v=lQ-MYnyxh7M

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. The CIE component consists of IA tests for 25 marks (Average of Two Tests) 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 for a total of 25 marks. It is evaluated through the learning activities which are 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: Case Study Presentation (Marks: 15 Marks)
Learning Activity - 2: Material Selection and Justification for a chosen Real-world Engineering Product (Marks: 10 Marks)

Rubrics for Learning Activity 1:

Case Study Presentation (15 Marks)

(To be conducted for 30 marks and the marks obtained shall be reduced to 15)

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	Documentation is complete, accurate, well-structured,	Documentation is mostly complete and accurate, well-organized,	Documentation covers most required elements but has some inaccuracies or	Documentation is incomplete with noticeable inaccuracies. Poor	Documentation is largely missing or irrelevant, lacks

Skills (10 Marks) (PO 9)	follows all formatting guidelines. Well-structured, clear, confident delivery; excellent visuals.**(9-10)**	follows formatting guidelines with minor deviations. Good structure, clear delivery; visuals mostly effective.**(7-8)**	omissions. Average structure; delivery clear but lacks engagement. **(5-6)**	organization; visuals unclear. **(3-4)**	structure. Unclear, disorganized presentation. **(0-2)**
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)**

Rubrics for Learning Activity 2:

Material Selection and Justification for a chosen Real-world Engineering Product (10 Marks)

(To be conducted for 20 marks and the marks obtained shall be reduced to 10)

Students will select one real-world engineering product (e.g., aircraft wing, car chassis, biomedical implant, wind turbine blade, Tennis racket etc.) and they will justify the choice of materials (Ferrous/Non-ferrous, Composite, Smart, Nano) based on properties, advantages, disadvantages, and application suitability, etc.,

Performance Indicators	Excellent	Good	Satisfactory	Needs Improvement	Poor
Material Selection & Relevance (10 Marks) (PO 1)	Chosen materials perfectly match the product requirements; strong justification using properties & industry relevance. **(9-10)**	Mostly relevant materials with good justification. **(7-8)**	Materials somewhat match requirements; justification partial. **(5-6)**	Poor material-product match; weak reasoning. **(3-4)**	Irrelevant material choice; no justification . **(0-2)**
Technical Content Accuracy (5 Marks) (PO 2)	All properties, types, advantages / disadvantages, and applications are correct and well- explained.**(5)**	Mostly accurate with minor errors. **(4)**	Adequate content; a few gaps or inaccuracies. **(3)**	Several inaccuracies; missing key aspects.**(2)**	Mostly incorrect or missing technical details.**(0-1)**

Organization & Presentation (5 Marks) (PO 10)	Well-structured, clear flow, good visuals/tables, and concise explanation. **(5)**	Clear structure; minor improvements needed. **(4)**	Acceptable structure but some clutter. **(3)**	Poor organizatio n; difficult to follow. **(2)**	Disorganize d; lacks clarity. **(0-1)**

1st year Syllabus

FUNDAMENTALS OF ELECTRONICS AND COMMUNICATION ENGINEERING		Semester	I
Course Code	**1BECPS151/252**	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.
6. 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 simulations concepts accurately with minor gaps in detail (8)	Shows basic understanding of simulation concepts but lacks depth or has some inaccurates (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/equation 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 errors calculations/simulation errors: answers often imprecise or incomplete (4)	Calclulations/ Simulations mostly incorrect answers missing or irrelevant (2)

Rubrics for Mini-Project

	Superior	Good	Fair	Needs improvement	Unacceptable
Student has well defined problem statement and a good technical report – 5 marks	Problem statement and mini-project report are clear, specific, and well justifies 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 requirements – 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 short comings (4)	Design does not requirements or is non - functional

Hardware circuit set up and demonstration is as per requirements - 10 marks	Hardware set up is correct, neat and demonstration fully meets requirements (10)	Set up 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)	Set up 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 Platform

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

1st year Syllabus

PROGRAMMING IN C		Semester	I/II
Course Code	**1BCSPS153/253**	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)

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	**8 Hours**
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	
Module-2	**8 Hours**
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	
Module-3	**8 Hours**
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	
Module-4	**8 Hours**
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	

Module-5	8 Hours
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 size of to Ensure Portability, typedef. Textbook 1: Chapter 7	

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

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.e-learning.vtu.ac.in/e-content/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
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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. Course 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 (Creating Effective Prompts):

Component & CO–PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Clarity & Simplicity of algorithm/program [CO1][PO9]	Well-structured Programs 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	Provides clear and correct	Provides correct	Provides correct results	Provides correct results.	Results are partially

& Comparison of Results for various cases [CO2, CO3][PO2, PO4, PO5]	results with analysis for multiple cases; comparisons among cases highlight key strengths and weaknesses.	results with analysis for multiple cases, though slightly less detailed.	with limited analysis; comparisons are present but shallow.	Minimal analysis; comparisons are weak or incomplete.	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 improvement 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.

PROGRAMME SPECIFIC COURSES LAB (PSCL)

FUNDAMENTALS OF ELECTRONICS AND COMMUNICATION ENGINEERING LAB		Semester	1/II
Course Code	**1BMEPB171/272**	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.
    1. 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.
    2. 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

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)

1st year Syllabus

ELEMENTS OF MECHANICAL ENGINEERING LAB		Semester	I / II
Course Code	**1BECPB172/272**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	24 Hours (12-week session)	Total Marks	100
Credits	1	Exam Hours	03
Examination type (SEE)	**Practical**		

Course Outcomes

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

1. Perform various operations using lathe and welding machine.
2. Calibrate various measuring devices to achieve accuracy of measurement.
3. Demonstrate angular measurement of a given specimen using appropriate device.
4. Determine the properties and characteristics of fuels and oils.
5. Determine the hardness of materials using hardness testing machine.

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.
   c. 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

1. Performing facing, plain turning and step turning operations by using a lathe.
2. Performing facing, plain turning and knurling operations by using a lathe.
3. Preparation of welded joints using the arc welding process.
4. Calibration of vernier caliper and micrometer using slip gauges.
5. Determination of the angle of a specimen using a sine bar.
6. Determination of the hardness of materials using hardness testing machine.

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. Comparative study of flash point and fire point of various fuels / oils using the open cup method
2. Comparative study of flash point and fire point of various fuels / oils using the closed cup method
3. Comparative study on viscosity of different base fuels.
4. Investigation of the effect of additives on the viscosity of base fuels.
5. Selection and justification of appropriate joining techniques for given applications
6. Fabrication of a sheet metal part with simple geometry and soldering.

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

Textbooks:

1. Amitabh Ghosh and Amit Kumar Mallik, Manufacturing Science, Affiliated East West Press (p) Ltd, New Delhi, 2002
2. Hajara and Choudhary, Workshop Technology Vol. I (2008) & II (2010), Median Promoters & publishers, Bombay.
3. Khanna O. P, Workshop Practice, Vol. I, Dhanpat Rai & Co., 2000.
4. Engineering Metrology, R.K. Jain, Khanna Publishers, Delhi, 2009.

Reference books / Manuals:

1. Serope Kalpakjian and Steven R Schmid, Manufacturing Engineering and Technology, Fourth Edition, Pearson Education, Asia, 2000.
2. P.N. Rao, Manufacturing technology--Foundry, Forming and Welding, Tata McGraw Hill Education, 2001.
3. I.C. Gupta, Engineering Metrology, Dhanpat Rai Publications, New Delhi, 2018.
4. Ganeshan. V, Internal Combustion Engines, Tata McGraw Hill, 4th Edition, 2012.

Web links and Video Lectures (e-Resources):

- https://openoregon.pressbooks.pub/manufacturingprocesses45/chapter/chapter-unit-1-the- engine-lathe/
- https://www.millerwelds.com/resources/article-library/the-fundamentals-of-welding- process-equipment-and-applications
- https://www.youtube.com/watch?v=sbbwJ5p6irc
- https://www.youtube.com/watch?v=TlhGTSDfQxc

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
- Video demonstration

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.

Rubrics for CIE – Continuous Assessment: 30 marks					
Performance Indicators	**Excellent**	**Good**	**Satisfactory**	**Needs Improvement**	**Poor**
Technical Skills & Procedure (PO1 & PO5) (10)	Performs operations flawlessly, correct sequence, excellent tool use. (9-10)	Minor errors, generally correct sequence and tool use. (7-8)	Performs task with some errors; needs occasional help. (5-6)	Many errors, requires frequent guidance. (3-4)	Cannot perform task without continuous supervision. (0-2)
Safety Compliance (PO6) (5)	Strictly follows all safety protocols, proper PPE usage at all times. **(5)**	Follows safety rules, occasional minor lapses. **(4)**	Mostly safe, some reminders needed. **(3)**	Frequent safety violations. **(2)**	Unsafe behavior, ignores safety rules. **(0-1)**

Interaction with the Group (PO8) (5)	Naturally leads, encourages, and includes all group members. Facilitates communication and ensures tasks are distributed fairly. Respects all opinions. (**5**)	Cooperates well with group members. Communicates clearly, shares the workload, and is a reliable and positive team member. **(4)**	Works alongside others but with limited communication or collaboration. Tends to work in isolation or contributes unevenly to the group effort. **(3)**	Fails to cooperate with the group. Is dismissive of others' ideas or causes friction and disagreement within the team. **(2)**	Refuses to work with the group or actively disrupts the group's ability to complete the experiment. **(1)**
Lab Report (PO9) (10)	Report is exceptionally well- organized, detailed, and insightful. All data and analysis are accurate. Submitted on time. **(9-10)**	Report is complete, well-organized, and accurate. All required sections are present and data is correctly reported. Submitted on time. **(7-8)**	Report has minor errors in data or analysis, or is missing some minor components. Organization could be clearer. **(5-6)**	Report is incomplete, contains significant errors, is poorly organized, or is submitted late without a valid reason. **(3-4)**	Fails to submit a report, or the submitted work is of completely unacceptable quality and lacks critical information. **(0-2)**

Rubrics for SEE / CIE Test: (CIE test -To be conducted for 100 marks and the marks obtained shall be reduced to 20) (SEE-To be conducted for 100 marks)					
Performance Indicators	**Excellent**	**Good**	**Satisfactory**	**Needs Improvement**	**Poor**
Execution (PO3 & PO5) (8)/ (40)	Executes operations accurately with correct parameters; smooth, safe	Minor execution errors; mostly correct handling of	Acceptable performance with some parameter or handling errors.	Multiple execution errors; needs frequent correction. **(2) /**	Unable to perform operation independently. **(0-1)/ (0-8)**

	handling of equipment. **(7-8) / (33-40)**	tools/ machines. **(5-6) / (25-32)**	**(3-4) / (17-24)**	**(9-16)**	
Result and Discussion (PO4) (7)/ (40)	Presents accurate results; clearly compares with standards; insightful discussion of deviations and causes. **(7-8) / (33-40)**	Accurate results; some useful discussion. **5-6) / (25-32)**	Results mostly correct; discussion basic. **(3-4) / (17-24)**	Results incomplete or partially wrong; weak discussion. **(2) / (9-16)**	Presents accurate results; clearly compares with standards; insightful discussion of deviations and causes. **(0-1)/ (0-8)**
Viva Voce (PO9) (5)/ (20)	Answers all questions confidently, showing deep conceptual and practical understanding. **(5) / (17-20)**	Answers most correctly; minor conceptual gaps. **(4) / (13-16)**	Answers some but lacks depth. **(3)/ (9-12)**	Gives vague or incomplete answers. **(2) / (5-8)**	Unable to answer. **(1) / (0-4)**

- 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**.

1st year Syllabus

C PROGRAMMING LAB		Semester	I/II
Course Code	**1BPBC173/273**	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	03
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.
    1. 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.
    2. 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	Student is capable of implementing the design with best suitable language structure and should be capable of	Student is capable of implementing the design with proper explanation.	Student is capable of implementing the design.	Student is capable of implementi ng the design with errors.

	solution/optimal efficiency.	explaining it.			
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 Communicatio n but with precise and correct terminologies/ answers.	Average Communicatio n but with imprecise and incorrect terminologies/ answers	Poor Communicatio n n (Minimal interaction/ answers)

PROJECT BASED LEARNING

INNOVATION & DESIGN THINKING LAB		Semester	1
Course Code:	**1BSHSL108**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	2	Total Marks	100
Credits	1	Exam Hours	03
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 & Mid Mapping	10	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	Teamwork, Journal, and Engagement	5	Peer and mentor evaluation of participation, teamwo journal updates.
7	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, stakehold 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).

1st year Syllabus

INTERDISCIPLINARY PROJECT WORK		Semester	1/2
Course Code	**1BSHPJ208**	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	3
Examination type (SEE)	Presentation/Practical/MCQ		

Course Outcome (Course Skill Set) - On successful completion, students will be able to:

1. Identify and define problems requiring interdisciplinary knowledge.
2. Apply basic concepts of science, engineering, and technology to design simple solutions.
3. Work effectively in teams with defined roles and responsibilities.
4. Use project management, documentation, and presentation skills.
5. Develop socially relevant, sustainable, and innovative prototypes/solutions.

Week - 1, 2 & 3: Introduction, Orientation, Team Formation and Literature Survey

Week -1&2: Introduction to project-based learning & interdisciplinarity. Motivational talk / case studies of successful student projects. Ice-breaking and team-building activities. Formation of groups (4–6 students). Selection of broad theme areas. Brainstorming techniques {mind mapping, 5W1H (what, who, when, where, why, and how) SCAMPER}. Identifying problems. Discuss feasibility & Interdisciplinarity. Mentor approval of project problem.

Week-3: How to search for prior work (journals, patents, research project, case studies). Understanding user needs. Role of each engineering branch in solving the problem.

Deliverables - Team list + chosen theme area and Literature survey report.

Week- 4, 5 and 6: Problem Statement, Multiple Solution Ideas and Selection of Best IDEA

Week-4&5: Refining the problem statement. Identifying constraints and scope. Framing objectives & expected outcomes. Generating multiple solution ideas. Discussing feasibility (technical, economic, social). Team roles assigned (design, research, coding, documentation, testing).

Week-6: Criteria-based selection of best idea (decision matrix). Rough sketches, block diagrams, flowcharts. Resource planning (materials, software, tools).

Deliverables - Finalized Problem definition with objectives, List of solution concepts (sketches/flowcharts) and Design document (diagrams, flow)

Week -7, 8 and 9: Selection of Best IDEA and Prototyping

Week-7: Work breakdown structure (task division). Timeline for development. Safety & ethical considerations.

Week-8&9: Development of subsystems/modules, Application of classroom knowledge (electrical circuits, coding, mechanics, CAD, etc.), Peer & mentor review sessions.

Deliverables - Prototype development plan, Subsystem demos (partial working models).

Week 9, 10,11&12: Prototyping stage 2 using Atal Idea Lab/Makers Space
Week-9&10: Integration of subsystems. Debugging & troubleshooting. Improvement based on test results. **Week-11&12:** Testing against objectives & user requirements. Experimentation results **(tables,** graphs). Analysing failures/limitations.
Deliverables – Prototype/working model, Testing Results, Limitations/challenges
Week 13 & 14: Refinement & Pre-Final Review
Week-13&14: Refining prototype for efficiency, cost, sustainability. Internal review & peer feedback. Preparing visuals for final presentation (posters, PPT, demo video).
Deliverables – Final Results of Experimentation or Testing & Working/ Prototype Model
Week 15 &16: Final Demo and Social Pitch
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 Interdisciplinary Project Work
CIE Parameters (50 Marks)

Stage/Activity	Weightage (%)	Marks (out of 50)	Description
Weeks 1–4: Problem Identification & Literature Survey	10%	05 marks	Focus on forming teams, identifying problems, understanding user needs, and reviewing prior work through journals, patents, etc.

Weeks 5–7: Concept Development & Design	20%	10 marks	Defining problem statements, framing objectives, generating ideas, preparing diagrams, flowcharts, and resource planning.
Weeks 8–11: Prototype Development	30%	15 marks	Creating subsystems, applying theoretical knowledge, peer and mentor review sessions, debugging, and troubleshooting.
Week 12: Testing & Validation	10%	5 marks	Evaluating the prototype's performance, user requirements, experiments, and analysis of failures.
Weeks 13–14: Documentation & Presentation	30%	15 marks	Finalizing the prototype, improving based on feedback, preparing presentations, reports, and demonstration materials.

*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"

Component	Weightage (%)	Marks (out of 100)	Description
Final Presentation & Demonstration	30%	30	Clear articulation of the problem, solution approach, prototype, and team contribution. Delivery, engagement, and response to questions are evaluated.
Prototype Quality & Functionality	30%	30	Working model evaluation, application of engineering principles, problem-solving effectiveness, debugging, and system integration.
Documentation Report	20%	20	Completeness, structure, accuracy, clarity i diagrams, data analysis, testing results, and conclusions.
Social Impact & Sustainability	05%	05	Relevance to society, cost-effectiveness, ethical considerations, environmental impact, and scalability.

Innovation & Originality	10%	10	Creativity, uniqueness, feasibility, and application of interdisciplinary concepts.
Viva – voce	05%	05	Viva – voce

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).

1st year Syllabus

HUMANITIES COURSES

COMMUNICATION SKILLS		Semester	I / II
Course Code	**1BSHAE106/206**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	15 hours (Theory) +15 hours (Lab/Asynchronous sessions)	Total Marks	100
Credits	01	Exam Hours	2
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:

1. Oxford Advance Learners Dictionary
2. Cambridge English Skills Real Listening and Speaking by Miles Craven Communicative English for Professionals by Nitin Bhatnagar and MamtaBhatnagar

Other Digital Resources

1. Google Docs + Voice Typing - https://docs.google.com
2. LearnEnglish – https://learnenglish.britishcouncil.org/
3. TakeIELTS - https://www.britishcouncil.in/exam/ielts
4. British Council Apps - **bbc Learn English online Grammar**
   Learn English Podcasts
   IELTS Word Power
   Bbc learning English
   Grammer Online
   Sounds Right (Phonemic Chart)

1st year Syllabus

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. The 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	**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	**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

	professional development Entrepreneurship and start-ups in engineering The future of work in the tech- driven world	familiar topics which are clearly delivered in simple language, and with illustrative images.	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.

1st year Syllabus

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes*										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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
Indirect assessment Methods	**C I E**	Internal Assessment test	Students	Two Tests (Average of the two will be computed)	25	Blue books/Answer Scripts	1 to 5
Direct Assessment		Creative writing	Students	Assignment-1 (10) Assignment-2 (15)	15+10 = 25	Quiz Projects Presentations Assignment Questions and Answers	1 to 5
		Case Analysis	Students	-----	-----	-----	------
		Surprise Quiz		------	------	----	----
				End of course			

	S E E	Standard examination Students Feedback	Students	(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:

S.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

Rubric for Presentation

Criteria	Excellent (2)	Good (1)	Needs Work (0)
Self-awareness	Demonstrates strong confidence, composure, and awareness of self and audience throughout the presentation.	Shows reasonable confidence and self-awareness with minor hesitation or inconsistency.	Appears unprepared or unaware; lacks confidence and audience connection.

Goal clarity	Purpose and objectives are clearly defined and consistently maintained; content aligns fully with goals.	Goals are mentioned but not consistently reflected in content or conclusion.	Lacks clear goals or focus; presentation seems disjointed or unfocused.
Communication & delivery	Communication & delivery Communicates fluently with clear articulation, proper tone, and effective non-verbal cues.	Communicates adequately but with minor lapses in clarity, tone, or expression.	Speech unclear, disorganized, or monotone; poor audience engagement.
Insight into opportunities	Demonstrates depth of understanding with insightful and relevant observations or applications.	Shows some understanding with limited depth or supporting examples.	Provides minimal or no relevant insight; lacks analytical depth.
Realistic challenges	Identifies realistic challenges and presents logical, practical, and evidence-based solutions.	Mentions a few challenges with general or partial explanations	Fails to identify or address relevant challenges effectively.

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	

COMMUNICATION SKILLS		**Semester**	**I / II**
Course Code	**1BSHAE106**	SEE Marks	50
Exam Hours	**2**	**Credits**	**1**

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.**	**C01-5**	**LO1**	**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 ANY FIVE questions selecting ONE full 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	LO2	(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	LO2	(6)

1st year Syllabus

UNIT – II					
3.		**Use the following idioms with their figurative meanings and construct workplace place -related sentences:** 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	CO2	LO3	(6)
4.		What role does body language play in a GD, and how would you ensure your non-verbal cues support your discussion?	CO2	LO2	(6)
5.		**Change the following conversation to a narrative/reported form in a paragraph.**	CO3	LO3	(6)
	Neha: The unemployment rate is worrying, especially for fresh graduates. **Ravi:** Yes, even with degrees, many are struggling to find relevant jobs. **Anjali**: Companies are cutting down on hiring due to automation and cost-saving. **Neha:** And they expect experience, but don't want to train freshers. **Ravi:** That's why many end up doing internships or freelance work just to stay updated. **Anjali:** We seriously need stronger industry-academia collaboration to bridge this gap.				
6		Write an argumentative essay for or against the proposition on the following topic: **Is online learning as effective as traditional in-person education, and should it be adopted more widely in schools?**	CO3	LO3	(6)
UNIT – IV					
What are netiquettes? Explain the acceptable online roles and behaviours while using social media, webinars, or forums for academic or professional purposes.			CO4		LO2
How do AI-based grammar tools and plagiarism checkers support academic writing? Discuss their problems and opportunities in handling digital resources.			CO4		LO2

UNIT – V			
Fill-in-the-blank questions (1 mark each) and rewrite the correct sentences based on Conditional Clauses & Modal Verbs: If the project _____(finish) on time, the company will gain the client's trust. If I _____(be) the manager, I would introduce flexible work hours. If the engineers had checked the wiring, the system _____(not fail). Students _____wear their ID cards while entering the lab. We _____complete the task tomorrow if everyone contributes. You _____verify the data before submitting the report.	CO5	LO2	(6)
Apply for the post of mobile application developer in any company of your choice along with a suitable resume. Assume the necessary information.	CO5	LO3	(6)

1st year Syllabus

INDIAN CONSTITUTION AND ENGINEERING ETHICS			
Course: AEC (NCMC) **Code**	**1BSHAE107/207**	**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**	**1**

Course objectives: This course will enable the students

1. Recall the basic structure of Indian Constitution.
2. List the salient features of constitution, their Fundamental Rights and preamble.
3. Tell about DPSPs, fundamental duties, Union executive- President, Prime Minister and Council of Ministers.
4. Recall the Parliamentary system & Judicial system of India.
5. List the state executive, Electoral process in India. Remember 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.

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. Senthil kumar, Prentice –Hall, 2004.

Course outcome (Course Skill Set): At the end of the course the student will be able to :	
CO1	Recall 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.

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.
5. K B: published by Merugu Publication, Second Edition, Bengaluru

ASSESMENT:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and Continuous Comprehensive Assessments (CCA): with each carrying 50% weightage.

Assessment	Marks	Method	Eligibility
CIE-1	25 Marks	25 objective Questions (MCQ)	a student must score at least **40% of 50 marks**, i.e., **20 marks**.
CIE-2	25 Marks	25 objective Questions (MCQ)	
CCA-1	25 Marks	Learning Activity -1: Written Assignment	a student must score at least **40% of 25 marks**, i.e., **10 marks**.
CCA-2	25 Marks (13+12)	Learning Activity -2: Written Quiz	a student must score at least **40% of 25 marks**, i.e., **10 marks**.
Total	**100 Marks**	**MCQ+ Written Assignment**	**Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and CCA is at least 40 out of 100 marks. , i.e., 40 marks.**

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

Rubrics for Evaluation (25 Marks)

Component & CO–PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Understanding of Concepts (CO1, CO2 – PO1, PO2)	Deep and comprehensive understanding; integrates multiple perspectives.	Strong understanding with minor factual gaps.	General understanding with some inaccuracies.	Limited understanding; key concepts missing.	Lacks conceptual understanding.
Critical Thinking & Analysis (CO3, CO4 – PO2, PO4)	Insightful analysis; connects principles to real contexts.	Good analysis with relevant examples.	Basic analysis, partially relevant examples.	Superficial analysis, weak connections.	No evidence of analysis.
Clarity, Organization & Structure (CO1 – PO8)	Exceptionally clear structure and flow.	Clear and well-organized with minor lapses.	Adequate organization; some incoherence.	Poorly structured; ideas not connected.	Disorganized and confusing.
Ethical Reflection & Relevance (CO5 – PO6, PO7)	Strong ethical reasoning; shows social responsibility.	Ethical implications discussed well.	Basic ethical awareness.	Minimal mention of ethics.	No ethical reflection.
Documentation & Presentation (PO9, PO10, PO11)	Neat, formatted, well-cited; no errors.	Mostly neat; minor errors.	Acceptable presentation; minor lapses.	Poor formatting or missing references.	Incomplete or unacceptable submission.

1st year Syllabus

SOFT SKILLS		Semester	I/II
Course Code	**1BSHNC106/206**	CIE Marks	100
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	-
Total Hours of Pedagogy	15	Total Marks	100
Credits	PP	Exam Hours	-

Course outcome (Course Skill Set)

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

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-1 **3 Hours**

Social Skills

- 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.

Module-2 **3 Hours**

Emotional Skills I

- 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.

Module-3 **3 Hours**

Emotional Skills II

- 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).

Module-4	**3 Hours**
Professional Skills I • Problem Solving: Identifying root causes, analyzing 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.	
Module-5	**3 Hours**
Professional Skills II • 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.	
Suggested Learning Resources: (Textbooks/ Learning Resources): **Extra Reading** 1. Principles of Scientific and Technical Writing, 1e, By Pratap K. J. Mohapatra, Sanjib Moulick, © 2025 | Published: December 23, 2024 2. 2. 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:** 1. Oxford Advance Learners Dictionary 2. Cambridge English Skills Real Listening and Speaking by Miles Craven 3. Communicative English for Professionals by Nitin Bhatnagar and Mamta Bhatnagar	
Web links and Video Lectures (e-Resources): 1. Google Docs + Voice Typing - https://docs.google.com 2. Learn English – https://learnenglish.britishcouncil.org/ 3. Take IELTS - https://www.britishcouncil.in/exam/ielts 4. British Council Apps – **BBC Learn English online Grammar** **Learn English Podcasts** **IELTS Word Power** **BBC learning English grammar online** **Sounds Right (Phonemic Chart)**	
Teaching-Learning Process (Experiential Learning Methods): TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach. 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 behaviors in context
- Peer discussions to gain diverse perspectives.

Assessment Structure:

- **Formative:** Role-plays, activities, group discussions, peer feedback.
- **Summative:** Presentations, written reflections, problem solving exercises.

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 ambitious 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

Rubrics for Assessment:

CO's rubric is scaled out of 20 marks for each module (10 marks Formative + 10 marks Summative)

CO 1- Role-Play & Oral Presentation (10 marks)

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)	Marks
Clarity & Articulation	Speaks fluently, precise pronunciation	Minor lapses	Frequent lapses	Hesitant, unclear	3
Persuasion & Engagement	Strong persuasive appeal, engages fully	Reasonable persuasion	Weak persuasion	No strategy	3
Non-Verbal Communication & Active Listening	Confident posture, accurately paraphrases	Mostly confident	Minimal use	Poor body language, Ignores cues	4

CO2 – Stress Management & Reflection Journal (10 marks)

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)	Marks
Understanding of EI Concepts	Deep insight + examples	Good understanding	Basic understanding	Misunderstands	4
Application in Activity	Fully applies techniques	Mostly effective	Few techniques	No application	3
Reflection Quality / Structure & Clarity	Highly personal/ Well-organized	Mostly clear	Some disorganization	No reflection, poorly structured	3

CO3 – Goal-Setting & Creativity Project (10 marks)

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)	Marks
SMART Goal Setting	All SMART criteria, inspiring	Most criteria	Some criteria	Vague	4
Creativity & Originality	Highly original	Some originality	Limited	None	3
Presentation & Relevance	Engaging, clear, relevant	Clear visuals, Mostly Practical	Basic visuals & partially relevant	no visuals, Irrelevant	3

CO4 – Problem-Solving Exercise (10 marks)

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)	Marks
Problem Analysis	Identifies all root causes	Most causes	Few causes	No clear causes	3
Application of Tools	Fully accurate	Mostly accurate	Partial	Incorrect	3
Solution Quality / Structure & Clarity	Highly logical, Clear flow	Mostly clear	Some unclear parts	Illogical, Disorganized	4

CO5 – Debate/Negotiation Simulation (10 marks)

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)	Marks
Team Collaboration	Fully cooperative	Mostly cooperative	Limited	Uncooperative	3
Argument Quality	Strong evidence-based reasoning	Mostly sound	Weak reasoning	No reasoning	3
Conflict Resolution/ Critical Thinking	Balanced, anticipates counterpoints	Mostly balanced, Thoughtful	Minimal attempt, Limited depth	Aggressive/avoidant ,	4

1st year Syllabus

SAMSKRATIKA KANNADA			
Course: AEC (HSMS) **Code**	**1BSHHM291/292**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	01Hours/Week	Total Marks	100
Credits	01	Exam Hours	1

Course objectives: This course will enable the students	
1	describe the necessity of learning of local language for comfortable life.
2	recall and read , write Kannada language as per requirement.
3	reproduce the communication (conversations) in Kannada language in their daily life with kannada speakers.
4	describe and understand the Kannada language properly.
5	Choose politeness in Kannada conservation.

Course objectives: ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

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.

(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 ಪ್ರೋ. 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. ತತ್ತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು ಶಿಶುನಾಳ ಶರೀಫ
ಘಟಕ -3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ (03 hours of pedagogy)
1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಅಯ್ದ 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

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ (**1BSHHM191 /**) ಪಠ್ಯ ಕಲಿಕೆಯ ನಂತರ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ :

- ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಕುರಿತು ಅರಿವು ಮೂಡಿರುತ್ತದೆ.
- ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಕಲಿತು ಹೆಚ್ಚಿನ ಓದಿಗೆ ಮತ್ತು ಜ್ಞಾನಕ್ಕೆ ಸ್ಫೂರ್ತಿ ಮೂಡುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಹೆಚ್ಚಾಗುತ್ತದೆ.
- ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ತಿಳಿದುಕೊಂಡು ನಾಡಿನ ಇನ್ನಿತರ ವ್ಯಕ್ತಿಗಳ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳಲು ಕೌತುಕತೆ ಹೆಚ್ಚಾಗುತ್ತದೆ.
- ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

University Prescribed Textbook:

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ : ಡಾ.ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ,
ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

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,

Assessment Structure:

Assessment	Marks	Method	Evaluation
CIE-1	25 Marks	25 objective Questions (MCQ)	25+25/2 = CIE Average. + CCA1(13) + CCA2 (12) = 50 The Weightage of CIE is 50% . The minimum passing marks is 40% (20 out of 50)
CIE-2	25 Marks	25 objective Questions (MCQ)	
CCA-1	13 Marks	Learning Activity -1: Written Assignment	
CCA-2	12Marks	Learning Activity -2: Report Writing	
Total	**50 Marks**	**MCQ+ Written Assignment**	
SEE	**50 marks**	**MCQ Questions (50)**	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.

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 Activity -1: (Marks- 13) Learning Activity -2 (Marks-12)

Learning Activity 1 – Writing Assignment (13 Marks)
Objective: Assess written communication, organization, and reflective thinking skills through analytical or creative writing. Total Marks: 13

Component & CO–PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Clarity & Organization (CO1 – PO10)	Exceptionally clear structure; ideas logically sequenced.	Clear and logical with minor lapses.	Adequate structure; some disorganization.	Poorly organized; lacks flow.	Disorganized or incomplete.
Content Relevance & Depth (CO2 – PO2)	Insightful, well-developed content with strong relevance.	Good content with few gaps.	Relevant but lacks depth.	Limited relevance or superficial treatment.	Irrelevant or incomplete content.
Grammar, Language & Tone (CO3 – PO10)	Grammatically flawless; professional tone.	Minor language issues.	Understandable ; a few grammar errors.	Frequent grammatical errors; tone inconsistent.	Poor grammar; unclear writing.
Creativity & Originality (CO4 – PO3)	Highly creative and original.	Some creative or thoughtful ideas.	Some originality; mostly conventional.	Limited originality.	No creativity or copied work.

Learning Activity 2 – Report Writing (12 Marks) Objective: Evaluate ability to organize information, present analysis, and communicate findings in a formal report. Total Marks: 12

Component & CO–PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Report Structure & Formatting (CO2 – PO8)	Fully compliant with format; title, headings, and sub-sections used	Mostly formatted correctly; minor lapses.	Some structure present; inconsistent headings.	Poor organization; formatting errors.	Disorganized or missing sections.

	effectively.				
Content Accuracy & Relevance (CO1, CO2 – PO1)	Comprehensive and factual; aligns well with objectives.	Mostly accurate with minor factual lapses.	Adequate but lacks completeness.	Incomplete or partially accurate.	Inaccurate or off-topic.
Analytical Insight / Observation (CO3 – PO2, PO4)	Excellent analytical reflection; demonstrates critical insight.	Good interpretation; minor gaps.	Basic observations; limited insight.	Minimal analysis; descriptive only.	No analysis or reflection.
Presentation & Clarity (CO4 – PO10, PO11)	Neatly presented; free from errors.	Minor presentation or language issues.	Satisfactory presentation.	Poorly presented or unclear.	Untidy, incomplete, or plagiarized.

1st year Syllabus

BALAKE KANNADA			
Course code: AEC (HSMS)	**1BSHHM191 / 1BSHHM192**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	01Hours/Week	Total Marks	100
Credits	01	Exam Hours	1

Course objectives: This course will enable the students

1	ಕನ್ನಡ ಭಾಷೆ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಕುರಿತು **ಯಾವುದೆಲ್ಲ** ವಿಚಾರಗಳಿವೆ ಎಂಬ ತಿಳುವಳಿಕೆ ಉಂಟಾಗುತ್ತದೆ.
2	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಗದ್ಯ, ಕಾವ್ಯಗಳ ಕುರಿತು ಇನ್ನಷ್ಟು **ಹುಡುಕಾಡಿ** ಹೆಚ್ಚಿನ ಓದಿಗಾಗಿ ಸ್ಫೂರ್ತಿ ನೀಡುತ್ತದೆ.
3	ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಂಸ್ಕೃತಿಯ ಕುರಿತು ಆಸಕ್ತಿಯನ್ನು **ಪ್ರದರ್ಶಿಸುವ** ಉತ್ಸಾಹ ಉಂಟಾಗುತ್ತದೆ.
4	ತಾಂತ್ರಿಕ, ಸಾಂಸ್ಕೃತಿಕ, ವೃತ್ತಿರಂಗದಲ್ಲಿ ನಾಡು ನುಡಿ ಸಾಧಕರು ಅವರ ಕೊಡುಗೆಗಳನ್ನು ಆಸಕ್ತಿಯಿಂದ **ಗುರುತಿಸುವ** ಮನೋಭಾವ ಬೆಳೆಯುತ್ತದೆ.
5	ಸಾಂಸ್ಕೃತಿಕ , ಜಾನಪದ , ಪ್ರವಾಸೀ ಕಥನಗಳ ಪರಿಚಯದ ಸಾಹಿತ್ಯವನ್ನು **ಆಯ್ದುಕೊಳ್ಳುವ** ಆಸಕ್ತಿ ಬೆಳೆಯುತ್ತದೆ.

(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

1st year Syllabus

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**

COUSRE OUTCOME	
1	describe the necessity of learning of local language for comfortable life.
2	recall and read , write Kannada language as per requirement.
3	reproduce the communication (conversations) in Kannada language in their daily life with kannada speakers.
4	describe and understand the Kannada language properly.
5	Choose politeness in Kannada conservation.

ASSESMENT:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and Continuous Comprehensive Assessments (CCA): with each carrying 50% weightage.

Assessment	Marks	Method	Evaluation
CIE-1	25 Marks	25 objective Questions (MCQ)	25+25/2 = CIE Average. + CCA1(13) + CCA2 (12) = 50 The Weightage of CIE is 50% . The minimum passing marks is 40% (20 out of 50)
CIE-2	25 Marks	25 objective Questions (MCQ)	
CCA-1	13 Marks	Learning Activity -1: Written Assignment	
CCA-2	12Marks	Learning Activity -2: Report Writing	
Total	**50 Marks**	**MCQ+ Written Assignment**	
SEE	**50 marks**	**MCQ Questions (50)**	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.

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-13) Learning Activity -2 (Marks-12)

Course: 1BKBK109 – Basic Kannada

Learning Activity 1 – Writing Assignment (13 Marks)

Objective: Assess ability to express ideas in Kannada with grammatical accuracy, coherence, and understanding of cultural context.

Total Marks: 13

Component & CO–PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Content Understanding (CO1 – PO1)	Deep understanding of the topic; well-developed ideas.	Good understanding; minor errors.	Adequate understanding; some missing points.	Limited understanding.	Inaccurate or irrelevant.
Language & Grammar (Kannada) (CO2 – PO10)	Excellent command of Kannada grammar and vocabulary.	Minor grammar errors.	Understandable ; moderate grammar mistakes.	Frequent grammatical issues.	Poor grammar; unclear writing.
Organization & Flow (CO3 – PO8)	Logical flow with proper paragraphing.	Mostly coherent.	Some structure; minor disorganization.	Poorly structured.	Disorganized or incomplete.
Creativity & Expression (CO4 – PO3)	Highly expressive and creative.	Some creative elements.	Moderate expression.	Limited creativity.	No originality.

Learning Activity 2 – Report Writing (12 Marks)

Objective: Evaluate ability to prepare a formal report or essay in Kannada demonstrating cultural awareness, language accuracy, and structure.

Total Marks: 12

Component & CO–PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Report Organization & Formatting (CO3 – PO8)	Clear title, introduction, body, and conclusion; well formatted.	Mostly organized with minor errors.	Adequate structure; missing small elements.	Weak organization.	Disorganized or incomplete.

Language & Grammar Accuracy (CO2 – PO10)	Excellent grammar and precise vocabulary.	Mostly correct with minor lapses.	Understandable ; moderate errors.	Frequent errors affecting readability.	Poor grammar and structure.
Content Relevance & Analysis (CO1 – PO1, PO2)	In-depth and relevant; demonstrates understanding of the topic.	Mostly relevant with small gaps.	Sufficient but basic analysis.	Weak or unclear content.	Off-topic or copied work.
Presentation & Neatness (CO4 – PO11)	Neat, clear handwriting/typing, and well formatted.	Mostly neat with few issues.	Acceptable presentation.	Untidy or inconsistent.	Unreadable or missing sections.

PROGRAMMING LANGUAGE COURSES (PLC)

INTRODUCTION TO C PROGRAMMING		Semester	I/II
Course Code	**1BISLC151/251**	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**.**

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)

1st year Syllabus

PYTHON PROGRAMMING		Semester	I/II
Course Code	**1BCDLC152/252**	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
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 . 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):

1. https://www.learnbyexample.org/python/ https://www.learnpython.org/
2. 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.

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]	Student is capable of implementing the design with best suitable language	Student is capable of implementing the design with best suitable language	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.

[PO5, PO8]	structure considering optimal solution/optimal efficiency.	structure and should be capable of explaining it.			
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.
	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).

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

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)