Course Code		**:**	1BMAC101C	**DIFFERENTIAL CALCULUS AND LINEAR ALGEBRA FOR CV STREAM**	**Semester**	**:**	**I**
L:T:P		**:**	**3 : 1 : 0**		**Course Type**	**:**	**BSC**
Hours/Sem.	**Teaching**	**:**	**42+28Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**44Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**120Hrs**		**Credits**	**:**	**04**

Professional Competency:

Apply calculus, differential equations, and matrix theory using computational tools to solve complex engineering problems.

Course Outcomes:

After completion of the course, student will be able to:

CO1: Apply foundational concepts of calculus for geometric properties of curves,

CO2: Apply the concepts of multivariable calculus to compute the derivatives, optimize the functions

CO3: Apply the concepts of differential calculus to solve first and higher-order ordinary differential equations in science and engineering.

CO4: Employ the principles of linear algebra to solve systems of linear equations, determine eigen values & eigen vectors

Unit-I	**11Hrs.**

Differential Calculus: Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations**.**

Curvature and Radius of Curvature - Cartesian, Polar (with proof), Parametric and Pedal forms (without proof) – Problems

Unit-II	**10Hrs.**

Multivariable Calculus: Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Partial differentiation, total derivative –differentiation of composite functions, Jacobian, Maxima and minima for the function of two variables.

Unit-III	**11Hrs.**

Ordinary Differential Equations: Linear and Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factors and Orthogonal trajectories, Law of natural growth and decay.

Higher-order linear 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 homogeneous differential equations. Applications: Solving governing differential equations of Mass Spring

Unit-IV	**10Hrs.**

Linear Algebra: Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-elimination method and approximate solution by Gauss-Seidel method. Eigen values and Eigen vectors, Rayleigh's power method to find the dominant Eigen value and Eigen vector. Applications-Traffic flow.

Text Books:

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

Reference Books:

1. B.V. Ramana, Higher Engineering Mathematics,McGraw-HillEducation,11th Ed.,2017
2. Srimanta Pal& Subodh C.Bhunia, Engineering Mathematics, Oxford University Press,3rd Ed.,2016.
3. N.P. Bali and Manish Goyal, AText book of Engineering Mathematics, Laxmi Publications,10th Ed., 2022.
4. H.K. Dass and Er. RajnishVerma, Higher Engineering Mathematics, S. Chand Publication,3rd Ed., 2014.
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Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (CO s)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
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CO1	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO2	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO3	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO4	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		

Sri B.V.V.S.
Basaveshwar Engineering College, Bagalkote
Scheme (from 2025-26)

Sl. No.	Course Code	Course Title	Teaching-Learning Scheme				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits (C)= Total Hours/30
			L Hrs/Week (Hrs/Sem.)	T Hrs/Week (Hrs/Sem.)	P Hrs/Week (Hrs/Sem.)	Term Work (TW) and Self Learning (SL) (TW+SL) Hrs/Sem.	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1	1BMAC101C	Differential calculus and linear algebra for CV stream	3(42)	28	0	44	3	3	120	50	50	100	4= 120/30

Course Code		**:**	1BMAM101C	**DIFFERENTIAL CALCULUS AND LINEAR ALGEBRA FOR ME STREAM**	**Semester**	**:**	**I**
L:T:P		**:**	**3 : 1 : 0**		**Course Type**	**:**	**BSC**
Hours/Sem.	**Teaching**	**:**	**42+28Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**44Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**120Hrs**		**Credits**	**:**	**04**

Professional Competency:

Apply calculus, differential equations, and matrix theory using computational tools to solve complex engineering problems.

Course Outcomes:

After completion of the course, student will be able to:

CO1: Apply foundational concepts of calculus for geometric properties of curves,

CO2: Apply the concepts of multivariable calculus to compute the derivatives, optimize the functions

CO3: Apply the concepts of differential calculus to solve first and higher-order ordinary differential equations in science and engineering.

CO4: Employ the principles of linear algebra to solve systems of linear equations, determine eigen values & eigen vectors

Unit-I	**11Hrs.**

Differential Calculus: Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations**.**

Curvature and Radius of Curvature - Cartesian, Polar (with proof), Parametric and Pedal forms (without proof) – Problems

Unit-II	**10Hrs.**

Multivariable Calculus: Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Partial differentiation, total derivative –differentiation of composite functions, Jacobian, Maxima and minima for the function of two variables.

Unit-III	**11Hrs.**

Ordinary Differential Equations: Linear and Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factors and Orthogonal trajectories, Law of natural growth and decay.Higher-order linear 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'shomogeneous differential equations. Applications: Solving governing differential equations of Mass Spring

Unit-IV	**10Hrs.**

Linear Algebra: Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-elimination method and approximate solution by Gauss-Seidel method.Eigen values and Eigen vectors, Rayleigh's power method to find the dominant Eigen value and Eigen vector. Applications-Traffic flow.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers,44thEd.,2021.
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CO3	3 (WK1, WK2, WK3, and WK4)	2 (WK 1, WK2 and WK3)						1			1		
CO4	3 (WK1, WK2, WK3, and WK4)	2 (WK 1, WK2 and WK3)						1			1		

Sl. No.	Course Code	Course Title	Teaching-Learning Scheme				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits (C)= Total Hours/30
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1	1BMAC101C	Differential calculus and linear algebra for ME stream	3(42)	28	0	44	3	3	120	50	50	100	4= 120/30

Course Code		**:**	**1BMAE101C**	**DIFFERENTIAL CALCULUS AND LINEAR ALGEBRA FOR EEE STREAM**	**Semester**	**:**	**I**
L:T:P		**:**	**3 : 1 : 0**		**Course Type**	**:**	**BSC**
Hours/Sem.	**Teaching**	**:**	**42+28Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**44Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**120Hrs**		**Credits**	**:**	**04**

Professional Competency:

Ability to analyze and solve engineering problems using calculus, differential equations ,and linear algebra.

Course Outcomes:

After the completion of the course student will be able to

CO1: Apply foundational concepts of calculus for geometric properties of curves,

CO2: Apply the concepts of multivariable calculus to compute the derivatives, optimize the functions

CO3: Apply the concepts of differential calculus to solve first and higher-order ordinary differential equations in science and engineering.

CO4: Employ the principles of linear algebra to solve systems of linear equations, determine eigen values and eigen vectors.

UNIT-I	**11 Hrs.**

Differential Calculus

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 (with proof), Parametric and Pedal forms (without proof) – Problems

UNIT–II	**10Hrs.**

Multivariable Calculus

Statement and problems on Taylor's and Maclaurin's series expansion for one variable.

Partial Differentiation: Partial differentiation, total derivative- differentiation of composite functions. Jacobian. Maxima and minima for a function of two variables.

UNIT–III	**11 Hrs.**

Ordinary Differential Equations

Exact and reducible to exact differential equations-Integrating factors $1/N\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $1/M\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$ only. Linear and Bernoulli's differential equations. Orthogonal trajectories, L-R and C-R circuits.

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

UNIT–IV	**10 Hrs.**

Linear Algebra

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

Text Books

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

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3. N.P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications,10th Ed., 2022.
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CO3	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO4	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		

Sl. No.	Course Code	Course Title	Teaching-Learning Scheme				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits (C)= Total Hours/30
			L Hrs/Week (Hrs/Sem.)	T Hrs/Week (Hrs/Sem.)	P Hrs/Week (Hrs/Sem.)	Term Work (TW) and Self Learning (SL) (TW+SL) Hrs/Sem.	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1	1BMAE101C	Differential calculus and linear algebra for EEE stream	3(42)	28	0	44	3	3	120	50	50	100	4=120/30

Course Code		**:**	**1BMAS101C**	**CALCULUS AND LINEAR ALGEBRA FOR CSE STREAM**	**Semester**	**:**	**I**
L:T:P		**:**	**3 : 1 : 0**		**Course Type**	**:**	**BSC**
Hours/Sem.	**Teaching**	**:**	**42+28Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**44Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**120Hrs**		**Credits**	**:**	**04**

Professional Competency:

Apply calculus and linear algebra to solve complex engineering problems.

Course Outcomes

After the completion of the course student will be able to

CO1: Apply the concepts of multivariable calculus to compute derivatives, optimize functions

CO2: Apply the concepts of vector calculus to vector fields for applications in computer science engineering.

CO3: Solve system of linear equations and determine eigen values and eigenvectors using direct and methods.

CO4: Apply the concepts of vector spaces and linear transformations to problems in computer science engineering.

UNIT-I	**11 Hrs.**

Multivariable Calculus

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

UNIT–II	**10Hrs.**

Vector Calculus

Vector Differentiation: Scalar and vector fields, Gradient, directional derivatives, divergence and curl-physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential. **Vector Integration**: Line integral, Green's theorem(Problem without verification).

UNIT–III	**11 Hrs.**

System of Linear Equations, Eigen values and Eigen vectors

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

UNIT–IV	**10 Hrs.**

Vector Space

Review Vector- spaces, subspace definition and examples. Linear Combinations, linear span, linearly independent and dependent sets, basis and dimension, Coordinates vector, inner products and orthogonality.

Linear Transformation

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

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEd.,2021.
2. Gilbert Strang, Linear Algebra and its Applications, Cengage Publications,4th Ed.,2022.

3. Seymour Lipschutz and Marc Lipson, Linear Algebra, Schaum's outlines series,4thEd.,2008.

Reference Books

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

Web Links and Video Lectures:

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CO2	3 (WK1, WK2, WK3, and WK4)	2 (WK1,W2 and WK3)						1			1		
CO3	3 (WK1, WK2, WK3, and WK4)	2 (WK1,W2 and WK3)						1			1		
CO4	3 (WK1, WK2, WK3, and WK4)	2 (WK1,W2 and WK3)						1			1		

Sl. No.	Course Code	Course Title	Teaching-Learning Scheme				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits (C)= Total Hours/30
			L Hrs/Week (Hrs/Sem.)	T Hrs/Week (Hrs/Sem.)	P Hrs/Week (Hrs/Sem.)	Term Work (TW) and Self Learning (SL) (TW+SL) Hrs/Sem	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1	1BMAS101C	Calculus and linear algebra for CSE stream	3(42)	28	0	44	3	3	120	50	50	100	4= 120/30

Course Code		**:**	**1BMAC201C**	**CALCULUS AND NUMERICAL METHODS FOR CV STREAM**	**Semester**	**:**	**II**
L:T:P		**:**	**3 : 1 : 0**		**Course Type**	**:**	**BSC**
Hours/Sem.	**Teaching**	**:**	**42+28Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**44Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**120Hrs**		**Credits**	**:**	**04**

Professional Competency:

Apply calculus, numerical methods and computational tools to solve complex engineering problems.

Course Outcomes

After the completion of the course student will be able to

CO1: Apply the concept of integral calculus to evaluate definite integrals.

CO2: Determine partial differential equations and their solutions for physical interpretations.

CO3: Apply the concept of vector calculus.

CO4: Apply the concept numerical methods to obtain approximate solutions for mathematical problems.

UNIT-I **11 Hrs.**

Integral Calculus

Multiple Integrals: 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- simple problems

UNIT–II **10Hrs.**

Partial Differential Equations(PDE)

Formation of PDEs by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Lagrange's equation Pp + Qq = R, Method of Separation of variables. Application of PDE: Derivation of one-dimensional heat equation and wave equation.

UNIT–III **11 Hrs.**

Vector Calculus

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 and surface integral, work done by a force and flux, Statements of Green's theorem and Stoke's theorem, problems without the verification.

UNIT–IV **10 Hrs.**

Numerical Methods

Solution of algebraic and transcendental equations: Newton-Raphson methods, problems.

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

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

Numerical solution of ordinary differential equations of first order and first degree: Modified Euler's method, Runge-Kutta method of fourth order.

Text Books

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

Reference Books

1. B.V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education,11th Ed.,2017
2. Srimanta Pal& SubodhC.Bhunia, Engineering Mathematics, Oxford University Press,3rd Ed.,2016.
3. N.P. Bali and Manish Goyal, AText book of Engineering Mathematics, Laxmi Publications,10th Ed., 2022.
4. H.K. Dass and Er. RajnishVerma, Higher Engineering Mathematics, S. Chand Publication,3rd Ed., 2014.
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Sl. No.	Course Code	Course Title	Teaching-Learning Scheme				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits (C)= Total Hours/30
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1	1BMAC201C	Calculus and numerical methods for CV stream	3(42)	28	0	44	3	3	120	50	50	100	4= 120/30

Course Code		**:**	**1BMAM201C**	**MULTIVARIABLE CALCULUS AND NUMERICAL METHODS FOR ME STREAM**	**Semester**	**:**	**II**
L:T:P		**:**	**3 : 1 : 0**		**Course Type**	**:**	**BSC**
Hours/Sem.	**Teaching**	**:**	**42+28Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**44Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**120Hrs**		**Credits**	**:**	**04**

Professional Competency:

Apply calculus and numerical methods to solve complex engineering problems.

Course Outcomes

After the completion of the course student will be able to

CO1: Apply foundational concepts of calculus for geometric curves

CO2: Employ vector calculus concepts to solenoidal and irrotational vector fields and extremum problems of functionals.

CO3: Apply the concept of numerical methods to obtain approximate solutions for mathematical problems.

CO4: Apply the concept of numerical methods to solve ordinary differential equations of first order and first degree

UNIT-I **11 Hrs.**

Integral Calculus

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.

UNIT–II **10Hrs.**

Vector Calculus

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, Surface integral , work done by a force and flux. Statement of Green's theorem and Stoke's theorem and problems without verifications.

UNIT–III **11 Hrs.**

Numerical Methods – 1

Solution of algebraic and transcendental equations: Regular falsi and Newton-Raphson methods. Interpolation: Finite differences, Interpolation using Newton's forward and backward difference formulae, Lagrange's interpolation formula.

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

UNIT–IV **10 Hrs.**

Numerical Methods- 2

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.

Text Books

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2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley &Sons,10th Ed.,2018.
3. Gilbert Strang, Linear Algebra and its Applications, Cengage Publications,4th Ed.,2022.

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3. N.P.Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications,10thEd., 2022.
4. H.K.Dass and Er.RajnishVerma, Higher Engineering Mathematics,S. Chand Publication,3rd Ed., 2014.
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CO1	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO2	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO3	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO4	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		

Sl. No.	Course Code	Course Title	Teaching-Learning Scheme				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits (C)= Total Hours/30
			L Hrs/ Week (Hrs/ Sem.)	T Hrs/Week (Hrs/Sem.)	P Hrs/Week (Hrs/Sem.)	Term Work (TW) and Self Learning (SL) (TW+SL) Hrs/Sem	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1	1BMAM201C	Multivariable calculus and Numerical methods for ME stream	3(42)	28	0	44	3	3	120	50	50	100	4= 120/30

Course Code		**:**	**1BMAE201C**	**CALCULUS, LAPLACE TRANSFORM AND NUMERICAL TECHNIQUES FOR EEE STREAM**	**Semester**	**:**	**II**
L:T:P		**:**	**3 : 1 : 0**		**Course Type**	**:**	**BSC**
Hours/Sem.	**Teaching**	**:**	**42+28Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**44Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**120Hrs**		**Credits**	**:**	**04**

Professional Competency:

Apply calculus, Laplace transforms and numerical methods to solve complex engineering problems.

Course Outcomes

After the completion of the course student will be able to

CO1: Apply the concepts of integral calculus and solve problems in engineering applications.

CO2: Apply the concepts of vector calculus for application of electrical field.

CO3: Apply the concepts of numerical methods to obtain approximate solutions for mathematical problems.

CO4: Employ Laplace transforms technique for time domain, wave forms, periodic function and solving differential equations.

UNIT-I — **11 Hrs.**

Integral Calculus

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

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

UNIT–II — **10Hrs.**

Vector Calculus

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.

UNIT–III — **11 Hrs.**

Numerical Methods

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

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

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

Numerical solution of ordinary differential equations of first order and first degree: Modified Euler's method, Runge-Kutta method of fourth order.

UNIT–IV — **10 Hrs.**

Laplace Transforms

Laplace Transform (LT): Definition of Laplace Transform, Laplace Transform of elementary functions. Properties– linearity, scaling, shifting property, differentiation in these domain, division by t. Laplace Transform of periodic functions, Heaviside Unit step function.

Inverse Laplace Transforms: Definition, properties, evaluation using different methods and applications to solve ordinary differential equations.

Text Books

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

Reference Books

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

Web Links and Video Lectures:

https://drive.google.com/file/d/1KtCtZmnJnOvV1S68wXS9FZPXUFvRktBQ/view?usp=sharing

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO2	3 (WK1, WK2, WK3, and WK4)	(WK1, WK2 and WK3)						1			1		
CO3	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO4	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		

Sl. No.	Course Code	Course Title	Teaching-Learning Scheme				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits (C)= Total Hours/30
			L Hrs/Week (Hrs/Sem.)	T Hrs/Week (Hrs/Sem.)	P Hrs/Week (Hrs/Sem.)	Term Work (TW) and Self Learning (SL) (TW+SL) Hrs/Sem.	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1	1BMAE201C	Calculus, Laplace transform and numerical techniques for EEE stream	3(42)	28	0	44	3	3	120	50	50	100	4= 120/30

2026-27

Course Code		:	1BPHC102C/202C	PHYSICS FOR SUSTAINABLE STRUCTURAL SYSTEMS (Integrated)	Semester	:	I/II
L : T : P		:	3:0 :2		Course Type	:	IPCC
Hours / Sem	Teaching	:	42+26Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	44Hrs		SEE Marks	:	50
	Exam	:	08Hrs		Total Marks	:	100
	Total Hrs	:	120Hrs		Credits	:	04

Professional Competency:

Apply fundamentals of oscillations, elasticity, acoustics and smart materials for sustainable structural systems.

Course Outcomes:

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

1. Apply concepts of oscillations and elasticity for engineering applications.
2. Apply the concepts of acoustics and select appropriate properties of ultrasonic waves for engineering applications.
3. Apply appropriate properties of waves and shockwaves for engineering applications.
4. Apply appropriate properties of lasers and smart materials for engineering applications.

Unit – I | 11 Hrs

Oscillations:

Simple harmonic motion (SHM), the differential equation for SHM (no derivation). 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 (derivation), resonance and sharpness of resonance, resonance in LCR circuits (qualitative). Numerical problems.

Elasticity:

Stress-strain curve, stress hardening and softening. Elastic moduli, Poisson's ratio, relation between Y, n and σ (derivation), limiting values of Poisson's ratio. Beams, types of beams, bending moment (qualitative), applications of beams, Numerical problems

Unit – II | 10 Hrs

Acoustics:

Introduction to acoustics, types of acoustics, reverberation and reverberation time, absorption power and absorption coefficient, requisites for acoustics in auditorium, Sabine's formula (derivation), measurement of absorption coefficient, factors affecting the acoustics and remedial measures. Numerical problems.

Nondestructive testing (NDT):

Introduction to NDT, need for inspection, types of inspection system, benefits of NDT. Visual inspection. Liquid penetration test: Principles, surface separation, penetrate application and development. Eddy current testing: Inspection probes, display methods. Ultrasonic testing: Principle, generation of ultrasonic waves, probes. Numerical problems.

Unit – III | 10 Hrs

Waves and their role in structural behavior:

Types of waves, wave propagation in beams, rods, slabs, boundary effects, wave dispersion, damping in structures, energy dissipation techniques in structures. Introduction to earthquakes, general characteristics, P-waves, S-waves, Love waves and Rayleigh waves, ground motion and structural response, site effects and soil-structure interaction, physics of earthquakes, Richter scale of measurement and earthquake resistant measures. Tsunami: causes for tsunami, characteristics, adverse effects, risk reduction measures, engineering structures to withstand Tsunami.

Shock waves:

Introduction to Shock waves, Mach number, classification of waves based on Mach number, Mach regimes, definition and characteristics of shock waves and Mach Angle, construction and working of Reddy shock tube, applications of shock waves. Numerical problems.

Unit – IV	11 Hrs

Laser:

Introduction, Introduction, interaction of radiation with matter (induced absorption, spontaneous emission and stimulated emission), Einstein's coefficients (derivation for energy density), conditions for laser action, requisites of a laser system, working mechanism, characteristics of a laser, classification of lasers, construction and working of semiconductor diode laser. Applications of laser: Laser range finder, LIDAR (air pollution), road profiling, bridge deflection, speed checker. Numerical problems.

Smart materials for sustainable structures:

Types of smart materials, piezo, magnetostrictive, electrostrictive, electro-rheological, magneto-rheological, overview of sensor technology, uses of sensors in intelligent structures, pressure (strain guage) and vibration sensors.

Practical Module	26 Hrs

01	Study of forced mechanical oscillations and resonance.
02	Study of the frequency response of series and parallel LCR circuits.
03	Determination of effective spring constant of the given springs in series and parallel combinations.
04	Kundt's dust tube – determination of velocity of sound.
05	Verification of inverse square law of intensity of light.
06	Determination of velocity of ultrasonic waves using ultrasonic interferometer.
07	Determination of Young's modulus of the material of the given bar using single cantilever.
08	Determination of rigidity modulus of the material of the wire using torsional pendulum.
09	Determination of moment of inertia of the given irregular body by setting torsional oscillations.
10	Determination of wavelength of LASER using diffraction grating.
11	Identification of passive components and estimation of their values in a given black box.
12	Determination of Young's modulus of the material by uniform bending method.
13	STEP Interactive physical simulations. (relevant to theory part).
14	PHET Interactive simulations (relevant to theory part).
15	Simple case study on acoustics (auditorium, cinema hall, etc,).
16	Study of motion using spread sheets.

Note: i) Introduction lab
ii) Any ten experiments are to be conducted from the above list.
iii) Two Virtual/simulation labs

Text Books:

01	Avadhanalu M. N. Kshirsagar P. G. and Arun Murthy T. V. S, "A Textbook of Engineering Physics", S. Chand, New Delhi 11th edition, 2019.
02	Agarwal H. M. and Agarwal R. M, "Physics Oscillations and Waves, Optics and Quantum Mechanics", Pearson,2025.
03	Sharma Satyendra and Sharma Jyotsna, "Engineering Physics", Pearson, 2018.

Reference Books:

01	Chopra Anil K, "Dynamics of Structures - Theory and Applications to Earthquake Engineering", University of California at Berkeley Prentice Hall, Fourth Edition.
02	Hull J. B. & John V, "Non-Destructive Testing - Macmillan International Higher Education", 2015.
03	Bhalla Suresh (IIT Delhi), C. K. Soh, Yaowen Yan, "Smart Materials in Structural Health Monitoring, Control and Biomechanics", Springer.
04	French A P, "Vibrations and Waves introductory Physics", MIT, 2003.
05	Kakani, S L Kakani Shubra, "Engineering Physics", CBS Publishers and Distributers Pvt. Ltd, 3rd Edition, 2020.
06	Stein, Seth, and Michael Wysession, " Introduction to Seismology, Earthquakes, and Earth Structure", Blackwell Publishing, 2003.
07	S Mani Naidu, " Engineering Physics", Pearson, 2025.
08	B. P. Singh and Devaraj Singh, "Building Science: Lighting and Acoustics", Dhanpat Rai Publications (P) Ltd.
09	Lagoudas, D. C, "Shape Memory Alloys: Modeling and Engineering Applications", Springer ISBN: 978-0-387-47684-1, 2008.
10	Holnicki-Szulc J. & Rodellar J, "Smart Structures: Requirements and Potential Applications in Mechanical and Civil Engineering", Springer ISBN: 978-0-7923-5612-7, 1999.

Web Links and Video Lectures:

01	Simple Harmonic Motion (SHM) – NPTEL Lecture: https://www.youtube.com/watch?v=gnD8Se92hfk
02	Waves and Oscillations Playlist (SHM, damping, resonance, etc.)– NPTEL https://www.youtube.com/playlist?list=PLyqSpQzTE6M9X7oRXliYM8t0aaR_N0Csd
03	Simple Harmonic motion: https://www.youtube.com/watch?v=k2FvSzWeVxQ
04	Stress- strain curves :https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
05	Stress curves: https://www.youtube.com/watch?v=f08Y39UiC-o
06	Acoustics: https://www.youtube.com/watch?v=fHBPvMDFyO8
07	INTRO – Fundamentals of Acoustics" (Lecture 1, NPTEL-NOC, IIT Madras) https://www.youtube.com/watch?pp=0gcJCfwAo7VqN5tD&v=rT9B44Q4Rko
08	Fundamentals of Acoustics playlist (multiple lectures on acoustic wave behavior, sound propagation, etc.) https://www.youtube.com/playlist?list=PLgMDNELGJ1CYWnDbcbVET5zCbN4aLEbZQ
09	Structural Health Monitoring of Composites (IIT Kanpur) – Full NPTEL Course: https://nptel.ac.in/courses/112104160
10	Course Introduction – Structural Health Monitoring (IITM – NPTEL): https://www.youtube.com/watch?v=It4aogUfQis 11.
11	Smart Structures (IIT Kharagpur) – Covers smart materials, actuators, SHM: https://onlinecourses.nptel.ac.in/noc23_ae19/preview

2026-27

Course Outcomes (Cos)	Program Outcomes and (WKs)										
	1	2	3	4	5	6	7	8	9	10	11
CO1	**3** (WK1,WK2 and WK3)	**2** (WK1,WK2 and WK3)						1			1
CO2	**3** (WK1,WK2 and WK3)	**2** (WK1,WK2 and WK3)						1			1
CO3	**3** (WK1,WK2 and WK3)	**2** (WK1,WK2 and WK3)						1			1
CO4	**3** (WK1,WK2 and WK3)	**3** (WK1,WK2 and WK3)						1			1

2026-27

Course Code		:	1BPHM102C/202C	PHYSICS OF MATERIALS (ME, AU &IP)	Semester	:	I/II
L : T : P		:	3:0 :2		Course Type	:	IPCC
Hours / Sem	Teaching	:	42+26Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	44Hrs		SEE Marks	:	50
	Exam	:	08Hrs		Total Marks	:	100
	Total Hrs	:	120Hrs		Credits	:	04

Professional Competency:

Apply fundamentals of oscillations, photonics, thermo electric materials and cryogenics for engineering systems.

Course Outcomes:

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

1. Apply concepts of oscillations and shock waves for engineering applications.
2. Apply appropriate properties of laser and type of optical fiber for engineering applications.
3. Apply appropriate thermoelectric materials and cryogenics concepts for engineering applications.
4. Apply appropriate tool for material characterization.

Unit – I — 11 Hrs

Oscillations:

Introduction, 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, 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.

Shock waves:

Introduction to shock waves, Mach number, classification of waves based on Mach number, Mach regimes, definition and characteristics of shock waves and Mach angle, construction and working of Reddy shock tube, applications of shock waves. Numerical problems.

Unit – II — 10 Hrs

Photonics: Laser:

Introduction, interaction of radiation with matter (Induced absorption, spontaneous emission and stimulated emission), Einstein's coefficients (expression for energy density), conditions for laser action, requisites of a laser system, working mechanism, characteristics of a laser, classification of lasers. Construction and working of Nd:YAG and carbon dioxide lasers. Applications of lasers - Industry (drilling, cutting, welding) and laser range finder. Numerical problems.

Optical fibers:

Introduction, total internal reflection, propagation mechanism in optical fibers, angle of acceptance, numerical aperture and its derivation, fractional index change, modes of propagation (qualitative),V number and number of modes, types of optical fibers, attenuation and mention of expression for attenuation coefficient. Applications-optical fiber communication system, merits and demerits, intensity modulated temperature sensor. Numerical problems.

Unit – III — 10 Hrs

Thermoelectric materials and devices:

Introduction, thermo emf and thermo current, Seebeck effect, Peltier effect, Seebeck and Peltier coefficients, figure of merit (mention expression) and its importance in efficiency, 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). Applications: RTG (radio isotope thermoelectric generator). Numerical problems.

Cryogenics:
Introduction to thermodynamics, efficiency, production of low temperature - Joule Thomson effect (derivation with 3 cases), porous plug experiment with theory, liquefaction of oxygen by cascade process, Lindey's air liquefier, liquefaction of helium and its properties (super fluidity). Applications of cryogenics-dewar container, aerospace. Numerical problems.

Unit – IV	11 Hrs

Material characterization and instrumentation techniques:
Material properties:
Introduction to quantum mechanics, matter waves and its properties, wave function and its properties. Introduction to Schrodinger wave equation, eigen function and eigen values, particle in an infinite 1D potential well (qualitative), band theory of solids, quantum 2onfinement in 0, 1, 2 and 3 dimesions (qualitative), density of states, expressions and graphical representation, optical properties due to quantum confinement, blue shift, absorption, florescence and quantum tunneling.

Instrumentation techniques:
X-ray diffractometer (XRD), Scherrer equation, atomic force microscope (AFM), X-ray photoelectron spectroscopy (XPS), scanning electron microscope (SEM). Numerical problems.

Practical Module	26 Hrs

01	Determination of effective spring constant of the given springs in series and parallel combinations.
02	The study of forced mechanical oscillations and resonance.
03	The study of frequency response in series and parallel LCR circuits.
04	Determination of wavelength of laser using diffraction grating.
05	Identification of passive components and estimation of their values in a given black box.
06	Determination of velocity of ultrasonic waves in a given liquid using ultrasonic interferometer.
07	Determination of acceptance angle and numerical aperture of a given optical fiber.
08	Determination of rigidity modulus of a wire by torsional pendulum method.
09	Determination of Young's modulus of metal strip by single cantilever method.
10	Determination of the radius of curvature of a given plano convex lens by Newton rings method.
11	Determination of moment of inertia of the given irregular body by setting torsional oscillations.
12	Verification of Newton's law of cooling.
13	Kundt's dust tube – determination of velocity of sound.
14	Verification of inverse square law of intensity of light.
15	Determination of Planck's constant using LEDs.
16	Study the working of Peltier modules.
17	STEP interactive physical simulations. (springs, simple pendulum).
18	Study of motion using spread sheets (linear and projectile motion).

Note: i) Introduction lab
ii) Any ten experiments are to be conducted from the above list.
iii) Two Virtual/simulation labs

Text Books:

01	Avadhanulu, M N and Kshirsagar, P G, and Arun Murthy, T. V. S , A Textbook of Engineering Physics , S. Chand, New Delhi, 11th edition, 2019.
02	Sharma Satyendra and Sharma Jyotsna, Engineering Physics, Pearson, 2018.
03	Kakani S L and Kakani Shubra, Engineering Physics, CBS Publishers and Distributers Pvt. Ltd, 3rd Edition, 2020.

Reference Books:

01	French, A P, MIT Vibrations and Waves introductory Physics, 2003.
02	Chintoo S Kumar, Takayama K and Reddy K P J, Shock waves made simple, Willey India Pvt. Ltd, New Delhi, 2014.
03	Laud, B.B. "Lasers and Non-Linear Optics" , New Age International Publishers, New Delhi, 2nd edition, 2002.
04	Nambiar, K.R. LASERS Principles, Types and Applications, New Age International Publishers, New Delhi, 2006.
05	Bahman Zohuri, "Physics of Cryogenics", Elsevier, 2018.
06	Ramachandra Rao M. S. & Shubra Singh, Nanoscience and Nanotechnology Fundamentals to Frontiers, Wiley India Pvt Ltd, 2013.
07	Parameswaranpillai, N.Hameed, T.Kurian, Y. Yu, Nano Composite Materials Synthesis, Properties and Applications, CRC Press, 2017.
08	Sam Zhang, Lin Li, Ashok Kumar, Materials Characterization Techniques , CRC Press. 1st edition, 2008.
09	Mitra P.K , Characterization of Materials, Prentice Hall India Learning Private Limited, 2014.
10	Agarwal H M and Agarwal R M, Physics, Oscillations and Waves, Optics and Quantum Mechanics, Pearson, 2025.

Web Links and Video Lectures:

01	Oscillations and Waves by Prof.S.Bharadwaj, Department of Physics and Meteorology, IIT Kharagpurn: https://www.youtube.com/watch?v=gnD8Se92hfk
02	Waves and Oscillations http://www.youtub.com/watch?v=xoJWoMwTAw&list=PLyqSpQzTE6M9X7oRXliYM8t0aaR_N0Csd
03	Stress- strain curves : https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
04	Stress curves: https://www.youtube.com/watch?v=f08Y39UiC-o
05	Cryogenic Engineering by Prof. M.D. Atrey , Department of Mechanical Engineering, IIT Bombay.: https://www.youtube.com/watch?v=4gGMBNEzeuc
06	Liquefaction of gases: https://www.youtube.com/watch?v=aMelwOsGpIs
07	Non-destructive testing: https://youtu.be/JGQnbwxPiFA
08	Non-destructive testing: https://youtu.be/uzogGRDSmMA
09	Materials Characterisation : https://youtu.be/SXIYzrFGmkU

Course Outcomes (Cos)	Program Outcomes and (WKs)										
	1	2	3	4	5	6	7	8	9	10	11
CO1	**3** (WK1,WK2 and WK3)	**2** (WK1,WK2 and WK3)						1			1
CO2	**3** (WK1,WK2 and WK3)	**2** (WK1,WK2 and WK3)						1			1
CO3	**3** (WK1,WK2 and WK3)	**2** (WK1,WK2 and WK3)						1			1
CO4	**3** (WK1,WK2 and WK3)	**3** (WK1,WK2 and WK3)						1			1

2026-27

Course Code		:	**1BPHE102C/202C**	**QUANTUM PHYSICS and ENGINEERING MATERIALS (Integrated)**	**Semester**	:	**I/II**
L : T : P		:	**3:0 : 2**		**Course Type**	:	**IPCC**
Hours / Sem	**Teaching**	:	**42+26Hrs**		**CIE Marks**	:	**50**
	Learning (TW+SL)	:	**44Hrs**		**SEE Marks**	:	**50**
	Exam	:	**08Hrs**		**Total Marks**	:	**100**
	Total Hrs	:	**120Hrs**		**Credits**	:	**04**

Professional Competency:

Apply appropriate properties of materials for engineering systems.

Course Outcomes:

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

CO1: Apply the quantum mechanics principles and properties of conductors for engineering applications.
CO2: Apply appropriate properties of superconductors and semiconductors for engineering applications
CO3: Apply appropriate properties of laser and type of optical fiber for engineering applications
CO4: Apply appropriate dielectric, magnetic and thermoelectric materials for engineering applications

Unit – I — 11 Hrs

Quantum mechanics:

Introduction, de Broglie hypothesis and its derivation, matter waves and its properties, quantization of energy levels, phase velocity and group velocity, relation between group velocity and particle velocity. Heisenberg's uncertainty principle and its physical significance (no derivation), Application of uncertainty principle (non-existence of electron in the nucleus-relativistic), Principle of complementarity, Wave function and its properties, Derivation of one dimensional time independent Schrodinger's wave equation. Physical significance of a wave function and Born interpretation, Expectation value and its physical significance. Eigen functions and eigen values. Applications of Schrodinger's wave equation - eigen functions and energy eigen values of a particle in a one dimensional potential well of infinite height, role of higher dimensions, waveforms and probabilities. Numerical problems.

Electrical properties of metals :

Introduction, failures of classical free electron theory, Matthiessen's rule, assumptions of quantum free electron theory, Fermi energy, Fermi-Dirac statistics, density of states (qualitative), Fermi factor, variation of Fermi factor with temperature and energy, success of quantum free electron theory. Numerical problems.

Unit – II — 10 Hrs

Superconductivity:

Introduction to superconductors, temperature dependence of resistivity in conductors and superconductors, Meissner's effect, critical magnetic field, temperature dependence of critical magnetic field, Silsbee effect. Formation of cooper pairs, BCS theory and its limitations, Type-I and Type-II superconductors, high temperature superconductors, quantum tunneling, Josephson junction. Applications of superconductors: DC and AC (RF) SQUIDs superconducting magnets and Maglev vehicle. Numerical problems.

Semiconductors :

Introduction, Fermi level in intrinsic and extrinsic semiconductor, expression for concentration of electrons in conduction band and holes concentration in valance band (no derivation), relation between Fermi energy and energy gap in intrinsic semiconductors (derivation), law of mass action, electrical conductivity of a semiconductor (derivation), Hall effect, expression for Hall voltage and Hall coefficient (derivation) and its applications. Numerical problems.

Unit – III	10 Hrs

Photonics :

Laser:

Introduction, interaction of radiation with matter (induced absorption, spontaneous emission and stimulated emission), Einstein's coefficients (derivation for energy density), conditions for laser action, requisites of a laser system, working mechanism, characteristics of a laser, classification of lasers. Construction and working of Nd:YAG laser, CO_2 laser and semiconductor diode laser. Applications of lasers- laser bar code scanner, laser printer and laser range finder. Numerical problems.

Optical fibers:

Introduction, principle and structure, propagation mechanism in optical fibers, angle of acceptance, numerical aperture and its derivation. Modes of propagation (qualitative), V number and number of modes, types of optical fibers, attenuation and fiber losses. Applications-optical fiber communication system and fiber optic networking. Numerical problems.

Unit – IV	11 Hrs

Dielectric, Magnetic and Thermoelectric Materials:

Dielectrics:

Introduction, polar and non-polar of dielectrics, electrical polarization mechanisms, dielectric constant and relation
between dielectric constant and polarization, Internal field and derivation of internal field in solids and liquids (one dimensional), Lorentz field, Clausius-Mossotti relation (derivation) and its implications, dielectric loss (qualitative). Application of solid, liquid and gaseous dielectrics. Numerical problems.

Magnetic materials:

Classification of magnetic materials, Weiss molecular field theory of ferromagnetism(qualitative), importance of Curie temperature, ferromagnetic hysteresis and explanation using domain theory, energy loss, hard and soft ferromagnetic materials. Applications-transformer cores, armature and permanent magnets. Numerical problems.

Thermoelectric Materials:

Thermo emf and thermo current, Seebeck effect, Peltier effect, Seebeck and Peltier coefficients, figure of merit (mention expression) and its importance, laws of thermoelectricity. Expression for thermo emf in terms of T_1 and T_2 (derivation). Applications: thermo couples and thermopile. Numerical problems.

Practical Module	26 Hrs

01	Determination of wavelength of LASER using diffraction grating.
02	Determination of numerical aperture and acceptance angle of the given optical fiber.
03	Study the characteristics of a photo - diode and to determine the power responsivity.
04	Determination of Planck’s constant using LEDs.
05	Determination of Fermi energy of copper.
06	Determination of energy gap of the given semiconductor diode.
07	Black-box experiment (Identification of basic electronic components).
08	Resonance in LCR circuit.
09	Determination of resistivity of a semiconductor by four probe method.
10	Determination of dielectric constant of the material in a capacitor by charging and discharging method.
11	Verification of Stefan’s law.
12	Characteristics of a bipolar junction transistor.
13	Interference by the division of amplitude (Air wedge/Newton’s rings).
14	Data analysis using spread sheets.
15	Electronic / electrical circuit simulations

Note: i) Introduction lab
ii) Any ten experiments are to be conducted from the above list.

iii) Two Virtual/simulation labs

Text Books:

01	Avadhanulu M.N., Kshirsagar P. G. and Arun Murthy T.V.S, " A Textbook of Engineering Physics", S. Chand, New Delhi, 11th edition, 2019.
02	Kakani S.L., Shubra Kakani, "Engineering Physics", CBS Publishers and Distributers Pvt. Ltd, 3rd edition, 2020.
03	Satyendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson, 2018.

Reference Books:

01	Pillai S.O, "Solid state physics", New Age International Publishers, 8th edition, 2018
02	Griffiths D. J, "Introduction to Quantum Mechanics", Pearson, 2nd edition, 2018.
03	Tinkham M, "Introduction to Superconductivity", Dover Publications, 2nd edition, 2004.
04	Mishra P. K, "Superconductivity – Basics and Applications", Ane Books, 2009.
05	Loud B.B, "LASERS and Non-Linear Optics", New Age International, 2002.
06	Saleh B. E. A. & Teich M. C, " Fundamentals of Photonics", Wiley, 3rd edition, 2019
07	Mathur D.S, "Elements of properties of Matter", S. Chand, Reprint, 2016.
08	Beiser A, " Concepts of Modern Physics", McGraw-Hill Education, 6th edition, 2002.
09	Krane Kenneth S, " Modern Physics", John Wiley and sons, 3rd edition, 2012.

Web Links and Video Lectures:

01	NPTEL – Quantum Mechanics I (IIT Madras): https://nptel.ac.in/courses/115106066
02	NPTEL – Physics: Introductory Quantum Mechanics (NOC): https://archive.nptel.ac.in/courses/115/104/115104096
03	Solid State Physics – NPTEL (IIT Madras) https://nptel.ac.in/courses/115106127
04	A Brief Course on Superconductivity – NPTEL IIT Guwahati (Prof. Saurabh Basu) Playlist Introduction Video: https://www.youtube.com/watch?v=SHoGV-sezNI Full playlist available via the YouTube channel description or archive link.
05	Concepts in Magnetism and Superconductivity – NOC (IIT Kharagpur) Series start (Lecture 1): https://digimat.in/nptel/courses/video/115105131/L01.html
06	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
07	Semiconductor Optoelectronics – NPTEL (IIT Delhi, Prof. M. R. Shenoy), Direct video link (start relevant lecture): https://nptel.ac.in/courses/108108174/05

Course Outcomes (Cos)	Program Outcomes and (WKs)										
	1	2	3	4	5	6	7	8	9	10	11
CO1	**3** (WK1,WK2 and WK3)	**2** (WK1,WK2 and WK3)						1			1
CO2	**3** (WK1,WK2 and WK3)	**2** (WK1,WK2 and WK3)						1			1
CO3	**3** (WK1,WK2 and WK3)	**2** (WK1,WK2 and WK3)						1			1
CO4	**3** (WK1,WK2 and WK3)	**3** (WK1,WK2 and WK3)						1			1

2026-27

2026-27

Course Code		:	1BPHS102C/202C	QUANTUM PHYSICS AND QUANTUM COMPUTING (CS, IS, AIML & BT) (Integrated)	Semester	:	I/II
L : T : P		:	3:0 :2		Course Type	:	IPCC
Hours / Sem	Teaching	:	42+26Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	44Hrs		SEE Marks	:	50
	Exam	:	08Hrs		Total Marks	:	100
	Total Hrs	:	120Hrs		Credits	:	04

Professional Competency:

Apply quantum mechanics principles to conductors, superconductors, laser and quantum computing.

Course Outcomes:

After completion of the course, student will be able to:

CO1: Apply the quantum mechanics principles and properties of conductors for engineering applications.
CO2: Apply appropriate properties of superconductors and semiconductors for engineering applications.
CO3: Apply appropriate properties of laser and type of optical fiber for engineering applications.
CO4: Apply basic principles of quantum computing for engineering applications.

Unit – I — 11 Hrs

Quantum mechanics:

Introduction, de Broglie hypothesis and its derivation, matter waves and its properties, quantization of energy levels, Phase velocity and group velocity, relation between group velocity and particle velocity. Heisenberg's uncertainty principle and its physical significance (no derivation), Application of uncertainty principle (nonexistence of electron in the nucleus-relativistic), Principle of complementarity, Wave function and its properties, Derivation of one dimensional time independent Schrodinger's wave equation. Physical significance of a wave function and Born interpretation, Expectation value and its physical significance. Eigen functions and eigen values. Applications of Schrodinger's wave equation - eigen functions and energy eigen values of a particle in a one dimensional potential well of infinite height, role of higher dimensions, waveforms and probabilities. Numerical problems.

Electrical properties of metals :

Introduction, failures of classical free electron theory, Matthiessen's rule, assumptions of quantum free electron theory, Fermi energy, Fermi-Dirac statistics, density of states (qualitative), Fermi factor, variation of Fermi factor with temperature and energy, success of quantum free electron theory. Numerical problems.

Unit – II — 10 Hrs

Superconductivity:

Introduction to superconductors, temperature dependence of resistivity in conductors and superconductors, Meissner's effect, critical magnetic field, temperature dependence of critical magnetic field, Silsbee effect. Formation of cooper pairs, Two-fluid model, BCS theory and its limitations, Type-I and Type-II superconductors, high temperature superconductors, quantum tunneling, Josephson junction. Applications of superconductors: DC and AC (RF) SQUIDs. In quantum computing - charge, phase and flux qbits. Numerical problems.

Semiconductors :

Introduction, Fermi level in intrinsic and extrinsic semiconductor, expression for concentration of electrons in conduction band and holes concentration in valance band (no derivation), relation between Fermi energy and energy gap in intrinsic semiconductors (derivation), law of mass action, electrical conductivity of a semiconductor (derivation), Hall effect, expression for Hall voltage and Hall coefficient (derivation) and its applications. Numerical problems.

Unit – III	10 Hrs

Photonics:

Laser:

Introduction, interaction of radiation with matter (absorption, spontaneous emission and stimulated emission), Einstein's coefficients (derivation for energy density), conditions for laser action, requisites of a laser system, working mechanism, characteristics of a laser, classification of lasers. Construction and working of Nd:YAG and semiconductor diode lasers. Applications of lasers- laser bar code scanner, laser printer and laser cooling, Mach-Zehnder interferometer. Numerical problems.

Optical fibers:

Introduction, principle and structure, propagation mechanism in optical fibers, angle of acceptance, numerical aperture and its derivation. Modes of propagation (qualitative), V number and number of modes, types of optical fibers, attenuation and fiber losses. Applications-optical fiber communication system and fiber optic networking. Numerical problems.

Unit – IV	11 Hrs

Quantum Computing:

Introduction to quantum computing, Moore's law and its limitations, classical vs quantum computation. Quantum system as a qubit and its properties. Representation of qubit on Bloch sphere, two and multi qubit systems. Dirac representation and matrix operations: Dirac's bra-ket representation of quantum states $|0\rangle$ and $|1\rangle$, their matrix forms. Inner product- proof of orthonormality of quantum states using matrix notation and basis. Outer product- density matrix representation of single and two qubit systems. Unitary matrices- Pauli matrices and their operation on single and two qubit systems. Hermitian operator. Numerical problems

Quantum gates:

Single qubit gates: quantum NOT gate, Pauli –X,Y and Z gates, Hadamard gate, phase gate - S and T gates. Multiqubit gates: control and target qubit, CNOT gate (discussion for 4 different input states), swap gate, controlled Pauli –X,Y and Z gates, Toffoli gate and Fredkin gate

Practical Module	26 Hrs

01	Determination of wavelength of LASER using diffraction grating.
02	Determination of numerical aperture and acceptance angle of the given optical fiber.
03	Study the characteristics of a photodiode and to determine the power responsivity.
04	Determination of Planck's constant using LEDs.
05	Determination of Fermi energy of copper.
06	Determination of energy gap of the given semiconductor diode.
07	Black-box experiment (Identification of basic electronic components)
08	Resonance in LCR circuit.
09	Determination of resistivity of a semiconductor by four probe method.
10	Determination of dielectric constant of the material in a capacitor by charging and discharging method.
11	Characteristics of a bipolar junction transistor.
12	Interference by the division of amplitude(Air wedge/Newton's rings)
13	Predicting the outputs of various combinations of single and two qubit gates using QUIRK quantum simulator.
14	Predicting the outputs of various combinations of single and two qubit gates using QISKIT.
15	Data analysis using spread sheets.
16	PhET simulations.

Note: i) Introduction lab
ii) Any ten experiments are to be conducted from the above list.
iii) Two Virtual/simulation labs

Text Books:

01	Avadhanulu M.N. and Kshirsagar P. G. and Arun Murthy T.V.S, " A Textbook of Engineering Physics", S. Chand, New Delhi, 11th edition, 2019.
02	Kakani S.L. Shubra Kakani, "Engineering Physics" CBS Publishers and Distributers Pvt. Ltd, 3rd edition, 2020.
03	Satyendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson, 2018.

Reference Books:

01	Pillai S. O, "Solid State Physics", New Age International Private limited, 8th Edition, 2018.
02	Lala Parag K, "Quantum Computing", McGraw Hill, 2020.
03	Beiser A, "Concepts of Modern Physics", McGraw-Hill Education, 6th edition, 2002.
04	Griffiths D. J, "Introduction to Quantum Mechanics" Pearson, 2nd edition, 2018.
05	Tinkham M, "Introduction to Superconductivity", Dover Publications, 2nd edition, 2004.
06	Mishra P. K, "Superconductivity – Basics and Applications", Ane Books, 2009.
07	Loud B. B, "LASERS and Non-Linear Optics", New Age International, 2nd edition, 2002.
08	Saleh B. E. A. and Teich M. C, "Fundamentals of Photonics", Wiley, 3rd edition, 2019.
09	Nielsen M. A. and Chuang I. L, "Quantum Computation and Quantum Information Cambridge", University Press, 10th Anniversary edition, 2010.
10	Vishal Sahani, "Quantum Computing", McGraw Hill, Education, 2007.
11	Anirban Pathak, "Elements of quantum computation and quantum communications", CRC Press, 2013.
12	Kenneth Krane.S, "Modern Physics", John Wiley and sons, 3 rd edition, 2012.

Web Links and Video Lectures:

01	NPTEL – Quantum Mechanics I (IIT Madras): https://nptel.ac.in/courses/115106066
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03	Solid State Physics – NPTEL (IIT Madras) https://nptel.ac.in/courses/115106127
04	A Brief Course on Superconductivity – NPTEL IIT Guwahati (Prof. Saurabh Basu) Playlist Introduction Video: https://www.youtube.com/watch?v=SHoGV-sezNI Full playlist available via the YouTube channel description or archive link.
05	Concepts in Magnetism and Superconductivity – NOC (IIT Kharagpur)Series start (Lecture 1): https://digimat.in/nptel/courses/video/115105131/L01.html
06	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
07	Semiconductor Optoelectronics – NPTEL (IIT Delhi, Prof. M. R. Shenoy)Direct video link (start relevant lecture): https://nptel.ac.in/courses/108108174/05
08	Lecture 04 – Quantum Computing Basics: https://www.youtube.com/watch?v=-fttE1SzpD8
09	Lecture 08 – Quantum Gates and Circuits Part 1: https://www.youtube.com/watch?v=nGPr1QM_XrY

2026-27

Course Outcomes (Cos)	Program Outcomes and (WKs)										
	1	2	3	4	5	6	7	8	9	10	11
CO1	**3 (WK1, WK2,and WK3)**	**2 (WK1, WK2,and WK3)**						1			1
CO2	**3 (WK1, WK2, and WK3)**	**2 (WK1, WK2, and WK3)**						1			1
CO3	**3 (WK1, WK2, and WK3)**	**2 (WK1, WK2, and WK3)**						1			1
CO4	**3 (WK1, WK2, and WK3)**	**2 (WK1, WK2, and WK3)**			2 **(WK1, WK2, and WK3)**			1			1

Course Code		**:**	**1BCHC102C/202C**	**Applied Chemistry for Civil Engineering Stream**	**Semester**	**:**	**1/2**
L:T:P		**:**	**3:0:2**		**Course Type**	**:**	**Integrated**
Hours/Sem.	**Teaching**	**:**	**42+26 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**44 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**05 + 03 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**120 Hrs**		**Credits**	**:**	**04**

Professional Competency:

Analyse and choose bulk/nano materials for the production of finished products for societal applications.

Course Outcomes:

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

CO1: Analyze water quality parameters and extent of water pollution.

CO2: Use polymers, nanomaterials and composite materials for structural integrity.

CO3: Evaluate sustainable construction materials like cement, geo polymer concrete, biopolymers and piezoelectric composites.

CO4: Apply corrosion control methods for metals and analytical techniques for industrial effluents.

UNIT – I Water chemistry and Water pollution — 11Hrs.

Water Chemistry: Introduction, Potable water, Standards of potable water, Significance of water quality parameters; pH, turbidity, chlorides, dissolved oxygen and alkalinity for environmental and construction applications. Hardness of water; types, determination of total hardness by EDTA method, numericals on hardness of water. Determination of chloride by Mohr's method. Softening of water by ion exchange and electrodialysis.

Water pollution: Sources, Sewage, aerobic and anaerobic oxidation, Sewage treatment, Primary, Secondary (Activated sludge process) and Tertiary treatment. Determination of dissolved oxygen by Winkler's method, Determination of Biological oxygen demand and numericals on BOD. Determination of Chemical oxygen demand and numericals on COD.

UNIT – II Polymer and Nanomaterials — 10Hrs.

Polymer: Introduction, polymerization, types, synthesis, properties and engineering applications of PVC, PMMA, Kevlar fiber and epoxy resins. Molecular weight of polymers: number average and weight average molecular weight of polymers, numericals on Mn & Mw. Properties and industrial applications of carbon-based reinforced composites-graphene/carbon nano-tubes as fillers. Conducting Polymer: Definition, Synthesis of polyacetylene. Conducting mechanism of Polyacetylene (n & p type) and applications.

Nanomaterials: Introduction, classification, size dependent properties *viz*; surface area, water absorption, permeability, thermal properties and antimicrobial activity, synthetic route (Bottom up and Top down approaches), synthesis of nanomaterials by sol-gel method and laser ablation method. Nano scale materials: Silica fumes, GGBS, Fly ash and rice husk ash their compositions and applications.

UNIT – III Conventional and Sustainable Construction Materials — 11 Hrs.

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Cement: Introduction, composition, manufacturing process of cement by dry process, process of setting and hardening of cement, special cements-composition, properties and applications. Geopolymer Concrete–Introduction, mechanism of geopolymerization and manufacturing process of geopolymer concrete. Biopolymers – Poly lactic Acid (PLA) and Poly hydroxyl butyrate (PHB) – synthesis, properties and applications.

Metals and Alloys: Introduction, classification of metal alloys: ferrous and non-ferrous, composition, properties, applications of iron and its alloys in civil engineering.
Piezoelectric Cement Composites: Introduction, piezoelectric materials in cement composites and its applications in civil engineering.

UNIT – IV Corrosion Science and Analytical Techniques	10 Hrs.

Corrosion: Introduction, electrochemical corrosion of steel in concrete, types- differential metal corrosion and differential aeration corrosion, stress corrosion in civil structures. Factors affecting the rate of corrosion. Corrosion control: Metallic coating-galvanization. Surface conversion coating: anodizing. Cathodic protection: Sacrificial anodic protection. Corrosion inhibitors. Corrosion penetration rate (CPR) - definition, importance and numericals on CPR.

Analytical Techniques: Sensors**:** Introduction, working principle**.** Applications of sensor in the detection of fire, cracks, metals. Potentiometric sensors: principle, instrumentation and application in estimation of iron in industrial effluents. Conductometric sensors: principle, instrumentation and application in determination of acid mixture in industrial effluents. pH sensor: Estimation of pH of soil sample.

Practical Module

1. Estimation of strength of acid in lead acid battery.
2. Determination of alkalinity of given boiler water sample.
3. Estimation of iron in TMT bar by diphenyl amine indicator method
4. Estimation of total hardness of water by EDTA method.
5. Estimation of percentage of CaO in cement.
6. Estimation of acid mixture by conductometric sensor.
7. Determination of pKa of vinegar using pH sensor.
8. Estimation of iron in rust sample by Potentiometric sensor.
9. Colorimetric estimation of copper present in e-waste by optical sensor.
10. Determination of coefficient of viscosity of a lubricant by Ostwald's viscometer.
11. Data analysis of pKa of a week acid and its interpretation using origin software.
12. Chemical structure drawing using software: Chem Draw/ Chem Sketch.

Text Books:

1. Dr. Suba Ramesh etal. "Wiley Engineering Chemistry", Wiley India Pvt. Ltd. New Delhi, 2nd Edition, 2018.
2. S.S. Dara etal, "A Text book of Engineering Chemistry", S. Chand Pub Pvt. Ltd., New Delhi, 12th Edition, 2011.
3. R.V. Gadag and Nityananda Shetty, "A Text Book of Engineering Chemistry", I. K. International Publishing house, New Delhi, 2nd Edition, 2016.

Reference Books:

1. B. S. Murthy etal., "Text book of Nano science and Technology", University press Pvt. Ltd., Hyderabad, 1st Edition, 2021.
2. M. S. Ramachandra etal., "Nano science and Technology", Wiley India Ltd., Publisher, 1st Edition 2017.
3. Premamoy Ghosh "Polymer Science and Technology" Tata Mc. Grow Hill Pvt., New Delhi, 3rd Edition 2011.
4. Dr. B. C. Punima, etal., "Building constructions", Laxmi Publications Pvt. Ltd., New Delhi, 12th Edition 2025.
5. S. S. Bevinakatti, Building Materials", Vikas Publishing/S. Chand imprint, India, 1st Edition,

2012.

Web Link and Video Lectures:

Web Links

1. https://share.google/osn5hvgxQ2HLcp018
2. https://share.google/2wsHfWUo988WwQ8Wf
3. https://share.google/RhB4pd8GzoZ10zXXP
4. https://share.google/K6DvK716X16dj9djZ

Video Links

- https://www.youtube.com/watch?v=faESCxAWR9k
- https://www.youtube.com/watch?v=j5Hml6KN4TI
- https://www.youtube.com/watch?v=1xWBPZnEJk8
- https://www.youtube.com/watch?v=wRAo-M8xBHM

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

- https://www.vlab.co.in/broad-area-chemical-sciences
- https://interestingengineering.com/science

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3 WK1 WK2 WK3	2 WK1, WK2 WK3									1	-	-
CO2	3 WK1 WK2 WK3	2 WK1 WK2 WK3									1	-	-
CO3	3 WK1 WK2 WK3	2 WK1 WK2 WK3									1	-	-
CO4	3 WK1 WK3	2 WK1 WK3									1	-	-
CO5	3 WK1 WK3	2 WK1 WK3									1	-	-

Course Code		:	**1BCHM102C/202C**	**Applied Chemistry for Mechanical Engineering Stream**	**Semester**	:	**1/2**
L:T:P		:	**3:0:2:0**		**Course Type**	:	**Integrated**
Hours/Sem.	**Teaching**	:	**42+26 Hrs**		**CIE Marks**	:	**50**
	Learning (TW+SL)	:	**44 Hrs**		**SEE Marks**	:	**50**
	Exam	:	**05 + 03 Hrs**		**Total Marks**	:	**100**
	Total Hrs.	:	**120 Hrs**		**Credits**	:	**04**

Professional Competency:

Proficiency in analyzing electro-analytical techniques to assess material performance, reliability, and durability.

Course Outcomes:

After completion of the course student will be able to;

CO1: Identify the existing and future fuels for conservative approach.

CO2: Apply current and futuristic energy sources and devices for energy storage.

CO3: Analyse the electro analytical processes that evaluate the performance and durability of materials.

CO4: Determine the various properties of materials and processing technologies for fabricating different materials.

UNIT-I Conventional and Green fuels	**11Hrs.**

Conventional Fuels: Introduction, classification, characteristics of good fuel, calorific value- (GCV& NCV), determination of calorific value using bomb calorimeter, numericals on GCV & NCV. Knocking in internal combustion engines–knocking mechanism, anti-knocking agents– anti knocking action of 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 alkali catalyzed 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. Photovoltaic cells (PV cells)– construction, working, advantages, limitations and applications.

UNIT–II Energy systems and nanomaterials	**10Hrs.**

Energy Systems: Batteries– Introduction, basic principle, classification of batteries, characteristics of battery: voltage, capacity, power density, shelf life and cycle life. Construction, working and applications of Li-ion battery and Na-ion battery. Fuel cells - Introduction, construction and working of methanol–oxygen fuel cell and solid oxide fuel cell (SOFCs) for auxiliary power units (APUs) applications, Construction, working and applications of vanadium redox flow battery, difference between fuel cell and battery.

Nanomaterials: Introduction, classification, size-dependent properties of nanomaterial-surface area, catalytical, electrical and thermal conductivity. Synthetic routes– Top down and bottom up approaches, synthesis of nano-materials by sol–gel and laser ablation methods, Nano scale materials– Nano clusters, Nano wires, carbon nano tubes and their applications.

UNIT–III Corrosion and Metal finishing	**11 Hrs.**

Corrosion: Introduction, electrochemical theory of corrosion, types of electrochemical corrosion– differential metal corrosion, differential aeration corrosion(waterline and pitting) and stress corrosion in steam boilers, Factors affecting rate of corrosion, Corrosion control– metal coating; galvanization, surface conversion coating; anodization and cathodic protection; sacrificial anode method, corrosion penetration rate (CPR) – Introduction and numericals on CPR (mmpy).

Metal finishing: Introduction, technological importance of metal finishing.
Electroplating process: Theory of electroplating– definition, principle components of an electroplating bath. Effects of plating variables on the nature of electro-deposit. Determination of throwing power of plating bath by

Haring Blum Cell and numericals on throwing power. Electroplating of copper, chromium and applications.
Electroless plating: meaning, distinction between electroplating and electroless plating, surface preparation, Electroless plating of Cu on PCB and electroless plating of nickel on aluminium and applications.

UNIT–IV Polymer and Analytical techniques	**10 Hrs.**

Polymers: Introduction, polymerization, types of polymerization, Glass transition temperature (Tg), factor affecting Tg and its significance. Molar mass of polymers– number average and weight average molecular weight, numerical on M_n and M_w, synthesis, properties and engineering applications of polyvinyl chloride (PVC), and poly methyl methacrylate (PMMA), Polymer composites– Introduction , fiber-reinforced polymers (FRPs); Kevlar–Synthesis, properties and industrial applications, 3D Printing materials– Introduction, synthesis, properties and applications of poly lactic acid (PLA) resin.

Analytical Technique: Sensors: Introduction, working principle, Potentiometric sensor; principle, instrumentation and its application in the estimation of iron in steel industry effluent. Conductometric sensor; Principle, instrumentation 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. Colorimetric sensor– principle, instrumentation and its application in the estimation of copper in brass.

Practical Module

1. Estimation of strength of acid in lead acid battery.
2. Determination of alkalinity of given boiler water sample.
3. Estimation of iron in TMT bar by diphenyl amine indicator method.
4. Estimation of total hardness of water by EDTA method.
5. Estimation of percentage of CaO in cement.
6. Estimation of acid mixture by conductometric sensor.
7. Estimation of iron in rust sample by Potentiometric sensor.
8. Determination of pKa of vinegar using pH sensor.
9. Colorimetric estimation of copper present in e-waste by optical sensor.
10. Determination of coefficient of viscosity of a lubricant by Ostwald's viscometer.
11. Data analysis of pka of a week acid and its interpretation using origin software.
12. Chemical structure drawing using software: Chem Draw/ Chem Sketch.

Text Books:

1. R. V. Gadag and Nityananda Shetty, A Text Book of Engineering Chemistry, I. K. International Publishing house. 2nd Edition, 2016.
2. Dr. Mahesh B and Dr. Roopashree B, , Engineering Chemistry, Publisher Sunstar Bengaluru, ISBN978-93-85155-70-3, 2022.
3. Dr. K. R. Mahadik & Dr. L. Sathiyanarayanan, Instrumental Methods of Analysis, Nirali, Prakashan, 2020.
4. V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, Polymer Science, New Age Int. Publishers 4th Edition, 2021.
5. Douglas A. Skoog, F. James Holler, Stanley R., Principles of Instrumental Analysis, Cengage Learning Crouch Seventh Edition, 2020.

Reference Books:

1. Wiley Engineeering Chemistry, Wiley India Pvt.Ltd.,ISBN-978-81-265-47205, 5th Edition 2019.
2. Kirby W. Beard, Linden's Hand book of Batteries , Mc Graw Hill, FifthEdition,2019.
3. Takatoshi Tsujimura, OLED Display Fundamentals and Applications, Wiley–Blackwell, 2012.
4. F. H. Froes, etal. High Performance Metallic Materials for Cost Sensitive Applications John, Wiley & Sons, 2010.
5. PC Jain & MonicaJain, Engineering Chemistry, Dhanpat Rai Publication, 6th Edition. 2015.
6. Hari Singh,Nano structured materials and nanotechnology, Nalwa, academic press, 1st Edition, 2002.
7. Sulabha K Kulkarni, Nanotechnology Principles and Practices, Capital Publishing Company,

3rd Edition 2014.
8. Phanikumar, Principles of nano technology, Sci Tech publications, 2nd Edition,2010.
9. B.S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar. Chemistry for Engineering Students, Subash Publications, 5th Edition, 2014.
10. O.G.Palanna, Engineering Chemistry, Tata Mc Graw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
11. Malini S KS Anantha Raju, Chemistry of Engineering materials, CBS publishers Pvt Ltd.
12. Anupma Rajput, Laboratory Manual Engg. Chemistry, Dhanpat Rai & Co.
13. Dr. S.S. Dhara and Dr. S.S. Umare, "A Text book of Engineering Chemistry" S.Chand & Co., Ltd., ISBN- 81-219-0359-9, 12th Edition 2011.

Web Links and Video Lectures

1. https://tasneemkhansite.wordpress.com/wp-content/uploads/2019/02/e-i-2-bomb-c.pdf
2. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SME1603.pdf
3. https://mcehassan.ac.in/assets/departments/CHE/materials/Energy,_Storage_and_Conversion.pdf
4. https://madar-ju.com/storage/images/files/file_1738779526YaGbl.pdf
5. https://www.rcet.org.in/uploads/academics/rohini_10009416162.pdf
6. https://www.informit.com/articles/article.aspx?p=2235827
7.
8. https://www.nrcmec.org/pdf/Content/NR25/FME/ppts/ece/i-semester/engineering-chemistry/unit-4/ppt.pdf
7. https://aiktc.ndl.gov.in/bitstreams/8b27e26c-cd04-41d4-b00a-902a70de44bf/download
9. https://www.youtube.com/watch?v=6Fk4DSMzlm8
10. https://youtu.be/tPCmj7dnb6w?list=PLzpBoXcNLUltsdSGokLPz3aiThovDWO3u
11. https://youtu.be/OGHsUevI14c
12. https://youtu.be/OGHsUevI14c?t=420
13. https://youtu.be/Yrz181Dnnlc
14. https://youtu.be/iZ6IZxCcP9Y
15. https://youtu.be/j_rNjiIiBKE
16. https://youtu.be/wVJ8WQax0rQ
17. https://youtu.be/hT7aLfwPVKs
18. https://youtu.be/20ATkRv-9To
19. https://youtu.be/WqUFevqldpI
20. https://youtu.be/1pED9NduPZ8
21. https://youtu.be/L4PsP92u_Po
22. https://youtu.be/NZrXDK5Plj4
23. https://youtu.be/3qd73a-qvMI
24. https://youtu.be/fVXR-6N6eeQ

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3 WK1 WK2	2 WK1 WK2									1		

	WK3	WK3											
CO2	3	2									1		
	WK1	WK1											
	WK3	WK3											
CO3	3	2									1		
	WK1	WK1											
	WK2	WK2											
	WK3	WK3											
CO4	3	2									1		
	WK1	WK1											
	WK3	WK3											
	WK1	WK1											
	WK3	WK3											

Course Code		:	1BCHE102C/202C	Applied Chemistry for Electrical & Electronics Engineering Stream	Semester	:	1/2
L:T:P		:	3:0:2		Course Type	:	Integrated
Hours/Sem.	Teaching	:	42+26 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	44 Hrs		SEE Marks	:	50
	Exam	:	05+03 Hrs		Total Marks	:	100
	Total Hrs.	:	120 Hrs		Credits	:	04

Professional Competency:

Graduate will processes the professional competency to apply fundamental, chemical sciences, analytical problem solving skills and engineering reasoning to design, evaluate and improve chemical processes and technologies responsibly and efficiently across diverse engineering domains.

Course Outcomes:

After completion of the course student will be able to;

CO1: Analyse the functioning of electrode system, energy storage and conversion systems.

CO2: Identify the synthesis, properties of nanomaterials and quantum dots in day today Applications.

CO3: Solve corrosion in metals, apply metal finishing methods for surface protection and material recovery from e-waste for environmental safety.

CO4: Apply basic principles of sensors and role of functional polymers and composites in flexible electronic applications.

UNIT-I Electrode system and Energy Devices	11Hrs.

Electrode System: Introduction, types of electrodes, reference electrode, construction, working and applications of calomel electrode. Ion selective electrode – definition. Construction and working of glass electrode, determination of pH using glass electrode. Construction and working of concentration cell and numericals on concentration cell.

Energy storage devices: Introduction, classification of batteries- primary, secondary and reserve battery, characteristics (voltage, capacity, power density, shelf life & cycle life). Construction, working and EV applications of lithium-ion battery and sodium-ion battery. Energy conversion devices: Introduction, construction, working principle, advantages and applications of photovoltaic cell (PV cell).

UNIT–II Nanomaterials and Quantum Dot Materials	10Hrs.

Nanomaterials: Introduction, classification, size dependent properties of nanomaterials (Surface area, Catalytic, Electrical, Magnetic, Mechanical and Optical). Synthesis of nanoparticles by sol-gel method and CVD method with example, (Show the nanoparticals using images). Nano scale materials: Nano clusters, Nano wire, Carbon nanotubes and their applications.

Quantum Dot materials: Introduction to Quantum Dots, Types. Inorganic Quantum Dot materials (IQDMs) – Introduction. Synthesis and properties of silicon based QDs by Sol-Gel Method and CdSe quantum dots by hot injection method and applications in optoelectronic devices. Quantum Dot -based Copper Conductive Ink by wet chemical reduction method, properties and applications.

UNIT–III Corrosion Chemistry and E-Waste management	11 Hrs.

Corrosion Chemistry: Introduction, electrochemical theory of corrosion, types of electrochemical corrosion, differential metal (electronic circuits) and differential aeration (waterline and pitting). Factors affecting rate of corrosion. Corrosion control-galvanization and anodization. Cathodic protection: sacrificial anodic method. Corrosion Penetration Rate (CPR) - Introduction and numericals on CPR (unit in mm/year).

Metal finishing: Introduction, technological importance of metal finishing. Electroplating-definition, Electroplating of chromium for hard and decorative coatings. Electroless plating-definition,

Electroless plating of copper on PCBs.

E-waste Management: Introduction, sources, composition of e-waste, effects of e-waste on environment and human health. Methods of disposal of e-waste, recycling of e-waste. Extraction of gold from e-waste. Role of stack holders in e-waste management.

UNIT–IV Sensing methods and Polymer materials	**10 Hrs.**

Sensing Methods: Sensors, working principle, types of sensors(Optical, Electrochemical & their applications in real life). Colorimetric sensors- Principle, instrumentation and its application in the estimation of copper in PCBs. Potentiometric sensors-Principle, instrumentation and its application in the estimation of iron in steel. Conductometric sensors- Principle, instrumentation and its application in the estimation of acid mixture.

Polymers: Introduction, synthesis, conduction mechanism of polyacetylene (n & p type) and electronic devices applications. Number average and weight average molecular weight and numericals on Mn and Mw. Synthesis and properties of Polydimethylsiloxane (PDMS) in RFID (Radio Frequency Identification) applications. Synthesis and properties of Polyvinylidene Fluoride (PVDF), applications in E-nose devices. Polymer Composites**:** Introduction, synthesis and properties of epoxy resin- Fe_3O_4 composite for sensors applications, synthesis of Kevlar Fiber Reinforced Polymer (KFRP)-properties and smart electronic devices applications.

Practical Module

1. Estimation of strength of acid in lead acid battery.
2. Determination of alkalinity of given boiler water sample.
3. Estimation of iron in TMT bar by diphenyl amine indicator method.
4. Estimation of total hardness of water by EDTA method.
5. Estimation of percentage of CaO in cement.
6. Estimation of acid mixture by conductometric sensor.
7. Determination of pKa of vinegar using pH sensor.
8. Estimation of iron in rust sample by Potentiometric sensor.
9. Colorimetric estimation of copper present in e-waste by optical sensor.
10. Determination of coefficient of viscosity of a lubricant by Ostwald's viscometer.
11. Data analysis of pka of a week acid and its interpretation using origin software.
12. Chemical structure drawing using software: Chem Draw/ Chem Sketch.

Text Books:

1. R. V. Gadag and Nityananda Shetty, A Text Book of Engineering Chemistry, I. K. International Publishing house. 2nd Edition, 2016.
2. Dr. Mahesh B and Dr. Roopashree B, , Engineering Chemistry, Publisher Sunstar Bengaluru, ISBN978-93-85155-70-3, 2022
3. Dr. K. R. Mahadik & Dr. L. Sathiyanarayanan, Instrumental Methods of Analysis, Nirali Prakashan, 2nd Edition, 2023.
4. V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, Polymer Science, New age Int. Publishers 4th Edition, 2021.
5. Douglas A. Skoog, F. James Holler, Stanley R., Principles of Instrumental Analysis, Cengage Learning Crouch 7th Edition, 2020.

Reference Books:

1. Wiley Engineering Chemistry, Wiley India Pvt.Ltd.,,ISBN-978-81-265-47205, 5th Edition 2019
2. Kirby W. Beard, Linden's Hand book of Batteries , Mc Graw Hill, 5th Edition,2019.
2. Takatoshi Tsujimura, OLED Display Fundamentals and Applications, Wiley–Blackwell, 1st Edition 2012
3. F.H.Froes, etal. High Performance Metallic Materials for Cost Sensitive Applications John, Wiley &

Sons, 2010
4. PC Jain & MonicaJain, Engineering Chemistry, Dhanpat Rai Publication, 6th Edition. 2015
5. Hari Singh, Nano structured materials and nanotechnology, Nalwa, academic press, 1st Edition, 2002.
6. Sulabha K Kulkarni, Nanotechnology Principles and Practices, Capital Publishing Company, 3rd Edition 2014
7. Phanikumar, Principles of nano technology, Sci Tech publications, 2nd Edition, 2010.
8. B.S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar. Chemistry for Engineering Students, Subash Publications,5th Edition, 2014
9. O.G.Palanna, Engineering Chemistry, Tata Mc Graw Hill Education Pvt. Ltd. New Delhi, 4th Reprint, 2015.
10. Malini S, KS Anantha Raju, Chemistry of Engineering materials, CBS publishers Pvt., Ltd., New Delhi,1st Edition, 2022.
11. Anupma Rajput, Laboratory Manual Engg. Chemistry, Dhanpat Rai & Co., New Delhi, 1st Edition, 2022.
12. Dr. S.S. Dhara and Dr. S.S. Umare, "A Text book of Engineering Chemistry" S.Chand & Co., Ltd., New Delhi., ISBN- 81-219-0359-9, 12th Edition 2011.

Web Links and Video Lectures

1. https://share.google/aVVplsAOe1orXXpim
2. https://share.google/QwXas6NSPc0of6zM9
3. https://share.google/ERD47wgd8C01N0yX4
4. https://share.google/CCs0ZW05ZZ2UqoMWx
5. https://share.google/1mGdeQfw5cC1Mf6VM
6. https://share.google/puIX4PlD66rLXHyVL
7. https://share.google/FJdSn0UcT7ft4W7lF
8. https://share.google/jw5PdB5k0c0IlQATa
9. https://share.google/1jBk456vAZqjq2L7d

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11			
CO1	3 WK1, WK2, WK3,	2 WK1, WK2 , WK3									1			
CO2	3 WK1, WK2, WK3,	2 WK1, WK3									1			
CO3	3 WK1, WK2, WK3,	2 WK1, WK2, WK3									1			
CO4	3 WK1, WK2, WK3,	2 WK1, WK2, WK3									1			

Course Code		:	1BCHS102C/202C	Applied Chemistry for Computer Science Engineering Stream	Semester	:	II
L:T:P		:	3:0:2		Course Type	:	Integrated
Hours/Sem.	Teaching	:	42 + 26 Hrs		CIE Marks	:	50
	Learning(W+SL)	:	44 Hrs		SEE Marks	:	50
	Exam	:	05 + 03Hrs		Total Marks	:	100
	Total Hrs.	:	120 Hrs		Credits	:	04

Professional Competency:

Students Able to analyze and apply the knowledge of advanced materials to modern computing hardware, smart and energy-efficient systems.

Course Outcomes:

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

CO1: Analyse the display systems and advanced battery systems.

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

CO3: Evaluate the need of green materials in sustainable electronics and e-waste management.

CO4: Apply concepts of sensors and corrosion control in engineering applications.

UNIT-I Display systems and Advanced Battery systems — 11 Hrs.

Display systems: Definition of optoelectronic devices. Photoactive materials-definition and working principles in display system. Electroactive materials; definition and working principles in display systems. Light Emitting Diode (LED): Introduction, construction, working and application of Light emitting diode (LED). Organic Light Emitting Diode (OLED): Introduction, anatomy of OLED, types of OLED, comparison between LED and OLED, advantages, disadvantages of OLED and applications of OLED. Quantum Light Emitting Diodes (QLED's); Properties and applications. Light emitting electrochemical cells- Introduction, properties and applications.

Advanced Battery Chemistry: Introduction, electrode potential. Concentration cell and numerical problems. Classification of batteries, characteristics of battery: voltage, capacity, power density, shelf life and cycle life. Construction, working and applications of sodium ion battery and lithium ion battery. Construction, working and applications of ultra-small asymmetric super capacitor in IoT/ wearable devices. Construction and working of redox flow battery and its applications.

UNIT–II Quantum Dot materials and Polymer — 10Hrs.

Quantum Dot materials: Introduction to Quantum Dots (QDs), types, optical and electrical properties of quantum dots (QDs). In-organic Quantum Dot materials (OQDMs): Introduction, synthesis and properties of silicon based QDs by Sol-Gel Method and CdSe quantum dots by hot injection method and applications in optoelectronic devices. Quantum Dot-based Copper Conductive Ink by Wet chemical reduction method, properties and applications.

Polymer: Introduction, molecular weight of polymers - number and weight average molecular weight of polymers, numerical problems. Structure-property relationship of polymers, synthesis, properties of nylon-12 and advantages in 3D printing applications. Synthesis and properties of PVC and PMMA for device applications. Conducting polymers-Introduction, synthesis of polyacetylene. Conduction mechanism of poly acetylene (n and p type) and its engineering applications.

UNIT–III Green Materials and E-Waste Management — 11 Hrs.

Green Chemistry: Introduction, principles of green chemistry, properties and applications of green solvents for server heat management, biosynthesis and properties of glycerol trioleate ester for server and IT infrastructure applications. Green synthesis of ZnO nanoparticles for magnetic radio frequency identification (RFID) & Internet of Nano Things (IONT) system applications.

Biomaterials: Introduction, synthesis and properties of poly lactic acid (PLA) and polyethylene glycol (PEG) for touch screen applications. Synthesis and properties of alginate hydrogel for Brain-Computer Interfaces (BCIs) applications.

E-waste: Introduction, sources, composition of e-waste, effects of e-waste on environment and Human Health. Artificial intelligence in e-waste management and its applications, extraction of Gold from e-waste by bioleaching method, direct recycling method of lithium-ion batteries. Role of stake holders in environmental management of e-waste (producers, consumers, recyclers, statutory and bodies).

UNIT–IV Sensing methods and Corrosion Control	**10 Hrs.**

Sensing methods: Sensors, Working principle, Colorimetric sensors- Principle, instrumentation and its application in the estimation of copper in PCBs. Potentiometric sensors-Principle, instrumentation and its application in the estimation of iron in steel. Conductometric sensors- Principle, instrumentation and its application in the estimation of acid mixture. pH sensor its applications in the estimation of pH of soil sample.

Corrosion: Introduction, electrochemical theory of corrosion, types of corrosion-differential metal and differential aeration corrosion, Factors affecting the rate of corrosion. Corrosion control-Galvanization, anodization, Cathodic protection by sacrificial anodic method, vapour corrosion inhibitors for protecting computer circuit boards, corrosion penetration rate (CPR)-definition, importance and numerical on CPR.

Practical Module

1. Estimation of strength of acid in lead acid battery.
2. Determination of alkalinity of given boiler water sample.
3. Estimation of iron in TMT bar by diphenyl amine indicator method.
4. Estimation of total hardness of water by EDTA method.
5. Estimation of percentage of CaO in cement.
6. Estimation of acid mixture by conductometric sensor.
7. Estimation of iron in rust sample by Potentiometric sensor.
8. Determination of pKa of vinegar using pH sensor.
9. Colorimetric estimation of copper present in e-waste by optical sensor.
10. Determination of coefficient of viscosity of a lubricant by Ostwald's viscometer.
11. Data analysis of pKa of a week acid and its interpretation using origin software.
12. Chemical structure drawing using software: Chem Draw/Chem Sketch.

Text Books:

1. R. V. Gadag and Nityananda Shetty, A Text Book of Engineering Chemistry, I. K. International Publishing house. 2nd Edition, 2016.
2. Dr. Mahesh B and Dr. Roopashree B, Engineering Chemistry, Publisher Sunstar Bengaluru, ISBN978-93-85155-70-3, 1st Edition, 2022.
3. Dr. K. R. Mahadik & Dr. L. Sathyanarayanan, Instrumental Methods of Analysis, Nirali Prakashan, 1st Edition, 2020.
4. V. R. Gowariker,N V Viswanathan, Jayadev, Sreedhar, Polymer Science, New age Int. Publishers, 4th Edition, 2021.
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1. Wiley Engineeering Chemistry, Wiley India Pvt.Ltd.,,ISBN-978-81-265-47205, 5th Edition 2019
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2. Takatoshi Tsujimura, OLED Display Fundamentals and Applications, Wiley–Blackwell, 2012.
3. F.H.Froes, etal. High Performance Metallic Materials for Cost Sensitive Applications John, Wiley & Sons, 2010.
4. PC Jain & Monica Jain, Engineering Chemistry, Dhanpat Rai Publication, 6th Edition. 2015.
5. Hari Singh, Nano structured materials and nanotechnology, Nalwa, Academic press, 1st Edition,2002

6. Sulabha K Kulkarni, Nanotechnology Principles and Practices, Capital Publishing Co., 3rd Edn.2014.

7. Phanikumar, Principles of nano technology, Sci Tech publications, 2nd Edition, 2010.
8. B.S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar. Chemistry for Engineering Students, Subash Publications, 5th Edition, 2014.
9. O.G.Palanna, Engineering Chemistry, Tata Mc. Graw Hill Education Pvt. Ltd. New Delhi, 4th Reprint, 2015.
10. Malini S KS Anantha Raju, Chemistry of Engineering materials, CBS publishers Pvt. Ltd. 1st Edition 2022
11. Anupma Rajput, Laboratory Manual Engg. Chemistry, Dhanpat Rai & Co.
12. Dr. S.S. Dhara and Dr. S.S. Umare, "A Text book of Engineering Chemistry" S.Chand & Co., Ltd., ISBN-81-219-0359-9, 12th Edition 2011.

Web Links and Video Lectures:

1. https://share.google/LtpHOOUap66I6NwOV
2. https://share.google/QwXas6NSPc0of6zM9
3. https://share.google/ERD47wgd8C01N0yX4
4. https://share.google/CCs0ZW05ZZ2UqoMWx
5. https://share.google/1mGdeQfw5cC1Mf6VM
6. https://share.google/puIX4PlD66rLXHyVL
7. https://share.google/s80xVHUdermr8iWbQ
8. https://share.google/CvfPaREV6ML3FuNLP
9. https://share.google/xcq5qgLDkw1FUzfBQ
10. https://share.google/4yT2LLms6onWX21Up
11. https://share.google/FJdSn0UcT7ft4W7lF
12. https://share.google/jw5PdB5k0c0IlQATa
13. https://www.scribd.com/document/438268216/Engineering-Chemistry-Notes-For-vtu-stud-pdf

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 WK1, WK2, WK3,	2 WK1, WK3									1	-	-	-
CO2	3 WK1, WK2, WK3,	2 WK1, WK2, WK3									1	-	-	-
CO3	3 WK1, WK2, WK3,	2 WK1, WK3,									1	-	-	-
CO4	3 WK1, WK2, WK3,	2 WK1, WK2, WK3,									1	-	-	-

Course Code		**:**	**1BMEC103C/ 1BMEC203C**	**Computer Aided Engineering Drawing for CV Stream**	**Semester**	**:**	**01/02**
L:T:P		**:**	**2:0:3**		**CourseType**	**:**	**PCC**
Hours/Sem.	**Teaching**	**:**	**70 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**14 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:

Prepare and communicate accurate engineering drawings of geometric entities, solids, and engineering components using manual drafting and Computer Aided Engineering Drawing (CAED) tools in compliance with engineering standards and industry requirements.

Course Outcomes:

After successful completion of the course, the student will be able to apply engineering drawing principles through manual drafting and computer-aided drafting (CAD) tools to:

CO1:Construct geometrical shapes and draw orthographic projections of points, lines and plane surfaces in different orientations with respect to the principal planes.
CO2:Draw orthographic projections of right regular solids in different orientations with respect to the principal planes.
CO3:Develop lateral surfaces of right regular solids, their truncated forms and orthographic to isometric projections of solids.
CO4: Create 2D drawings of basic building components.

UNIT–I	**25 Hrs.**

Introduction
Introduction, Significance of engineering drawing, Different types of lines used in engineering drawing, Dimensioning: - elements and systems of dimensioning, Geometrical Constructions: -triangles and regular polygons, Orthographic Projections: - principal planes, principal views, four quadrants, systems of projection, symbol of projection. Introduction to Computer Aided Drafting software.

Orthographic Projections of Points, Lines and Planes
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).

UNIT–II	**15 Hrs.**

Orthographic Projection of Solids
Orthographic projection of right regular solids (Resting on HP only and axis inclined to HP only); prisms, pyramids, cylinders and cones.

UNIT-III	**24 Hrs.**

Development of lateral surfaces of Solids:
Development of lateral surfaces of right regular prisms, pyramids, cylinders and cones with base on HP and their truncations (no problems on lateral surfaces of trays, tetrahedrons, spheres and transition pieces).

Isometric projections (Using Isometric Scale only)
Introduction, isometric scale, isometric projection of simple geometrical shapes, isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres, frustums and combination of two co-axial solids.

UNIT-IV	06 Hrs.
Building Components Drafting (free hand sketch) Basic Building Components: foundations, columns, beams, slabs, walls, doors windows, staircase, assigning materials and rendering building components. Drafting a 2D floor plan for a simple single-storey residential/commercial building. .	
Text Books:	
1. K. R. Gopalakrishna and Sudhir Gopalakrishna, "A Textbook of Computer Aided Engineering Drawing", Subash Stores Bangalore, 39th Edition, 2017. 2. N. D. Bhatt, "Engineering Drawing-Plane and Solid Geometry", Charotar Publishing House Pvt. Limited, 56th Revised and Enlarged Edition, 2025.	
Reference Books:	
1. S. N. Lal and T. Madhusudhan, "Engineering Visualisation", Cengage Learning India Pvt. Ltd., 1st Edition, 2022. 2. Prof. P. J. Shah, "Computer Aided Engineering Drawing", S. Chand Publishing, 2021. 3. M. B. Shah and B. C. Rana, "Engineering Drawing", Pearson Education, 2nd Edition, 2009.	
Web Links and Video Lectures (e-Resources):	
1. https://nptel.ac.in/courses/112104172 2. https://nptel.ac.in/courses/112102304 3. https://nptel.ac.in/courses/112105294 4. https://www.coursera.org/courses?query=3d%20modeling&utm 5. https://www.classcentral.com/subject/sheet-metal-design?utm	

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3 (WK 1 and WK3)	2 (WK 1 and WK3)	-	-	3 (WK6)	-	1 (WK 9)	1	-	-	1	2	-
CO2	3 (WK 1 and WK3)	2 (WK 1 and WK3)	-	-	3 (WK6)	-	1 (WK 9)	1	-	-	1	2	-
CO3	3 (WK 1 and WK3)	2 (WK 1 and WK3)	-	-	3 (WK6)	-	1 (WK 9)	1	-	-	1	2	-

CO4	**2 (WK 1 and WK3)**	**2 (WK 1 and WK3)**	**-**	**-**	**1 (WK6)**	**-**	**1 (WK 9)**	**1**	**-**	**-**	**1**	**2**	**-**

Course Code		**:**	**1BMEE103C/ 1BMEE203C**	**Computer Aided Engineering Drawing for EEE Stream**	**Semester**	**:**	**01/02**
L:T:P		**:**	**2:0:3**		**Course Type**	**:**	**PCC**
Hours/Sem.	**Teaching**	**:**	**70 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**14 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:

Prepare and communicate accurate engineering drawings of geometric entities, solids, and engineering components using manual drafting and Computer Aided Engineering Drawing (CAED) tools in compliance with engineering standards and industry requirements.

Course Outcomes:

After successful completion of the course, the student will be able to apply engineering drawing principles through manual drafting and computer-aided drafting (CAD) tools to:

CO1:Construct geometrical shapes and draw orthographic projections of points, lines and plane surfaces in different orientations with respect to the principal planes.

CO2:Draw orthographic projections of right regular solids in different orientations with respect to the principal planes.

CO3:Develop lateral surfaces of right regular solids, their truncated forms and orthographic to isometric projections of solids.

CO4: Create schematic 2D diagrams of electrical components.

UNIT–I	**25 Hrs.**

Introduction

Introduction, Significance of engineering drawing, Different types of lines used in engineering drawing, Dimensioning: - elements and systems of dimensioning, Geometrical Constructions: -triangles and regular polygons, Orthographic Projections: - principal planes, principal views, four quadrants, systems of projection, symbol of projection. Introduction to Computer Aided Drafting software.

Orthographic Projections of Points, Lines and Planes

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).

UNIT–II	**15 Hrs.**

Orthographic Projection of Solids

Orthographic projection of right regular solids (Resting on HP only and axis inclined to HP only); prisms, pyramids, cylinders and cones.

UNIT-III	**24 Hrs.**

Development of lateral surfaces of Solids:

Development of lateral surfaces of right regular prisms, pyramids, cylinders and cones with base on HP and their truncations (no problems on lateral surfaces of trays, tetrahedrons, spheres and transition pieces).

Isometric projections (Using Isometric Scale only)

Introduction, isometric scale, isometric projection of simple geometrical shapes, isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres, frustums and combination of two co-axial solids.

UNIT-IV	**06 Hrs.**

Electrical Drawing (free hand sketch)

2D drawing of switches, sockets, panels, junction boxes and electric circuits. Schematic diagrams of automatic fire alarm, call bell system, UPS system, basic power system and residential layout.

Text Books:

1. K. R. Gopalakrishna and Sudhir Gopalakrishna, "A Textbook of Computer Aided Engineering Drawing", Subash Stores Bangalore, 39th Edition, 2017.
2. N. D. Bhatt, "Engineering Drawing-Plane and Solid Geometry", Charotar Publishing House Pvt. Limited, 56th Revised and Enlarged Edition, 2025.

Reference Books:

1. S. N. Lal and T. Madhusudhan, "Engineering Visualisation", Cengage Learning India Pvt. Ltd., 1st Edition, 2022.
2. Prof. P. J. Shah, "Computer Aided Engineering Drawing", S. Chand Publishing, 2021.
3. M. B. Shah and B. C. Rana, "Engineering Drawing", Pearson Education, 2nd Edition, 2009.

Web Links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/112104172
2. https://nptel.ac.in/courses/112102304
3. https://nptel.ac.in/courses/112105294
4. https://www.coursera.org/courses?query=3d%20modeling&utm
5. https://www.classcentral.com/subject/sheet-metal-design?utm

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Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3 (WK1 and WK3)	2 (WK1 and WK3)	-	-	3 (WK6)	-	1 (WK9)	1	-	-	1	2	-
CO2	3 (WK1 and WK3)	2 (WK1 and WK3)	-	-	3 (WK6)	-	1 (WK9)	1	-	-	1	2	-
CO3	3 (WK1 and WK3)	2 (WK1 and WK3)	-	-	3 (WK6)	-	1 (WK9)	1	-	-	1	2	-
CO4	2 (WK1 and WK3)	2 (WK1 and WK3)	-	-	1 (WK6)	-	1 (WK9)	1	-	-	1	2	-

Course Code		**:**	**1BMES103C/ 1BMES203C**	**Computer Aided Engineering Drawing for CSE Stream**	**Semester**	**:**	**01 / 02**
L:T:P		**:**	**2:0:3**		**Course Type**	**:**	**PCC**
Hours/Sem.	**Teaching**	**:**	**70Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**14 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:

Prepare and communicate accurate engineering drawings of geometric entities, solids, and engineering components using manual drafting and Computer Aided Engineering Drawing (CAED) tools in compliance with engineering standards and industry requirements.

Course Outcomes:

After successful completion of the course, the student will be able to apply engineering drawing principles through manual drafting and computer-aided drafting (CAD) tools to:

CO1:Construct geometrical shapes and draw orthographic projections of points, lines and plane surfaces in different orientations with respect to the principal planes.

CO2:Draw orthographic projections of right regular solids in different orientations with respect to the principal planes.

CO3:Develop lateral surfaces of right regular solids, their truncated forms and orthographic to isometric projections of solids.

CO4: Create basic 2D/3D diagrams of networking, router and switches.

UNIT–I	**25 Hrs.**

Introduction

Introduction, Significance of engineering drawing, Different types of lines used in engineering drawing, Dimensioning: - elements and systems of dimensioning, Geometrical Constructions: -triangles and regular polygons, Orthographic Projections: - principal planes, principal views, four quadrants, systems of projection, symbol of projection. Introduction to Computer Aided Drafting software.

Orthographic Projections of Points, Lines and Planes

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).

UNIT–II	**15 Hrs.**

Orthographic Projection of Solids

Orthographic projection of right regular solids (Resting on HP only and axis inclined to HP only); prisms, pyramids, cylinders and cones.

UNIT-III	**24 Hrs.**

Development of lateral surfaces of Solids:

Development of lateral surfaces of right regular prisms, pyramids, cylinders and cones with base on HP and their truncations (no problems on lateral surfaces of trays, tetrahedrons, spheres and transition pieces).

Isometric projections (Using Isometric Scale only) Introduction, isometric scale, isometric projection of simple geometrical shapes, isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres, frustums and combination of two co-axial solids.
UNIT-IV **06 Hrs.**
Computer Network Drawing (free hand sketch) 2D Network drawing: Network topology of wired and wireless networks. 3D drawing of router and switches.
Text Books:
1. K. R. Gopalakrishna and Sudhir Gopalakrishna, "A Textbook of Computer Aided Engineering Drawing", Subash Stores Bangalore, 39th Edition, 2017. 2. N. D. Bhatt, "Engineering Drawing-Plane and Solid Geometry", Charotar Publishing House Pvt. Limited, 56th Revised and Enlarged Edition, 2025.
Reference Books:
1. S. N. Lal and T. Madhusudhan, "Engineering Visualisation", Cengage Learning India Pvt. Ltd., 1st Edition, 2022. 2. Prof. P. J. Shah, "Computer Aided Engineering Drawing", S. Chand Publishing, 2021. 3. M. B. Shah and B. C. Rana, "Engineering Drawing", Pearson Education, 2nd Edition, 2009.
Web Links and Video Lectures (e-Resources):
1. https://nptel.ac.in/courses/112104172 2. https://nptel.ac.in/courses/112102304 3. https://nptel.ac.in/courses/112105294 4. https://www.coursera.org/courses?query=3d%20modeling&utm 5. https://www.classcentral.com/subject/sheet-metal-design?utm

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3 (WK 1 and WK3)	2 (WK 1 and WK3)	-	-	3 (WK6)	-	1 (WK 9)	1	-	-	1	2	-
CO2	3 (WK 1 and WK3)	2 (WK 1 and WK3)	-	-	3 (WK6)	-	1 (WK 9)	1	-	-	1	2	-

CO3	**3 (WK 1 and WK3)**	**2 (WK 1 and WK3)**	**-**	**-**	**3 (WK6)**	**-**	**1 (WK 9)**	**1**	**-**	**-**	**1**	**2**	**-**
CO4	**2 (WK 1 and WK3)**	**2 (WK 1 and WK3)**	**-**	**-**	**1 (WK6)**	**-**	**1 (WK 9)**	**1**	**-**	**-**	**1**	**2**	**-**

Course Code		**:**	**1BAIA103C/203C**	**Introduction to AI and Applications**	**Semester**	**:**	**1/2**
L:T:P*		**:**	**3:0:0**		**Course Type**	**:**	**ETC**
Hours/Sem.	**Teaching**	**:**	**42 Hrs.**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**28 Hrs.**		**SEE Marks**	**:**	**50**
	Exam	**:**	**3 Hrs.**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs.**		**Credits**	**:**	**03**

Professional Competency:

Develop the knowledge and skills to understand, apply, and evaluate artificial intelligence concepts, machine learning techniques, prompt engineering, and AI applications for solving real-world engineering problems ethically and effectively.

Course Outcomes:

After completion of the course, 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.

UNIT-I	**10 Hrs.**

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.

Textbook 1: Chapter 1 (1.1-1.5)

Machine Intelligence: Defining Intelligence, Components of Intelligence, Differences Between Human and Machine Intelligence, Agent and Environment.

Textbook 1: Chapter 3 (3.1-3.4)

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

Textbook 1: Chapter 4 (4.1-4.4)

UNIT-II	**11 Hrs.**

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

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

Textbook 2: Chapters 1 and 3

UNIT-III	**11 Hrs.**

Machine Learning: Techniques in AI, Machine Learning Model.

Textbook 1: Chapter 2 (2.1-2.2)

Computer Vision: Human Vision vs Computer Vision, Tasks in Computer Vision, Applications of Computer Vision, Understanding Image Pixels.

Textbook 1: Chapter 6 (6.1,6.4,6.6,6.9)

Trends in AI: AI and Ethical Concerns, AI as a Service (AIaaS).

Textbook 1: Chapter 8 (8.1- 8.2)

Expert System, Internet of Things, Artificial Intelligence of Things (AIoT).

Textbook 1: Chapter 9 (9.1- 9.3)

UNIT-IV	**10 Hrs.**

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

Textbook 1: Chapter 1 (1.6, 1.7, 1.8, 1.10, 1.11), Chapter 8 (8.3)

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)
Text Books:
1. Reema Thareja, (2023), Artificial Intelligence: Beyond Classical AI, Pearson Education. 2. Ajantha Devi Vairamani and Anand Nayyar, (2024), Prompt Engineering: Empowering Communication, (1st Edition), CRC Press, Taylor & Francis Group. 3. Saptarsi Goswami, Amit Kumar Das and Amlan Chakrabarti, (2024), AI for Everyone – A Beginner's Handbook for Artificial Intelligence, Pearson Education.
Reference Books:
1. Stuart Russell and Peter Norvig, (2023), Artificial Intelligence: A Modern Approach (4th Edition), Pearson Education. 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.

Course Outcomes	**Program Outcomes and WKs**											**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3 (WK3)	2 (WK4)	-	-	-	-	-	-	1	-	2	3	2	2
CO2	3	3 (WK4)	2	2	3 (WK6)	-	-	-	1	-	1	3	3	2
CO3	2	2	2 (WK4)	-	-	2 (WK6)	-	1 (WK8)	-	1	2	3	3	3
CO4	2	1	-	-	3 (WK5)	-	2 (WK7)	-	2	-	2	3	3	3
CO5	2	-	-	-	2 (WK5)	1 (WK6)	-	-	1	-	3 (WK 9)	3	3	2

Sl. NO.	**Activity on Creating Effective Prompts**
Note: To conduct the activity students can use any of the AI tools such as ChatGPT.	
1.	**Basic Prompt writing:** Create two different prompts to ask an AI about the topic "Electricity." The first prompt should be vague, and the second prompt should be clear and specific. Compare the responses you get and describe which prompt gave a better answer and why.
2.	**Zero-Shot Prompting:** Create a prompt that asks an AI to explain Ohm's Law without giving any example or background. Evaluate how well the AI explains the concept based on your prompt alone.
3.	**One-Shot and Few-Shot Prompting:** Provide the AI with a single example of how to calculate the resistance in a simple circuit. Then write your own prompt asking the AI to solve a similar resistance calculation. After that, add two more examples to your prompt and observe any changes in the AI's response quality.
4.	**Chain-of-Thought Prompting:** Develop a prompt that guides the AI step-by-step through calculating current flow in a circuit using Ohm's Law with resistors in series. Then, ask a final question for the AI to solve. Analyze how breaking down the reasoning steps impacts the accuracy

	of the answer
5.	**Prompt Refinement:** Start with an ambiguous prompt related to the "Water Cycle." Test the AI's response, note the confusion or errors, and then refine your prompt to make it clearer and more specific. Repeat this process twice and record how the AI's responses improve with each refinement. **Role-Based Prompting:** Create three prompts asking the AI to explain "Newton's Laws of Motion," each with a different role instruction: (a) as an expert engineer, (b) as a high school teacher, (c) as a beginner. Compare the tone, detail, and style of the responses.
6.	Creative Engineering Problem Prompts: Craft a prompt that asks the AI to brainstorm ideas for designing a low-cost water purification system suitable for rural areas. Encourage creativity by adding phrases like **"limited resources"** and **"sustainability"**.
7.	Ethical Prompt Design Discussion: Identify a biased prompt related to job descriptions (e.g. language with respect to a gender). Rewrite the prompt to remove bias and create a neutral, inclusive version. Explain why this revision is more ethical.
8.	Simulated Customer Support Chatbot: Develop a prompt that instructs the AI to play the role of a technical support agent helping a customer troubleshoot a failure in an electronic circuit. Include instructions to keep the tone friendly and professional and to ask diagnostic questions.
9.	Multi-Language Prompting: Develop a prompt that asks the AI to translate a simple engineering glossary (5 technical terms) from English to your native language. Then modify the prompt to request additional explanations of these terms in the translated language.
10.	Review a curated set of different prompt types (e.g., for summarization, information extraction, paraphrasing, question answering) from a "Prompt Gallery." For each prompt type, match it with a real world task (e.g., summarizing a lecture note, extracting names from a project report). Test at least three prompt templates on an AI tool or by role-play (students simulate being the AI), with varied wording. Record the outcomes and discuss which prompt (or template) was most effective for each task, and explain why you think it worked best. Reflect on how changing small parts of a prompt can alter model response quality, completeness, or accuracy.
11.	Choose a real engineering challenge or societal problem relevant to your field (e.g., "Reducing plastic waste in campus cafeterias" or "Optimizing solar panel placement on campus rooftops"). Draft an initial prompt that asks an AI to propose practical solutions. Share the AI's (or peer's) answer in small groups and identify aspects that are missing, vague, or not actionable. Refine your prompt based on feedback (e.g., specify constraints, ask for step-by-step solutions, or require a list of pros and cons). Repeat the process one more time, refining again for further clarity or specificity. Document the entire prompt-refinement process and share the best solution generated, along with a brief analysis of how prompt improvements led to better responses

Rubrics for Learning Activity (Creating Effective Prompts):

Component & CO- PO Mapping	**Outstanding (5)**	**Exceeds Expectations (4)**	**Meets Expectations (3)**	**Needs Improvement (2)**	**Unsatisfactory (1)**
Appropriate Use of Prompting	Demonstrates precise and	Correctly applies the	Uses the prompting	Limited understanding of	No evidence of correct prompting

Technique [CO4] [PO1, PO5]	creative application of the intended prompting technique (e.g., zero-shot, few-shot, role-based) with full alignment to objectives.	prompting technique with minor gaps or missed opportunities.	technique, but with partial understanding or inconsistent application.	the technique; incorrect or weak application	technique use.
Analysis & Comparison of Responses [CO1] [PO2, PO4]	Provides thorough, insightful, and well supported analysis of AI responses, comparisons highlight key strengths and weaknesses	Provides clear analysis with relevant comparisons, though slightly less detailed.	Provides basic analysis with limited insight, comparisons are present but shallow.	Minimal analysis, comparisons are weak or incomplete.	No meaningful analysis or comparison.
Creativity & Problem-Solving [CO3, CO5] [PO3, PO11]	Demonstrates outstanding creativity and innovation in crafting prompts, especially for problem-solving or design tasks	Demonstrates creativity and some innovation; solutions are practical.	Shows moderate creativity; prompts are functional but not innovative.	Minimal creativity; prompts are repetitive or unimaginative.	No creativity or problem-solving is evident.
Ethical Awareness & Inclusivity [CO-5] [PO7]	Identifies biases clearly and revises prompts to be fully ethical, inclusive, and culturally sensitive	Identifies some biases and revises prompts to improve inclusivity.	Attempts bias identification, but revisions are incomplete or partly effective.	Minimal effort is made to address bias; inclusivity not fully considered.	No consideration of bias or ethics is used in prompts.
Clarity & Specificity of Prompts, Documentation & Reflection [CO1, CO4] [PO8, PO9, PO11]	Prompts are self explanatory, specific, and well structured for the intended activity; no ambiguity is present. Documentation is complete, well organized,	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

	and includes deep reflection on improvements across iterations.				

Course Code		**:**	**1BCVA104N**	**Introduction to Civil Engineering**	**Semester**	**:**	1/2
L:T:P*		**:**	**3 : 0 : 0**		**Course Type**	**:**	**ESC**
1Hours/Sem.	**Teaching**	**:**	**42 Hrs.**		**CIE Marks**	**:**	50
	Learning (TW+SL)	**:**	**42 Hrs.**		**SEE Marks**	**:**	50
	Exam	**:**	**06 Hrs.**		**Total Marks**	**:**	100
	Total Hrs.	**:**	**90 Hrs.**		**Credits**	**:**	03

Professional Competency:

This course lays the engineering-science foundation for Civil Engineering practice by introducing students to the scope, disciplines and materials alongside the principles of engineering mechanics that govern structural behaviour.

Course Outcomes:

After completion of the course, student will be able to:

CO1: Describe the scope and disciplines of civil engineering, common construction materials, and the structural elements of a building.

CO2: Resolve and compose coplanar force systems and compute moments of forces and couples using fundamental principles of statics.

CO3: Apply the principles of equilibrium and free body diagrams to determine support reactions for statically determinate beams.

CO4: Determine the centroid and moment of inertia of plane areas, including composite and built-up sections, using the method of integration.

Unit-I	**10 Hrs.**

Introduction and Scope of Civil Engineering: Basics and Importance of Engineering and Civil Engineering, Role of Civil Engineers in society, Broad disciplines of Civil Engineering.

Basic Materials of Construction: Stones, bricks, mortars, Concrete, Construction Chemicals, Steel, Carbon Composites, Plastics in Construction, 3D printing, Recycling of Construction & Demolition wastes, Sustainable Building Materials.

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

Unit-II	**10 Hrs.**

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.

Unit-III	**11 Hrs.**

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.

Unit-IV	**11 Hrs.**

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.

Moment of Inertia of Plane Areas: Introduction, Moment of inertia about an axis, Parallel axes theorem, Perpendicular axes theorem, Polar moment of inertia, Radius of gyration. Second moment of inertia of square, rectangular, triangular and circular areas from the method of Integration, Moment of inertia of composite areas and simple built-up sections: Numerical Examples.

Text Books:

1. Kolhapure B K, "Elements of Civil Engineering and Engineering Mechanics", EBPB, 2014.
2. Sawant H. J. and Nitsure S. P., "Elements of Civil Engineering and Mechanics", Technical Publications, 2018 Scheme Edition, 2019.

Reference Books:

1. Beer F P and Johnston E R, "Vector Mechanics for Engineers: Statics and Dynamics", McGraw Hill, 12th Edition, 2019.
2. Hibbeler R C, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson, 15th Edition, 2022.
3. Meriam J L, Kraige L G and Bolton J N, "Engineering Mechanics: Statics", Wiley Publications, 9th Edition, 2017.

Table 5: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	2 (WK1 and WK3)	-	-	-	-	3 (WK7)	2 (WK5)	-	-	-	-	2	1
CO2	3 (WK1, WK2, and WK3)	2 (WK2 and WK3)	-	-	-	-	-	-	-	-	-	2	-
CO3	3 (WK1 and WK3)	3 (WK2 and WK3)	2 (WK4)	-	-	-	-	-	-	-	-	3	-
CO4	3 (WK1, WK2, and WK3)	2 (WK2)	-	-	-	-	-	-	-	-	-	3	-

Course Code		:	1BEEA104N/204N	**Introduction to Electrical Engineering**	Semester	:	I / II
L:T:P		:	3:0:0		Course Type	:	ESC
Hours/Sem	Teaching	:	42 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs		SEE Marks	:	50
	Exam	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	90 Hrs		Credits	:	03

Professional Competency:

Demonstrate the ability to apply fundamental electrical engineering principles—including DC and AC circuit analysis, electromagnetism, and electrical safety—to analyze, design, and solve practical electrical engineering problems.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply Ohm's law, KCL, and KVL to analyze DC circuits, explain the principles of electromagnetic induction and related laws with numerical applications.
2. Analyze AC circuit parameters and evaluate voltage, current, power relationships in single-phase and three-phase systems.
3. Describe the operation of DC machines, transformers, and three-phase induction motors, and compute EMF, slip, losses, and efficiency
4. Illustrate basic electrical power generation methods, identify domestic wiring systems, and implement electrical safety practices and billing calculations.

Unit - 1 (11 Hours)

DC Circuits: Ohm's law and its limitations, KCL & KVL, series, parallel, series-parallel circuits. Simple Numerical.

Electromagnetism: Faraday's laws of electromagnetic induction, Lenz's law, Fleming's rules, statically and dynamically induced emf, concepts of self and mutual inductance, coefficient of coupling, energy stored in magnetic field, Numerical.

Unit - 2 (10 Hours)

Single Phase AC Circuits: Generation of AC voltage/current. Definitions: time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. Vector representation of alternating quantity: Lag, lead and in phase quantities. Voltage and current relationship in R, L, and C circuits, concept of impedance, analysis of R L, R-C, R-L-C series circuits, active power, reactive power and apparent power, concept of power factor, Numerical.

Unit - 3 (11 Hours)

Three Phase AC Circuits: Generation of three phase AC quantity, advantages and limitations, star and delta connection, relationship between line and phase quantities, Numerical.

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

DC Motor: Principle of operation, back emf and its significance, Types of motors, Numerical.

Three-phase induction Motors: Concept of rotating magnetic field, Principle of operation, Constructional features of squirrel cage and slip ring induction motor. Slip and its significance, Numerical.

Unit - 4 (10 Hours)

Power Generation: Hydro, Thermal, Nuclear power plants: Block diagram, Operation, Factors to be considered for site selection, Advantages and disadvantages.

Transformers: Principle of operation, Construction and Types of single-phase transformers, EMF equation, losses. Efficiency and condition for maximum efficiency, Numerical.

Domestic Wiring: Types of wiring, Two way and three way control of loads. Calculation of electricity bill for domestic consumers.

Electrical Safety: Electric Shock, effect of shock on body, Factors affecting the impact of electric shock on human body, Safety Precautions to avoid shock, Earthing and its types.

Text Books:

1. Edward Hughes, "Electrical and Electronic Technology", Pearson Publications, 10th Edition, 2010.
2. B. L Theraja, "Fundamentals of Electrical Engineering and Electronics", S. Chand Publications, 27th Edition, 2008.

Reference Books:

1. D C Kulshreshth, “Basic Electrical Engineering”, Tata McGraw Hill, 1st Edition 2019.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 4th edition, 2019.
3. V. K. Mehta, Rohit Mehta, “Principles of Electrical Engineering & Electronics”, S. Chand and Company Publications, 2nd edition, 2015.
4. A K Sawhney, “Electrical and electronic measurements and instrumentation”, A K Sawhney, DhanapatRai and Co. edition, 2015.
5. Rajendra Prasad, “Fundamentals of Electrical Engineering”, PHI Learning, 2nd Edition, 2009.
6. V. N. Mittle& A. Mittal, “Basic Electrical Engineering”, Tata McGraw-Hill Education, 2005.
7. S. K. Bhattacharya, “Basic Electrical and Electronics Engineering”, 2nd Edition, Pearson Publications, 2017.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2)		1 (WK8)							1 (WK8)	2	1	1
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2)		1 (WK8)							1 (WK8)	2	1	1
CO3	3 (WK1) (WK2) (WK3) (WK4)	1 (WK3)	1 (WK5)								1 (WK8)	3	1	1
CO4	2 (WK1) (WK2) (WK3) (WK4)	1 (WK3)				2 (WK5) (WK7)					1 (WK8)	2		1

Course Code		**:**	**1BECA104/204N**	**Introduction to Electronics & Communication Engineering**	**Semester**	**:**	**I/II**
L:T:P		**:**	**3:0:0**		**Course Type**	**:**	**ESC-I Theory**
Hours/Sem.	**Teaching**	**:**	**42 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**42 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90Hrs**		**Credits**	**:**	**03**

Professional Competency:

Apply foundational concepts of electronic components, analog and digital circuits, and communication systems to design, analyze, and troubleshoot basic electronic and communication devices.

Course Outcomes:

After completion of the course, student will be able to:

1. Differentiate and analyze the applications of electronic devices and circuits.
2. Analyze the operation of oscillators, op amps and its applications.
3. Analyze different number systems, logic circuits and embedded systems.
4. Describe communication system and modulation techniques.

Unit-I	**11Hrs.**

Power Supplies: Block diagram, PN junction diode characteristics, half-wave rectifier, full-wave rectifiers and filters, voltage regulators, voltage multipliers.
BJT Characteristics: Introduction, Common base and common emitter Characteristics
Self-study component: Switched mode power supply.

Unit-II	**11Hrs.**

Amplifier and Oscillators: Single stage CE amplifier, Barkhausen criterion, sinusoidal and non-sinusoidal oscillators, Ladder network oscillator, Wein bridge oscillator, (Only Concepts, working, and waveforms. No mathematical derivations)
Operational amplifiers: Ideal op-amp; characteristics of ideal and practical op-amp; Practical op-amp circuits: Inverting and non-inverting amplifiers, voltage follower, summer, integrator, and differentiator.
Self-study component: Op-amp as zero crossing detectors.

Unit-III	**10Hrs.**

Boolean Algebra and Logic Circuits: Binary numbers, number base conversion, octal & hexa decimal numbers, complements, basic definitions, axiomatric definition of Boolean algebra, basic theorems and properties of Boolean algebra, digital logic gates. **Combinational logic**: Introduction, design procedure, Adders- Half adder, Full adder, Parallel adder.
Embedded Systems: Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, Elements of an Embedded System, Core of the Embedded System, Microprocessor vs Microcontroller, RISC vs CISC.
Self-study component: Half subtractor and full subtractor.

Unit-IV	**10Hrs.**

Communication System: Modern communication system, types of communication systems.
Analog Modulation Schemes: Amplitude Modulation, Frequency Modulation. (only concepts)
Digital Modulation Schemes: Advantages of digital communication over analog communication, ASK, FSK, PSK, radio signal transmission multiple access techniques.
Self-study component: Opto-couplers.

Text Books:

1. Mike Tooley, “Electronic Circuits, Fundamentals & Applications”, Elsevier, 4th Edition, 2015
2. M. Morris Mano, “Digital Logic and Computer Design”, PHI Learning, 2008 ISBN-978-81-203-0417-84
3. D. P. Kothari, I. J. Nagrath, “Basic Electronics”, McGraw Hill Education (India), 2nd edition, 2018
4. K V Shibu, “Introduction to Embedded Systems”, McGraw Hill Education (India), Private Limited, 2nd Edition, 2016
5. S L Kakani and Priyanka Punglia, “Communication Systems”, New Age International Publisher, 2017.

Reference Books:

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall, 2006.
2. Floyd and Jain, “Digital fundamentals”, Pearson, 8th edition, 2006.
3. Jacob Milliman, Christos C. Halkies, “Electronics Devices and Circuits”, TMH, 2001

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1, WK2, WK3, and WK4)	3 (WK1, WK2, WK3, and WK4)	2 (WK5)		2 (WK2, and WK6)	2 (WK1)						3		
CO2	3 (WK1, WK2, WK3, WK4)	2 (WK1, WK2, WK3, and WK4)	3 (WK5)		2 (WK6)	1 (WK1)						3		
CO3	3 (WK1, WK2, WK3 and WK4)	2 (WK2, WK3, and WK4)	3 (WK5)		3 (WK2)				1			3		
CO4	3 (WK1, WK2, and WK3)	1 (WK3, and WK4)	1		2	1 (WK1)			1		1	3		
Course Contribution to POs and PSOs	3	2	2.25		2.25	1			0.5		0.25	3		

Course Code		**:**	**1BMEA104 / 204N**	**Introduction to Mechanical Engineering**	**Semester**	**:**	**01 / 02**
L:T:P		**:**	**3:0:0**		**Course Type**	**:**	**ESC - I**
Hours/Sem.	**Teaching**	**:**	**42 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW)	**:**	**42 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:

This course enables non-mechanical engineering students to acquire basic mechanical engineering knowledge required for multidisciplinary engineering applications.

Course Outcomes:

After completion of the course, student will be able to:

CO1: Explain the properties and applications of engineering materials and composite materials.

CO2: Apply the concepts of power plants, machine tool operations and joining processes in industrial contexts.

CO3: Determine the performance (Power and Efficiency) of IC engine and. Identify the components and working of IC Engine and refrigeration system.

CO4: Identify and describe the components, systems, and applications of mechatronics, gear drives, CNC, robotics and electric vehicle & hybrid vehicle.

UNIT–I	**10 Hrs**

Introduction: Role of Mechanical Engineering in Industries and Society. Streams in mechanical engineering and their relevance/significance.

Energy Sources and Power Plants: Basic working principles of Hydel power plant, Nuclear power plant, Solar power plant and Wind power plant

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.

UNIT–II	**11 Hrs**

Machine Tool Operations:

Working Principle of lathe, Lathe operations: Turning, facing, knurling. Working principles of Drilling Machine, drilling operations: drilling, reaming and tapping. Working of Milling Machine, Milling operations: plane milling, face milling and end milling. (No sketches of machine tools, sketches to be used only for explaining the operations).

Introduction to Advanced Manufacturing Systems: Introduction, components of CNC, advantages and applications of CNC, 3D printing.

Joining Processes: Soldering, Brazing and Welding, Definitions, classification of welding process, Arc welding, Gas welding and types of flames.

UNIT-III	**11 Hrs**

Introduction to Refrigeration and Air Conditioning: Principle of refrigeration, Refrigerants and their desirable properties. Working principle of VCR refrigeration system, Working principle of room air conditioner.

Introduction to IC Engines: Components and Working Principles, 4-Strokes Petrol and Diesel

Engines, Application of IC Engines, Numerical.
Insight into Future Mobility; Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of EVs and Hybrid vehicles.

UNIT-IV	**10 Hrs**

Power Transmission systems: Classification of gears, simple & compound gear trains, concepts of automatic and CVT transmission.
Automation technology: Definition of automation, types of automation, basic elements of automation and advantages.
Introduction to Mechatronics and Robotics: open-loop and closed-loop mechatronic systems. Classification based on robotics configuration: polar cylindrical, Cartesian coordinate and spherical. Application, Advantages and disadvantages.
Integrated system: Need for integration of technologies, ADAS (Advanced Driver Assistance System).

Text Books:

1. K R Gopala Krishna, "Elements of Mechanical Engineering", Subhash Publications, 38th Edition, 2018.
2. Hazra Choudhry and Nirzar Roy, "Elements of Workshop Technology (Vol. 1 and 2)", Media Promotersand Publishers Pvt. Ltd, 17th edition, 2023.

Reference Books:

1. Appu Kuttan KK, "Robotics", I K International Publishing House Pvt Ltd, 2013.
2. Jonathan Wickert and Kemper Lewis," An Introduction to Mechanical Engineering", Global Engineering. 5th Edition, September 2023.
3. Mikell P. Groover,"Automation, production systems and computer integrated manufacturing", Prentice Hall, 5th Edition, 2021.

Web links and Video Lectures (e-Resources):

1. https://www.vlcsolutions.com/blog/artificial-intelligence-in-manufacturing/
2. https://www.neuralconcept.com/post/how-is-ai-used-in-mechanical-engineering
3. https://www.youtube.com/watch?v=MKiiXubKaGM
4. https://www.youtube.com/watch?v=_canCYWZPsc
5. https://www.youtube.com/watch?v=lQ-MYnyxh7M

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	**Program Outcomes and (WKs)**											**Program Specific Outcomes (PSOs)**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	**2 (WK1 and WK3)**							**1**			**1**	**1**	
CO2	**2 (WK1 and WK3)**					**1 (WK5)**		**1**			**1**	**1**	
CO3	**2 (WK1, WK2 and, WK3)**							**1**			**1**	**1**	
CO4	**2 (WK1 and**				**1 (WK6)**			**1**			**1**	**1**	

	WK3)												

Course Code		:	**1BISA104N/ 1BISA204N**	**Essentials of Information Technology**	**Semester**	:	**2**
L:T:P		:	**3:0:0**		**Course Type**	:	**ESC**
Hours/Sem.	**Teaching**	:	**42 Hrs.**		**CIE Marks**	:	**50**
	Learning (TW+SL)	:	**42 Hrs.**		**SEE Marks**	:	**50**
	Exam	:	**6 Hrs.**		**Total Marks**	:	**100**
	Total Hrs.	:	**90 Hrs.**		**Credits**	:	**3**

Professional Competency:

"Exhibit comprehensive understanding of core IT infrastructure, computational logic, system-level architecture, networking protocols, cybersecurity practices, and database systems to support modern computing environments."

Course Outcomes:

After completion of the course student will be able to

CO1: Understand how data is represented and stored in digital systems using binary systems, and how it is manipulated through computer architecture and machine-level instructions.

CO2: Explain the functions and structure of operating systems, including process management, memory handling, and system security.

CO3: Apply algorithmic thinking to solve basic computational problems and represent algorithms using standard notations like pseudo code and flowcharts.

CO4: Analyze the structure and functioning of computer networks, Internet protocols, and describe security measures used in modern networking and cyber security practices.

CO5: Demonstrate knowledge of software engineering principles, methodologies, and database concepts including the relational model and database operations.

Unit-I	**10 Hrs.**

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)

Unit-II	**11 Hrs.**

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)

Unit-III	**11 Hrs.**

Networking and the Internet: Network Fundamentals, The Internet, The World Wide Web, Internet Protocols, Security.

Cyber security: Overview—What is Cyber security? Brief History of Cyber security Events, The Basic Information Security Model, Cyber Hygiene, Teams in Cyber security.

Ethical Issues in Information Technology: Overview, Ownership Rules, Ethics and Online Content

Textbook 1: Chapter-4

Textbook 2: Chapter-16, Chapter-17

Unit-IV	**10 Hrs.**

Software Engineering: The Software Engineering Discipline, Software Lifecycle, 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)

Text Books:

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:

1. V. Rajaraman, “Introduction to Information Technology”, Third Edition, PHI Learning, 2018.
2. Pelin Aksoy, Information Technology in Theory, First Edition, Cengage.

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	**Program Outcomes and (WKs)**											**Program Specific Outcomes (PSOs)**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	3 (WK1, WK2, WK3)	2 (WK1, WK2)	1	-	-	-	-	-	-	-	-	2	1
CO2	3 (WK1, WK2, WK3)	3 (WK3, WK4)	2	1	1 (WK5)	-	-	-	-	-	-	2	1
CO3	2 (WK2, WK3)	3 (WK4, WK5)	3 (WK5)	2	2 (WK5)	-	-	-	-	-	-	3	2
CO4	2 (WK3, WK4)	3 (WK4, WK5)	2	2 (WK5)	3 (WK5, WK6)	1	-	1	-	-	-	3	2
CO5	2 (WK3, WK4)	3 (WK4, WK5)	3 (WK5, WK6)	2 (WK6)	2 (WK6)	-	-	-	-	-	1	3	3

Course Code		**:**	**1BCVA205C**	**ENGINEERING MECHANICS**	**Semester**	**:**	**1/2**
L:T:P		**:**	**3:0:0**		**Course Type**	**:**	**PSC**
Hours/Sem	**Teaching**	**:**	**42Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**42Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90Hrs**		**Credits**	**:**	**03**

Professional Competency:

Develop the ability to apply the principles of engineering mechanics to analyze and solve problems involving the equilibrium of rigid bodies.

CourseOutcomes:

After completion of the course, student will be able to:
CO1. Understand the concept of coplanar and non-coplanar concurrent force system.
CO2. Apply the principles of force systems and equilibrium to determine support reactions.
CO3. Analyze the truss and frictional resistance offered by different planes.
CO4. Locate the centroid of simple and composite plane area using first principles.

UNIT–I	**12Hrs.**

Introduction to Engineering Mechanics: Particle, continuum, rigid body, laws of motion, law of parallelogram of forces, polygon of forces, classification of force systems, resolution and addition of forces, principle of transmissibility of force, resultant of coplanar concurrent force systems, Lami's theorem, and equilibrium of a particle.

Numerical Problems: Coplanar concurrent forces to find the resultant of a system of forces by composition of forces, including the law of parallelogram of forces, triangle law of forces, and rectangular component method.

UNIT–II	**10Hrs.**

Moment and Couple: Definition of moment, moment of a couple, characteristics of a couple, equivalent force and couple system, Varignon's principle, and resultant of coplanar non-concurrent force systems. Numerical problems.

Support Reactions: Types of loadings, beams and supports, concept of statically determinate and indeterminate structures, and support reactions. Numerical examples on statically determinate beams subjected to various loads.

UNIT-III	10Hrs.

Analysis of Trusses: Introduction, classification of trusses, analysis of plane perfect trusses by the method of joints and the method of sections, and numerical examples.

Friction: Introduction, laws of Coulomb friction, equilibrium of blocks on a horizontal plane, equilibrium of blocks on an inclined plane, and numerical examples.

UNIT-IV	10Hrs.

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

Moment of Inertia of Plane Areas: Introduction, moment of inertia about an axis, parallel axes theorem, perpendicular axes theorem, polar moment of inertia, radius of gyration, second moment of inertia of square, rectangular, triangular, and circular areas using the method of integration, moment of inertia of composite areas and simple built-up sections. Numerical examples.

TextBooks:

1. Rangwala, *Building Construction*, 33rd Edition, 2016, Charotar Publishing House Pvt. Ltd., ISBN-10: 9385039040, ISBN-13: 978-9385039041.
2. Bansal R. K., Rakesh Ranjan Beohar, and Ahmad Ali Khan, *Basic Civil Engineering and Engineering Mechanics*, 3rd Edition, 2015, Laxmi Publications, ISBN: 9789380856674.
3. Kolhapure B. K., *Elements of Civil Engineering and Engineering Mechanics*, 11th Edition, 2018, Eastern Book Promoters Belgaum (EBPB), ISBN: 5551234003896.

ReferenceBooks:

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. Hibbeler 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,

Question Paper Pattern for SEE

1. Total of eight questions with two questions from each unit should be set, uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered, choosing at least one question from each unit.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=nGfVTNfNwnk&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT
2. https://www.youtube.com/watch?v=nkg7VNW9UCc&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=2
3. https://www.youtube.com/watch?v=ljDIIMvxeg&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=5
4. https://www.youtube.com/watch?v=VQRcChR9IkU&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=18
5. https://www.youtube.com/watch?v=3YBXteL-qY4
6. https://www.youtube.com/watch?v=z95UW4wwzSc&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=10
7. https://www.youtube.com/watch?v=lheoBL2QaqU&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=7
8. https://www.youtube.com/watch?v=atoP5_DeTPE
9. https://www.youtube.com/watch?v=ksmsp9OzAsI
10. https://www.youtube.com/watch?v=x1ef048b3CE
11. https://www.youtube.com/watch?v=l_Nck-X49qc
12. https://play.google.com/store/apps/details?id=appinventor.ai_jgarc322.Resultant_Forcehttps://www.youtube.com/watch?v=RIBeeW1DSZg
13. https://www.youtube.com/watch?v=R8wKV0UQtlo
14. https://www.youtube.com/watch?v=0RZHHgL8m_A
15. https://www.youtube.com/watch?v=Bls5KnQOWkY

Table5 : Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3 (WK2, WK3)	3 (WK2, WK3)	-	-	-	-	-	-	-	-	1	2	1
CO2	3 (WK2, WK3	3 (WK2, WK3	2(WK3)	-	2(WK3)			-	-	-	1	2	1
CO3	2 (WK3)	2 (WK3)	2 (WK3)	2 (WK3)	2 (WK6)		-	-	-	-	1	3	2
CO4	3 (WK2, WK3)	3 (WK2, WK3)		2 (WK3)	-		-	-	-	-	1	2	1

Course Code		:	1BEEA105C/205C	**Basic Electrical Engineering**	Semester	:	I / II
L:T:P		:	3:0:0		Course Type	:	PCC
Hours/Sem	Teaching	:	42 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs		SEE Marks	:	50
	Exam (CIE+SEE)	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	90 Hrs		Credits	:	03

Professional Competency:

Demonstrate the ability to apply fundamental electrical engineering principles—including DC and AC circuit analysis, electromagnetism, and electrical safety—to analyze, design, and solve practical electrical engineering problems.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the fundamental laws of DC circuits, electrostatics, and electromagnetism to analyze and solve basic electrical problems involving resistive, capacitive, and magnetic circuits.
2. Apply the laws of electromagnetic induction and magnetic force to analyze induced EMF, inductance, and the interaction of current-carrying conductors in magnetic fields
3. Apply the concepts of single-phase and three-phase AC circuits using phasor methods to calculate voltage, current, power, and power factor under balanced load conditions.
4. Apply the concepts of domestic wiring, electricity billing, and electrical safety to identify types of household wiring, calculate energy consumption and electricity bills, and follow safe practices in handling electrical equipment

Unit-1 (10 Hours)

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

Electrostatics: Coulombs law, definitions of absolute and relative permittivity, electric field, electric flux, electric field strength, flux density. Capacitor: Expression of parallel plate capacitor, factors affecting capacitance, capacitors in series and capacitors in parallel, energy stored in an electrostatic field. Numerical.

Electromagnetism: Electromagnets-direction of flux produced, right-hand rule, definition-magnetic circuit, mmf, magnetic field strength, free space and relative permeability, reluctance, permeance, useful and leakage flux, series circuits and parallel circuits.

Unit-2 (11 Hours)

Electromagnetic Induction: Fundamentals of Electromagnetism, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Fleming's right hand rule, statically and dynamically induced EMF; concepts of self and mutual inductance, coils connected in series- adding and opposing, Coefficient of Coupling, Comparison of electric and magnetic circuits, Energy stored in magnetic field. Numerical.

Force experienced by a current-carrying conductor placed in the magnetic field. Fleming's left-hand rule. Force between conductors carrying current in the same and in the opposite directions. Numerical.

Unit-3 (11 Hours)

Single-phase AC circuits: Generation of sinusoidal voltage, average value, RMS value, form factor and peak factor of sinusoidal voltage and currents, phasor representation of alternating quantities, analysis of R, L, C, R-L, R-C and R-L-C circuits with phasor diagrams, real power, reactive power, apparent power and Power factor. Numerical.

Three-phase AC circuits: Necessity and advantage of 3-phase system, generation of 3-phase power, balanced supply and balanced load, relationship between line and phase values of balanced star and delta connections, power in balanced 3-phase circuits, measurement of 3-phase power by 2-wattmeter method. Numerical.

Unit-4 (10 Hours)

Domestic Wiring: Service mains – overhead and underground, types of wiring: exposed to open space – wooden batten wiring and casing & capping, Concealed wiring: conduit wiring, wiring for two-way and three-way control of load.

Domestic Electricity Bill: Power-rating of household connected loads, sanctioned load, practical unit of measuring energy, energy expressed for commercial purposes - Unit, its definition, Electricity bill, Tariff method: two-part tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principles of fuse and miniature circuit breaker (MCB), the

merits and demerits of fuse and MCB.

Personal safety measures: Electric shock, possible effects of shocks, safety precautions to avoid personal shock while dealing with electricity, Permanent measure: Earthing, pipe and plate earthing.

Text Books:

1. Edward Hughes, "Electrical and Electronic Technology", Pearson Publications, 10th Edition, 2010
2. B. L Theraja, "Fundamentals of Electrical Engineering and Electronics", S. Chand Publications, 27th Edition, 2008

Reference Books:

1. D C Kulshreshth, "Basic Electrical Engineering", Tata McGraw Hill, 1st Edition 2019.
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill 4th edition, 2019.
3. V. K. Mehta, Rohit Mehta, "Principles of Electrical Engineering & Electronics", S. Chand and Company Publications, 2nd edition, 2015.
4. A K Sawhney, "Electrical and electronic measurements and instrumentation", A K Sawhney, Dhanapat Rai and Co. edition, January 2015.
5. Rajendra Prasad, "Fundamentals of Electrical Engineering", PHI Learning, 2nd Edition, 2009
6. V. N. Mittle & A. Mittal, "Basic Electrical Engineering", Tata McGraw-Hill Education, 2005
7. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Publications, 2017.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)									1 (WK8)	3		1
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)									1 (WK8)	3		1
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)									1 (WK8)	3	1	1
CO4	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)				1 (WK5)		1	1		1 (WK8)	3		1

Course Code		**:**	**1BECA205C**	**Fundamentals of Electronics and Communication Engineering**	**Semester**	**:**	**II**
L:T:P		**:**	**3:0:0**		**Course Type**	**:**	**PSC**
Hours/Sem.	**Teaching**	**:**	**42 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**42 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90Hrs**		**Credits**	**:**	**03**

Professional Competency:

Demonstrate the ability to apply foundational concepts of electronic components, analog and digital circuits, and communication systems to design, analyze, and troubleshoot basic electronic and communication systems.

Course Outcomes:

After completion of the course, student will be able to:

1. Apply the working principles, fundamental characteristics of various semiconductor diodes in basic electronic circuits..
2. Analyze the working principles and characteristics of BJT, FET.
3. Illustrate the fundamental concepts of operational amplifiers their configurations.
4. Design basic combinational circuits using the fundamental principles of digital systems and Analyze the fundamental concepts of communication systems.

Unit-I	**11 Hrs.**

Construction, operation and characteristics of PN junction diode, Zener diode, Applications of diodes: Half wave rectifier, Full wave rectifier, Bridge rectifier, rectifier parameters and derivation, Rectifier with capacitor filter, voltage multipliers, Zener diode voltage regulator, and DC power supply.

Unit-II	**11 Hrs.**

Bipolar Junction Transistors: Introduction, BJT Voltages & Currents, Common Base Characteristics, Common Emitter Characteristics, Single stage amplifier, RC phase shift oscillator.

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

Unit-III	**10 Hrs.**

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, and Input Offset Voltage, Input Bias Current and Input Offset Current, The Ideal Op-Amp, Open Loop Op-Amp Configurations: Differential, Inverting & Non Inverting Amplifier. Closed Loop Op-Amp Configurations: Differential, Inverting & Non Inverting Amplifier, Voltage Follower, Summing amplifier, Integrator, Differentiator.

Unit-IV	**10 Hrs.**

Number Systems: Introduction, Decimal, Binary, Octal and Hexadecimal Number Systems, Conversion between number systems, Addition and subtraction. Digital Logic: Basic Theorems and Properties of Boolean Algebra, Logic Gates, Universal Gates implementation, Half and Full Adder, Parallel Adder.

Fundamentals of Communication: Elements of a Communication System, Modulation: Need for

Modulation, Amplitude Modulation, Frequency Modulation, Waveforms. (Excluding Derivation and Spectral Diagrams).

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. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education India, 2017
4. Albert Paul Malvino, David J. Bates, Patrick E. Hoppe, "Electronic Principles", TMH, 9th Edition 2021.

Reference Books:

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th Edition Prentice Hall, 2013.
2. Thomas L. Floyd, "Digital fundamentals", 11th edition, Pearson Education India.
3. Jacob Milliman, Christos C. Halkias, "Electronics Devices and Circuits", TMH, 2010

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1, WK2, WK3 and WK4)	1	2 WK 5	3 WK8	2 (WK 2 and WK6)	1	-	-	-	-	-	3	-	-
CO2	3 (WK1, WK2 WK3 and, WK4)	2 (WK1 , WK2, WK3 and WK4)	1	3 WK 8	2 (WK 2 and WK6)	1	-	-	-	-	-	3	-	-
CO3	3 (WK1 , WK2 WK3 and, WK4)	1	-	2 WK8	-	-	-	-	-	-	-	3	-	-
CO4	3 (WK1, WK2 WK3 and, WK4)	2 (WK1, WK2, WK3 and WK4)	3 WK 5	2 WK8	2 (WK 2 and WK6)	1	-	-	-	-	-	3	-	-
Course Contribution to POs and PSOs	3	1. 5	2	2.5	2	1	-	-	-	-	-	3	-	-

Course Code		:	1BMEA105 / 205 N	**Elements of Mechanical Engineering**	**Semester**	:	01 / 02
L:T:P		:	3:0:0		**Course Type**	:	PSC
Hours/Sem.	**Teaching**	:	42 Hrs		**CIE Marks**	:	50
	Learning (TW)	:	42 Hrs		**SEE Marks**	:	50
	Exam	:	06 Hrs		**Total Marks**	:	100
	Total Hrs.	:	90 Hrs		**Credits**	:	03

Professional Competency:

This course enables mechanical engineering students to acquire fundamental mechanical engineering knowledge and skills to understand concept, apply and solve basic engineering problems in manufacturing, energy, thermal, and automation systems.

Course Outcomes:

After completion of the course, student will be able to:

CO1: Apply the concepts of steam turbine, water turbine, power plants, machine tool operations and Joining processes in industrial contexts.

CO2: Calculate the energy of steam and performance parameters (power and efficiency) of IC Engine.

CO3: Identify the components, systems, and applications of mechatronics, CNC, robotics and electric vehicle and hybrid vehicle in automation and manufacturing processes.

CO4: Determine velocity ratio of gear drives and power transmitted through power transmission system.

UNIT–I	**10 Hrs**

Introduction to Mechanical Engineering (Overview only): Role of Mechanical Engineering in Industries and Society.

Introduction to Mechanical Properties of Materials: Types of materials (ferrous and non-ferrous materials), Study of behavior of metals: stress, strain, yield strength, ultimate strength, toughness, ductility, elastic and plastic deformation, impact strength and hardness.

Machine Tool Operations: (No sketches of machine tools, sketches to be used only for explaining the operations).

Lathe: Principle of working of a center lathe, Lathe operations: Turning, facing and Taper turning by swiveling the compound rest.

Drilling Machine: Principle of working of simple drilling machine, Drilling operations: drilling, boring, reaming and tapping.

Computer Numerical Control: Introduction, Components of CNC, Advantages and Applications of CNC.

Joining Processes: Soldering, Brazing and Welding: Definitions, Classification and working principle.

UNIT–II	**11 Hrs**

Steam Formation and Application: Steam formation, Types of steam, Steam properties and Applications of steam (simple numerical problems).

Steam Turbines: Introduction, Classification and working principle of impulse and reaction turbines.

Water Turbines: Introduction to turbine, Classification of water turbine, principle and operation of Pelton and Francis turbine.

Energy Sources and Power Plants: Basic working principles of Hydel power plant, Thermal power plant, Nuclear power plant, Solar power plant and Wind power plant.

UNIT-III	**11 Hrs**

Introduction to IC Engines: Components and working principles of 4-Stroke Petrol and Diesel engines, Application of IC Engines, Fuel properties, Performance of IC engines (BP, IP, FP, Mechanical and Thermal efficiency) (Simple numerical problems).

Introduction to Refrigeration and Air Conditioning: Principle of refrigeration, Refrigerants and their desirable properties. Working principle of VCR refrigeration system, Working principle of room air conditioner.

Insight Into Future Mobility Technology: Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of Electric Vehicles (EVs) and Hybrid vehicles.

UNIT-IV	**10 Hrs**

Mechanical Power Transmission: Gear Drives: Types - spur, helical, bevel, worm and rack and pinion, Velocity ratio, Simple and Compound gear trains (simple numerical problems).

Belt Drives: Introduction, Types of belt drives (Flat and V-Belt drive), Length of the belt and Tensions ratio (simple numerical problems).

Introduction to Mechatronics and Robotics: Open-loop and closed-loop mechatronic systems. Robot anatomy, Joints & links, Industrial and non-industrial applications of robots.

Text Books:

1. K R Gopala Krishna, "Elements of Mechanical Engineering", Subhash Publications, 38th Edition, 2018.
2. Hazra Choudhry and Nirzar Roy, "Elements of Workshop Technology (Vol. 1 and 2)", Media Promoters and Publishers Pvt. Ltd, 17th edition, 2023.

Reference Books:

1. Appu Kuttan KK,"Robotics", I K International Publishing House Pvt Ltd, 2013.
2. Jonathan Wickert and Kemper Lewis," An Introduction to Mechanical Engineering", Global Engineering. 5th Edition, 2023.
3. Mikell P. Groover,"Automation, production systems and computer integrated manufacturing", Prentice Hall, 5th Edition, 2021.
4. P.N. Rao, "Manufacturing Technology- Foundry, Forming and Welding", Tata McGraw Hill 3rd Ed. 2003,

Web links and Video Lectures (e-Resources):

1. https://www.vlcsolutions.com/blog/artificial-intelligence-in-manufacturing/
2. https://www.neuralconcept.com/post/how-is-ai-used-in-mechanical-engineering
3. https://www.youtube.com/watch?v=MKiiXubKaGM
4. https://www.youtube.com/watch?v=_canCYWZPsc
5. https://www.youtube.com/watch?v=lQ-MYnyxh7M

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	2 (WK1 and WK3)					1 (WK5)		1			1	1	
CO2	2 (WK1, WK2 and WK3)	1 (WK1, WK2, and WK3)						1			1	1	
CO3	2 (WK1 and WK3)				1 (WK6)			1			1	1	
CO4	2 (WK1, WK2 and WK3)	1 (WK1, WK2 and WK3)						1			1	1	

Course Code		:	1BCSA105C/ 1BCSA205C	Programming in C	Semester	:	1/2
L:T:P		:	3:0:0		Course Type	:	PSC
Hours/Sem.	Teaching	:	42 Hrs.		CIE Marks	:	50
	Learning (TW+SL)	:	28 Hrs.		SEE Marks	:	50
	Exam	:	3 Hrs.		Total Marks	:	100
	Total Hrs.	:	90 Hrs.		Credits	:	03

Competency:

Ability to design, develop, and implement modular and structured programs using the C programming language for solving computational and real-world problems.

Course Outcomes

After completion of the course 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 to model simple real- world scenarios.

CO5: Choose suitable datatypes and language constructs to solve a given computational or real-world problem

UNIT-I	**10Hrs.**

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 1: Chapter 1,2

UNIT II	**10Hrs.**

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

UNIT III	**11Hrs.**

Arrays and Strings: Single-Dimension Arrays, Strings, Two-Dimensional Arrays, Array Initialization, Variable Length Arrays.

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

Functions: The General Form of a Function, Understanding the Scope of a Function, Function Arguments

Textbook 1: Chapter 4,5,6

UNIT IV	**11Hrs.**

Functions Continued: argc and argv—Arguments to main(), The return Statement, What Does main() Return?, Recursion, Function Prototypes.

Input and Output To Files: The Standard Library, Variable Type FILE, File Pointers and the fopen Function, Accessing The File with getc, putc, and fprintf,

Structures, Unions, Enumerations, and type def: Structures, Arrays of Structures, Arrays and Structures within Structures, Unions

Textbook 1: Chapter 6,7

Textbook 2: Chapter 12

Reference Books

1. Schildt, Herbert. "C the complete reference", 4th Edition, Mc GrawHill.
2. E. Balagurusamy "Programming in ANSI C", eight edition, Group D Publications Ltd.
3. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, 2nd Edition, Prentice Hall of India.
4. Hassan Afyouni, Behrouz A. Forouzan. "A Structured Programming Approach in C", 4th Edition, Cengage.

Mapping Of COs with POs and PSOs

Course Outcomes	**Programme Outcomes(POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	**1 (WK1, WK2, WK3, and WK4**	**2 (WK1, WK2, WK3, and WK4)**	**2 (WK 5)**	**-**	**2 (WK 6)**		**-**	**-**	**-**	**-**	**-**	**1**		**2**
CO2	**2 (WK1, WK2, WK3, and**	**-**	**1 (WK 5)**	**-**	**3 (WK 6)**		**-**	**-**	**-**	**-**	**-**		**1**	

	WK4													
CO3	1 (WK1, WK2, WK3, and WK4	2 (WK1, WK2, WK3, and WK4)	-	-	2 (WK 6)	-	-	1 (wk5, wk8)	-	-	-	2		1
CO4	2 (WK1, WK2, WK3, and WK4	1 (WK1, WK2, WK3, and WK4)	1 (WK 5)	-	2 (WK 6)		-	-	1 (wk5, wk8)	-	1 (WK 8		1	2
CO5	1 (WK1, WK2, WK3, and WK4	2 (WK1, WK2, WK3, and WK4)	-	-	2 (WK 6)	-	-	1			2 (WK 8		1	1

Course Code		:	1BISA204N	ELEMENTS OF BIOTECHNOLOGY	Semester	:	1/2
L:T:P*		:	3: 0:0		Course Type	:	PSC
Hours/Sem.	Teaching	:	42 Hrs.		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs.		SEE Marks	:	50
	Exam	:	6 Hrs.		Total Marks	:	100
	Total Hrs.	:	90 Hrs.		Credits	:	3

Professional Competency:

Demonstrate understanding of fundamental biological principles, cellular organization, biomolecules, and the history, scope, and societal relevance of biotechnology, while evaluating its diverse applications in healthcare, agriculture, industry, environment, and food sectors and applying emerging technologies such as artificial intelligence and bioinformatics in biotechnology research and practice.

Course Outcomes:

After completion of the course, student will be able to:

CO1: Analyze the fundamental principles of biology and biomolecules

CO2 :Discuss the history, scope, and sustainable developments in biotechnology

CO3: Select and differentiate various domains of biotechnology

CO4: Analyse the applications of Artificial Intelligence in biological research**.**

UNIT-I	10 Hrs.

Basics of Biology:

Structure and functions of prokaryotic and eukaryotic cells. Central dogma of Biology (DNA to RNA to Protein),

History and Scope of Biotechnology: Introduction to biotechnology- Definition, scope, importance & commercial potential of biotechnology. Eminent contributors to biotechnology. Stages of development of biotechnology: ancient biotechnology, classical biotechnology and modern biotechnology.

UNIT–II	10 Hrs.

Biotechnology and developing World: Biotechnology institutes in India- Public and private sector, Biotech success stories, Public perception of biotechnology. Biotechnology in context of developing world.

Sustainable Biotechnology

Concept of sustainability: Triple bottom line (economic, environmental, social). Role of Biotechnology in achieving SDGs. Life cycle assessment (LCA) in biotechnology. Circular bioeconomy and biorefinery. Carbon capture and utilization by biotechnology.

UNIT–III	12Hrs.

Overview of Biotechnology:

History, scope, and branches/types of biotechnology: Medical biotechnology (red) - focusing on healthcare; Agricultural biotechnology (green):improving crops and livestock; Industrial biotechnology(white): using biological systems for industrial processes; Environmental biotechnology (grey/brown):focused on environmental protection and remediation; Food production (yellow): probiotics. Marine biotechnology (blue): oil slick, Bioinformatics (blue): application of computational techniques to store, retrieve, organize and analyse biological data; Drug discovery.

UNIT–IV	10 Hrs.

AI application in Biological Research : study through flow charts of the following

Role of AI in genomics. Role of AI in drug development. AI-assisted target (receptor) design and ligand (inhibitor) design. AI in medical imaging and disease diagnosis. AI-driven personalized medicine and predictive healthcare. Role of AI in agriculture and crop improvement. Role of AI in fermentation industry and bioprocess optimization. Role of AI in Protein and enzyme engineering. Role of AI in biosensors and diagnostics.

Text Books:

1.Singh B.D., Biotechnology :Expanding Horizons, Med Tech Science Press, 5th Edition, 2023.
2.P.K.Gupta, Elements of Biotechnology, Rastogi Publications, 2010.

Reference Books:

1. Nath, Bhaskar, Advances in Biotechnology, Atlantic Publishers, 2020.
2.Alok Kumar Srivastav, Priyanka Das and Babasaheb Ghodke, Artificial Intelligence in Biotechnology and Genomics Emerging Technologies, Innovations and Applications, IBP Books, 2025.
3.Arthur M Lusk, Introduction to bioinformatics, fifth edition, Oxford publication, 2019.

Web links and Video Lectures(e-Resources):

1. Bioengineering: An Interface with Biology and Medicine, https://onlinecourses.nptel.ac.in/noc21_bt05/preview?utm_source=chatgpt.com.
2.Industrial Biotechnology, https://onlinecourses.nptel.ac.in/noc20_bt21/preview?utm_source=chatgpt.com
3. Fundamentals of Bioprocess Engineering, https://onlinecourses.nptel.ac.in/noc25_bt84/preview?utm_source=chatgpt.com.

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	2(WK1, WK2, WK3 andWK4)	2(WK1, WK2,WK3 andWK4)	“““	“ “	“ “	“““	“““	“ “	“ “	“ “	2(WK8)	1	2	1
CO2	2((WK1, WK2,WK3 andWK4)	2(WK1, WK2,WK3 andWK4)	“““	“ “	“ “	2(WK1, WK53 andWK7)	3(WK9)	“ “	“ “	“ “	2(WK8)	1	2	2
CO3	2(WK1, WK2,WK3 andWK4)	3(WK1, WK2,WK3 andWK4)	2(WK5)	“ “	“ “	2 (WK1, WK53 andWK7)	2(WK9)	“ “	“ “	“ “	2(WK8)	1	2	1
CO4	3(WK1, WK2,WK3 andWK4)	3(WK1, WK2,WK3 andWK4)	2(wk5)	“ “	“ “	1(WK1, WK53 andWK7)	1(WK9)	“ “	“ “	“ “	2(WK8)	1	2	2

Course Code: 1BCSA105D/ 1BCSA205D	**Introduction to C Programming (for non-IT programmes CV, ME, EEE Streams)**	**Credits :04**
Hours/Week (L:T:P) : 3:0:2		**CIE Marks:50**
SH:42 SS:08		**SEE Marks:50**
Total Hours of Pedagogy (Theory +Lab) (42 + 28P)		

Course Type: Integrated

Competency:

Ability to design, implement, test and debug C programs with hands-on skills to solve mathematical and logical problems using effective problem-solving.

UNIT – I	**11 Hrs**

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.

UNIT – II	**11 Hrs**

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.

UNIT – III	**10 Hrs**

Arrays: Introduction, One dimensional arrays, declaration and initialization of one-dimensional arrays, Two dimensional arrays, declaration and initialization of two-dimensional arrays. Operations on arrays.

Strings: Introduction, Declaring and initializing string variables, String-handling functions, Array of String.

UNIT – IV	**10 Hrs**

User defined functions: Introduction, Need for user-defined functions, a multi-function program, Elements of user defined function, Definition of functions, Return values and their types, Function calls, Function declaration. Category of functions: Based on call by value, call by reference, argument and return type and recursion.

Structures: Introduction, Defining a structure, Declaring structure variables, Accessing structure members, Structure Initialization, Arrays of structure, Arrays within Structures. Structures and Functions.

Reference books:

1. E. Balaguru swamy, Programming in ANSI C**,** 9th Edition, Tata McGraw Hill Publications, 2023.
2. ReemaThareja, Computer fundamentals and programming in c, Oxford University, Third edition, 2017.
3. Kernighan and Ritchie, C Programming Language, 2nd Edition, 1988, 49th Reprint, 2017
4. Wesley J. Chun, A Structured Programming approach using C, Pearson Education India, 3rd Edition, 2015.
5. Stephen Kochan, Programming in C, 4th Edition, 2014

6. B. S. Anami, S. A. Angadi & S. S. Manvi, Computer Concepts and C programming-A Holistic approach to learning C, 2nd Edition, PHI, 2010

Programming Exercises

1. Develop a program to calculate the temperature converter from degree to Fahrenheit.
2. C Program to convert Kilometers into Meters and Centimeters.
3. Write a C program to input marks of five subjects Physics, Chemistry, Biology, Mathematics and Computer. Calculate percentage and display the grade according to following:

   Percentage Grade
   More than or equal to 90% S
   Between 80% - 89.99% A
   Between 70%-79.99% B
   Between 60%-69.99% C
   Between 40%-59.99% D
   Between 35%-40% E
   Below 35% F
4. Write a C program to compute area of the following of geometric objects based on user's preference using switch case:
   - Circle
   - Triangle
   - Parallelogram
   - Square
5. Develop a program to find the roots of quadratic equations.
6. Develop a modular program to find GCD and LCM of given numbers.
7. Develop a program to find the sum of digits of a given number.
8. Develop a program to find whether a given number is prime or not.
9. Develop a program to find key elements in an array using linear search.
10. Sort the given set of N numbers using bubble sort.
11. Develop a program to perform Matrix Multiplication.
12. Write functions to implement string operations such as compare, concatenate, and to find string length. Use the parameter passing techniques.
13. Write a C program to find the factorial of a number using recursive function.
14. Implement structures to read, write and compute average- marks of the students, list the students scoring above and below the average marks for a class of N students.

Course Outcomes:

After completion of the course 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.

CO and POs Mapping

Course Outcomes	Programme Outcomes											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1								1	2		1	3	1	1
CO2	1	1	2	1	1			1	1		2	2	1	1
CO3	1	2	2	2	2			1	1		2	2	1	2
CO4	1	1	2	1	1			1	1		2	2	1	2

CO5	1		2					1	1		2	2	1	2

Course Code: 1BCSB105D/ 1BCSB205D	Python Programming	Credits: 04
Hours/Week (L:T:P) : 3:0:2		CIE Marks : 50
SH:42 SS:08		SEE Marks: 50
Total Hours of Pedagogy (Theory +Lab) (42 + 28P)		

Competency:

By the end of this course, a student will be proficient in using Python to write structured, readable, and efficient code to solve computational problems, process data, handle exceptions, and apply object-oriented techniques to build small-scale applications aligned with real-world scenarios.

UNIT-I **11 Hrs**

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,Evaluatingexpressions,Operatorsandoperands,Typeconverterfunctions,Orderofoperations, 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.

UNIT-II **10 Hrs.**

Mutable versus immutable and aliasing

Exceptions: Catching Exceptions, Raising our own exceptions.

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.

UNIT-III **10 Hrs.**

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.

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

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

UNIT-IV **11 Hrs.**

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.

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.

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.

Practical Module

1. a. Develop a python program to read 2 numbers from the keyboard and perform the basic arithmetic operations based on the choice. (1-Add, 2-Subtract, 3-Multiply, 4-Divide).
   b. Develop a program to read the name and year of birth of a person. Display whether the person is a senior citizen or not.
2. a. Develop a program to generate Fibonacci sequence of length(N). Read N from the console.
   b. Write a python program to create a list and perform the following operations
      - Inserting an element

- Removing an element
- Appending an element
- Displaying the length of the list
- Popping an element
- Clearing the list

3. a. Read N numbers from the console and create a list. Develop a program to print mean, variance and standard deviation with suitable messages.
   b. Read a multi-digit number (as chars) from the console. Develop a program to print the frequency of each digit with a suitable message.
4. Develop a program to print 10 most frequently appearing words in a text file. [Hint: Use a dictionary with distinct words and their frequency of occurrences. Sort the dictionary in the reverse order of frequency and display the dictionary slice of the first 10 items].
5. Develop a program to read 6 subject marks from the keyboard for a student. Generate a report that displays the marks from the highest to the lowest score attained by the student. [Read the marks into a 1-Dimesional array and sort using the Bubble Sort technique].
6. Develop a program to sort the contents of a text file and write the sorted contents into a separate text file. [Hint: Use string methods strip(), len(), list methods sort(), append(), and file methods open(), readlines(), and write()].
7. Develop a function named DivExp which takes TWO parameters a, b, and returns a value c (c=a/b). Write a suitable assertion for a>0 in the function Div Expand 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 Student Grade Tracker: Accept multiple students 'names and marks. Store them in a list of Tuples or dictionaries. Display summary reports (average, topper, etc.).

Text Book

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

1. Al Sweigart, 2015,"Automate the Boring Stuff with Python", 1st Edition, No Starch Press, (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/) (Chapters 1 to 18, except 12) for lambda functions use this link: https://www.learnbyexample.org/python-lambda-function/
2. Allen B. Downey, 2015, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf (Chapters 13, 15, 16, 17, 18) (Download pdf/html files from the above link)
3. B. Nagesh Rao, "Learning Python", 2nd edition, Cyberplus publication.
4. Gaowrishankar S., Veena A, "Introduction to python programming", CRC press.

Course Outcomes

After completion of the course 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.

Course	Programme Outcomes (POs)	Program Specific

Outcomes												Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	8	9	**10**	**11**	**1**	**2**	**3**
CO1	2	2	1		1							1		
CO2	2	3	1	1	1							**1**		
CO3	2	3	2	1	1							**1**		
CO4	2	3	2	1	1	2						**1**		
CO5	2	3	2	1	1							**2**	**1**	**2**

Course Code		**:**	**1BHSA106M/ 1BHSA206M**	**Soft Skills**	**Semester**	**:**	**I/II**
L:T:P		**:**	**1:0:0**		**Course Type**	**:**	**AEC**
Hours/Sem.	**Teaching**	**:**	**14Hrs**		**CIE Marks**	**:**	**100**
	Learning (TW+SL)	**:**	**14Hrs**		**SEE Marks**	**:**	**00**
	Exam	**:**	**02Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**30Hrs**		**Credit**	**:**	**00**

Professional Competency:

Learners will develop interpersonal, teamwork, and problem-solving skills to communicate effectively and apply professionalism and emotional intelligence to succeed in diverse environments.

Course Outcomes:

After completion of the course, 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 goals, practice empathy, and apply creativity for problem solving.

CO4**:** Demonstrate discipline, time management, structured problem solving, work in teams with all competency.

Unit-I	**3 Hrs.**

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.

Unit-II	**4 Hrs.**

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.

Unit-III	**4 Hrs.**

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).

Unit-IV	**3 Hrs.**

Collaboration & Teamwork: Working effectively in diverse teams, fostering trust, and achieving shared goals.
Negotiation & Conflict Resolution: Strategies to resolve differences and reach win outcomes.
Critical Thinking: The ability to analyze, evaluate, and synthesize information to make well-reasoned decisions.

Text Books:

1. Pratap K. J. Mohapatra, Sanjib Moulick, Principles of Scientific and Technical Writing, 1e, © 2025 Published: December 23, 2024

Reference Books:

1. Soma Mahesh Kumar Soft Skills, 1e, © 2024 | Published: June 8, 2023
2. Ashraf M. Rizvi, Priyadarshi Patnaik Effective Technical Communication, 3e, © 2024 | Published: September 12, 2024
3. Yadav, D. P. (2022). A course in English pronunciation. Notion Publications.

Course Outcomes	Programme Outcomes(POs)										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CO1	-	-	-	-	-	-	-	-	1 WK9		2 WK8
CO2	-	-	-	-	-	-	-	1 WK7	-		2 WK8
CO3	-	-	-	-	-	-	-	-	1 WK8		2 WK8
CO4	-	-	-	-		-	-	-	1 WK8		2 WK8

Course Code		**:**	**1BHSB106C/ 1BHSB206C**	**Communication Skills**	**Semester**	**:**	**I/II**
L:T:P		**:**	**1:0:0**		**Course Type**	**:**	**AEC**
Hours/Sem.	**Teaching**	**:**	**14Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**13Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**03Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**30Hrs**		**Credit**	**:**	**01**

Professional Competency:

Demonstrate clear and confident professional communication using appropriate grammar, pronunciation, intonation, and vocabulary in academic and workplace interactions. Minimize Mother Tongue Influence (MTI) to achieve fluent, accurate, and context-appropriate English communication.

Course Outcomes:

After completion of the course, student will be able to:

CO1**:** Apply the Fundamentals of communication skills in their communication. Use interpersonal skills in group discussions, presentations, and professional interactions.

CO2**:** Identify the nuances of phonetics, intonation and enhance pronunciation skills.

CO3**:** Practice Basic English grammar skills and utilize essential language skills as per requirement.

CO4**:** Build and use all types of English vocabulary and language proficiency. Solve the hindrances faced by Mother Tongue Influence (MTI).

Unit-I	**3 Hrs.**

Introduction to Communicative English : Communicative English, Fundamentals of Communicative English, Process of Communication, Barriers to Effective Communicative English, Different styles and levels in Communicative English. Interpersonal and Intrapersonal Communication Skills.

Speaking & Listening: Listening to English Pronunciation, Mother Tongue Influence (MTI) techniques to overcome mother tongue influence.

Unit-II	**4 Hrs.**

Introduction to Phonetics: Phonetic Transcription, English Pronunciation, Pronunciation Guidelines to consonants and vowels, Sounds Mispronounced, Silent and Non silent Letters, Syllables and Structure. Word Accent, Stress Shift and Intonation, Spelling Rules and Words often Miss spelt. Common Errors in Pronunciation.

Unit-III	**4Hrs.**

English for employability. Formal letter writing (enquiry, order, and complaint). Reported speech,email etiquettes, structure, writing and responding to emails, paragraph writing, blog writing. Introduction to English Grammar, Parts of Speech. Articles and Preposition. Question Tags, One Word Substitutes, Strong and Weak forms of words, Introduction to Vocabulary, Word Pairs (Minimal Pairs).

Unit-IV	**3 Hrs.**

AI in Professional Communication: Significance of AI, its scope and benefits in language enhancement.

AI tools: Grammarly, Copy AI,Enago, Scribendi, Clarde, Jasper,Teal Semantic analysis helps to detect copied ideas. Building a resume using AI tools. Intra and Interpersonal Communication Skills at workplace, Non-Verbal Communication Skills, its importance in Group Discussion and Interview.

Text Books:

1. Sanjay Kumar and Pushplata, 'Communication Skills', Oxford University Press - 2018. Refer it's workbook for activities and exercises – "Communication Skills – I (A Workbook)" published by Oxford University Press – 2018

Reference Books:

1. Meenakshi Raman and Sangeetha Sharma, 'Technical Communication – Principles and Practice', 3rd edition by, Oxford University Press 2017.
2. Wren and Martin, 'High School English Grammar & Composition' ,S. Chandh & Company Ltd., 2015.
3. M. Ashraf Rizvi, 'Effective Technical Communication' – 2nd edition, McGraw Hill Education (India) Pvt. Ltd. – 2018.
4. Abishith G Rao, Dr. Binoy Mathew, and Somasundar S M. Professional Writing Skills in English, Infinite Learning Solutions – (Revised Edition) 2022.
5. Gajendra Singh Chauhan, Smita Kashiramka and L. Thimemesha Functional English (As per AICTE 2018 Model Curriculum) Cengage learning India Pvt. Ltd. [Latest Revised Edition] - 2020.
6. D. Praveen Sam and K.N.Shoba. A Course in Technical English, Cambridge University Press – 2020.
7. Technical Communication - Cengage learning India Pvt. Ltd. [Latest Revised Edition] - 2020.

CO-PO Mapping:

Course Outcomes	Programme Outcomes(POs)										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CO1	-	-	-	-	-	-	-	-	1 WK7		2 WK9
CO2	-	-	-	-	-	-	-	-	-		2 WK1
CO3	-	-	-	-	-	-	-	-	-		2 WK1
CO4	-	-	-	-		-	-	-	1 WK7		2 WK1

Course Code		**:**	**1BHSC107M/ 1BHSC207M**	**Indian Constitution and Engineering Ethics**	**Semester**	**:**	**I/II**
L:T:P		**:**	**01:0:0**		**Course Type**	**:**	**MC**
Hours/Sem.	**Teaching**	**:**	**14Hrs**		**CIE Marks**	**:**	**100**
	Learning (TW+SL)	**:**	**14Hrs**		**SEE Marks**	**:**	**00**
	Exam	**:**	**02Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**30Hrs**		**Credit**	**:**	**00**

Professional Competency:

Ability to critically analyze the structure and provisions of the Indian Constitution, exercise rights ,duties and apply constitutional principles to governance, technology, and ethical challenges in professional and societal contexts.

Course Outcomes:

After completion of the course, student will be able to:

CO1**:** Analyse the basic structure of Indian Constitution.

CO2**:** Identify and exercise their rights and duties as responsible citizens and professionals.

CO3**:** Analyze the relevance of governance structures.

CO4**:** Evaluate the impact of constitutional provisions on modern technological challenges and Ethical issues.

Unit-I	**3 Hrs.**

Introduction to the Indian Constitution and its Evolution

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.

Unit-II	**4 Hrs.**

Fundamental Rights, Duties & DPSPs

Fundamental Rights and their relevance to engineers (e.g., freedom of expression, right to equality)Reasonable restrictions in the context of public safety, technology use, and social media, Fundamental Duties and civic responsibilities of a citizen-engineer, Directive Principles of State Policy: Welfare state, environmental protection, and social justice.

Unit-III	**4Hrs.**

Governance Structure

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

State Government: 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.

Unit-IV	**3 Hrs.**

Role 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 and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety

and liability in Engineering.

Text Books:

1. Singles Shubham,CharlesE.Haries,and et al(2019) **"Constitution of India, Professional Ethics and Human Rights"** Cengage Learning India, Latest Edition.

Reference Books:

2. Naidhruva **(**2022) **"ConstitutionofIndia"(for CompetitiveExams)** Edutech Learning Solutions, Bengaluru.
3. Durga Das Basu(**DDBasu**) (2008) "**Introduction to the Constitution of India**",(Students Edition.) Prentice –Hall,.
4. M.Govindarajan, S.Natarajan, V.S.Senthilkumar(2004) "Engineering Ethics", Prentice –Hall.
5. Merunandan K B **"The Constitution of India"** SecondEdition MeruguPublication, , Bengaluru.
6. **JusticeDhas NagamohanHN, Sahayana, kerekon. "Samvidhana Odu"-for Students &Youths**
7. M.Govindarajan,S.Natarajan,V.S.Senthilkumar(2004),"**Engineering Ethics**", Prentice–Hall,
8. Govt. of India – Bare Act of the Constitution
9. UGC MOOCs / NPTEL Courses on Indian Constitution

Web Links and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc25_lw09/preview?utm_source=chatgpt.com
2. https://onlinecourses.nptel.ac.in/noc26_lw10/preview?utm_source=chatgpt.com
3. https://en.wikipedia.org/wiki/SWAYAM?utm_source=chatgpt.com
4. https://nptel.ac.in/courses/110105097?utm_source=chatgpt.com
5. https://www.youtube.com/playlist?list=PLbRMhDVUMngdL7ofhT7uH9_XBk4-2qsIL&utm_source=chatgpt.com

Course Outcomes	Program Outcomes(POs)										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CO1	-	-	-	-	-	2 WK7		-	-	-	2 WK8
CO2	-	-	-	-	-	3 WK7	1 Wk9	-	-	-	2 WK8
CO3	-	-	1 WK7	-	-	3 WK7	3 WK7	-	-	-	2 WK8
CO4	-	-	1 WK8	-	-	2 WK7& WK9	3 WK7 & WK9	-	-	-	3 WK7& WK9

Course Code		**:**	**1BxxA108P**	**Innovation & Design Thinking Lab (Project Based Learning)**	**Semester**	**:**	**1**
L:T:P		**:**	**0:0:2**		**Course Type**	**:**	**AEC/ SDC**
Hours/Sem.	**Teaching**	**:**	**06 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**22 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**02 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**30 Hrs**		**Credits**	**:**	**1**

Professional Competency: Student will be able to develop professional competencies in creative problem-solving, design thinking and innovation, enabling to design and develop innovative solutions through project-based learning**.**

Course Outcome:

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 Makers' Space.
4. Pitch socially relevant ideas with scalable models
5. Collaborate effectively in diverse teams.

Week1,2&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 **5stages**: Empathize – Define – Ideate – Prototype – Test.

Week-3: Innovation warm-up activities, forming teams, and instructions about next week's activities.

Week4–5: 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.

Week6,7and8: 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 in sights through affinity Clustering and Problem Tree. Mention of clearly Defined challenge statements.

Week9,10&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.

Week12,13&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

Week15&16: Final Demo

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.

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 the SEE, a student must score at least 40% of 50 marks in the CIE, 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 Internal Evaluation (CIE):

CIE Parameters (50Marks)

Sl. No.	CIE Component/Week	Marks	Description
1	Orientation Activities & Communication Skills	5	Participation in Week 1–3 orientation, communication and team work skill-building exercises.
2	Empathy & Field Exploration Documentation	10	Quality and completeness of field visit reflections, stakeholder interviews, and the activity book.
3	Problem Definition and Framing	10	Clarity of challenge statements, use of 'How Might We', affinity mapping, and problem trees.
4	Ideation & Mind Mapping	10	Participation in brainstorming, mind mapping, and idea filtering sessions
5	Prototype Development & Iteration	10	Quality and creativity of prototype/model, user testing, feedback collection, and iterations.
6	Team work, Journal, and Engagement	5	Peer and mentor evaluation of participation, teamwork, and 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 shall be conducted by one Internal and one External Examiner".

Sl. No.	Evaluation Parameter	Marks	Details
1	Prototype / Solution Demonstration	20	Working functionality, creativity, use of tools, relevance to the problem.
2	Final Presentation	10	Clarity, storytelling, problem–solution fit, communication, visual aids.
3	Viva Voce	10	Individual understanding, contribution.
4	Documentation Report	10	Project report, reflection, team activity log, stakeholder input summaries.
5	Total SEE Marks	50	To be reduced to 50.

Submission Requirements:

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

Mapping of COs with POs

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1. Empathize with community problems and define meaningful challenges.	2	3	1	–	–	3	2	2	2	1	–
CO2. Apply design thinking principles and multidisciplinary skills to develop user-centric solutions.	2	3	3	2	2	2	2	–	2	1	–
CO3. Build and test basic prototypes using tools available in the Atal Idea/Tinkering Lab Makers' Space.	2	2	3	3	3	1	1	–	2	1	–
CO4. Pitch socially relevant ideas with scalable models.	1	2	3	1	1	3	2	2	2	3	3
CO5. Collaborate effectively in diverse teams.	–	–	1	–	–	1	–	2	3	2	1

Justification

- **CO1** emphasizes understanding societal problems through empathy, making it strongly related to **PO2 (Problem Analysis)** and **PO6 (Society)**.
- **CO2** focuses on applying the design thinking process to develop innovative solutions, giving a strong correlation with **PO2 (Problem Analysis)** and **PO3 (Design/Development of Solutions)**.
- **CO3** involves prototype development and testing using makerspace tools, which strongly maps to **PO3 (Design)**, **PO4 (Investigation)**, and **PO5 (Engineering Tools)**.
- **CO4** requires presenting innovative ideas with scalable business or social models, leading to strong correlations with **PO3 (Design)**, **PO6 (Society)**, **PO10 (Communication)**, and **PO11 (Project Management & Finance)**.
- **CO5** develops teamwork and collaboration skills, making it strongly related to **PO9 (Individual and Team Work)** and moderately related to **PO10 (Communication)**.

Course Code		:	1BxxA208P	Interdisciplinary Project Work (Project Based Learning)	Semester	:	1
L:T:P*		:	0: 0 : 2		Course Type	:	AEC
Hours/Sem.	Teaching	:	28 Hrs.		CIE Marks	:	50
	Learning (TW+SL)	:	0 Hrs.		SEE Marks	:	50
	Exam	:	2 Hrs.		Total Marks	:	100
	Total Hrs.	:	30 Hrs.		Credits	:	1

Course Competency:

Ability to collaboratively integrate multidisciplinary knowledge to design and implement practical, real-world problem-solving solutions through project-based learning.

Course Outcomes:

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

Activity	Weightage (%)	Marks (out of 50)	Description
Weeks 1–4: Problem Identification & Literature Survey	10 %	5 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.
Total		**50 Marks**	

***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: 50 Marks

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

SEE Marks allocation Parameters for Interdisciplinary Project Work.

Sl. No.	**Evaluation Parameter**	**Marks**	**Details**
1	Prototype / Solution Demonstration	20	Working functionality, creativity, use of tools, relevance to the problem.
2	Final Presentation	10	Clarity, storytelling, problem–solution fit, communication, visual aids.
3	Viva Voce	10	Individual understanding, contribution.
4	Documentation Report	10	Project report, reflection, team activity log, stakeholder input summaries.
5	Total SEE Marks	50	To be reduced to 50.

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).

Mapping of COs with POS.

Course Outcomes (COs)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1. Identify and define problems requiring interdisciplinary knowledge.	2	3	1	1	–	2	1	–	1	–	–
CO2. Apply basic concepts of science, engineering, and technology to design simple solutions.	3	2	3	2	2	1	1	–	1	–	–
CO3. Work effectively in teams with defined roles and responsibilities.	–	–	1	–	–	1	–	2	3	2	1
CO4. Use project management, documentation, and presentation skills.	–	1	1	1	1	–	–	1	2	3	3
CO5. Develop socially relevant, sustainable, and innovative prototypes/solutions.	2	2	3	2	2	3	3	2	2	2	2

Rationale

CO	Major POs Mapped	Justification
CO1	PO2 (3), PO1 (2), PO6 (2)	Students identify and analyze interdisciplinary problems while considering societal needs.
CO2	PO1 (3), PO3 (3), PO4 (2), PO5 (2)	Application of engineering fundamentals to design and implement simple solutions using appropriate tools.
CO3	PO9 (3), PO10 (2), PO8 (2)	Emphasizes teamwork, ethics, and effective collaboration.
CO4	PO10 (3), PO11 (3), PO9 (2)	Focuses on communication, project planning, documentation, and project management.
CO5	PO3 (3), PO6 (3), PO7 (3)	Development of innovative, sustainable, and socially beneficial solutions with environmental awareness.

Course Code		**:**	**1BCVA209L**	**Mechanics and Materials Lab**	**Semester**	**:**	**02**
L:T:P		**:**	**0:0:2**		**Course Type**	**:**	**PSC/ESC**
Hours/Sem	**Teaching**	**:**	**00 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**26Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**04Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**30Hrs**		**Credits**	**:**	**01**

Professional Competency:

Develop the ability to analyze the behavior of rigid bodies and evaluate the mechanical properties of engineering materials through experimental testing and interpretation of results.

Course Outcomes:

After completion of the course, student will be able to:

CO1. Analyse coplanar force systems by analytical and graphical methods and verifying Lami's theorem.

CO2. Compute support reactions in simply supported beams experimentally and analytically.

CO3. Identify and understand the properties of various construction materials.

List of Experiments
Part A

PART A -COVENTIONAL EXPERIMENTS

1. Verification of Lami's Theorem.
2. Equilibrium of concurrent forces.
3. Parallel force system- Simply supported beam.
4. Verification of Varignon's theorem.
5. Specific Gravity of a) Fine aggregates. b) Coarse aggregates. c) Cement. d) Soil.
6. Sieve analysis of soil-Graphical representation of the gradation curve and Visual identification of building materials: Bricks, Stones, Tiles, M-Sand, Bitumen, Fly-Ash, GGBS, Steel Bars of Various Sizes.

Part B

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. Reactions.
2. Field tests on cement.
3. Particle size distribution.
4. Gap graded.
5. Uniformly graded.
6. Well graded.

TextBooks:

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

1. M. L. Gambhir : Concrete Manual : Dhanpat Rai & sons New – Delhi, ISBN-135551234001965.
2. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, third edition, 2015, Laxmi Publications, ISBN: 9789380856674
3. Ramamrutham.S, Engineering Mechanics, Dhanpat Rai Books, 2013,ISBN: 9789352164271.
4. Soil Mechanics and foundation Engineering by B C Punmia, Ashok kumar jain, Arun kumar jain, 18th edition, 2023, Laxmi Publications New Delhi..

ReferenceBooks:

1. Meriam J. L. and Kraige L. G, Engineering Mechanics-Statics, Vol I–sixth Edition,2008, Wiley publication.
2. Rattan S.S., Strength of Materials, Third edition, 2017, McGraw Hill Education; New Delhi. ISBN 13978- 9385965517.
3. Bansal R K, Strength of Materials, Laxmi Publications. 2023, 4th Edition, ISBN:978-8131808146.
4. IS 4031 (Part 11):1988 – Specific gravity test for hydraulic cement.
5. IS 383:1970 – Specification for coarse and fine aggregates from natural sources for concrete.
6. IS 2386(Part 3):1963 Methods of test for aggregates for concrete: Part 3 Specific gravity, density, voids, absorption and bulking
7. IS 2720 (Part 3/Sec 1):1980 – Determination of specific gravity of soil.

Web links and Video Lectures (e-Resources):

1. https://www.nptel.ac.in/courses/122104015/
2. https://nptel.ac.in/courses/112103109/
3. http://vlab.co.in/

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. Active Learning Techniques
2. Problem-Based Learning (PBL)
3. Team-Based Learning (TBL)
4. Hands-On Experiments and Simulations

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

CIE Practical component will be 20 marks. 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 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 20 marks. For both CIE and SEE, the student is required to conduct one experiment each from both Part A and Part B.

Table5:Matrix to describe the mapping of Cos with Pos (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6		8	9	10	11	1	2
CO1	3 (WK2, WK3)	3 (WK2, WK3)	-	2 (WK3)	2 (WK6)	-		1	1	-	1	2	1
CO2	3 (WK2, WK3)	3 (WK2, WK3)	-	2 (WK3)	2 (WK6)	-	-	1	1	-	1	2	1
CO3	2 (WK3)	2 (WK3)	2 (WK5)	3 (WK3)	2 (WK6)	2 (WK5)		1	1	-	1	3	2

Course Code		:	1BEEA109L/209L	**Basic Electrical Engineering Laboratory**	Semester	:	I/II
L:T:P		:	0:0:2		Course Type	:	PSC
Hours/Sem	Practical	:	26 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	00 Hrs		SEE Marks	:	50
	Exam (CIE+SEE)	:	04 Hrs		Total Marks	:	100
	Total Hrs.	:	30 Hrs		Credits	:	01

Professional Competency:

The Basic Electrical Engineering Laboratory enables students to develop practical competency in analyzing electrical circuits using fundamental laws, performing electrical measurements using standard instruments, and understanding single-phase and three-phase systems. Students acquire skills in domestic wiring, fault detection, troubleshooting, and electrical safety practices. The laboratory also develops competency in evaluating energy-efficient lighting systems and interpreting electrical parameters using SCADA tools.

Course Outcomes:

After completion of the course the students will be able to:

1. Measure key electrical parameters such as resistance, inductance, impedance, power, and power factor with standard methods.
2. Design and perform experiments to solve practical open-ended electrical problems.
3. Analyse experimental data from non-routine method to arrive at a solution.

List of Experiments

1. Verification of Ohm's law and Kirchhoff's laws.
2. Measurement of resistance, inductance, impedance and power factor using voltmeter, ammeter and wattmeter in single phase AC circuits.
3. Measurement of three phase power of resistive-inductive load, when the load is (a) star connected and (b) delta connected. Calculation of resistance, reactance, impedance and power factor.
4. Wiring and appropriate electric circuit, understanding the basic principle used for one way, two way and three way control of load (Lamp).
5. Creation of short circuit to determine the time taken by fuse of different length. Documenting the test data and the conclusions.
6. Trouble shooting experiments in simple DC circuits the trouble maybe due to lose connection faulty component leading to open circuits or short circuits detection of fault and the reasons for that and conclusion.
7. Measurement of voltage between line and neutral ground and line ground and neutral in respect of healthy and unhealthy 3 pin socket conclusions arrived for the faulty wiring.
8. Using three voltmeters and standard resistance measure the single phase power consumed by and inductive load.

Light Laboratory Experiments:

9. Luminous Efficacy and Energy Efficiency Comparison of Various Light Sources.
10. Measure power consumption of different lamps.

SCADA Laboratory Experiments:

11. Calculate the voltage unbalance for the selected device and for a set time interval.
12. Calculate the power factor for the selected device and for a set time interval.

Reference Books:

1. V. K. Mehta, Principles of Electrical Engineering. New Delhi, India: S. Chand & Company Ltd.
2. B. L. Theraja, Basic Electrical Technology. New Delhi, India: S. Chand & Company Ltd.
3. A. K. Sawhney, Electrical Measurements and Instrumentation. New Delhi, India: Dhanpat Rai & Sons.
4. D. P. Kothari and I. J. Nagrath, Basic Electrical Engineering. New Delhi, India: Tata McGraw-Hill.
5. J. B. Gupta, Fundamentals of Electrical Engineering. New Delhi, India: Katson Publishing.

Web Links and Video Lectures (e-Resources):

1. https://bes-iitr.vlabs.ac.in/List%20of%20experiments.html **[Virtual Labs, an Ministry of education (MOE) Govt. of India Initiative]**

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)		2 (WK8)	2 (WK2) (WK6)							3	2	3
CO2	2 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	3 (WK8)	2 (WK2) (WK6)				2	1		3	3	3
CO3	2 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	3 (WK8)	2 (WK2) (WK6)					1		3	2	3

Course Code		**:**	**1BECA109L /1BECA209L**	**Fundamentals of Electronics and Communication Engineering Lab**	**Semester**	**:**	**I/II**
L:T:P		**:**	**0:0:2**		**Course Type**	**:**	**PSC**
Hours/Sem.	**Teaching**	**:**	**26Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**--**		**SEE Marks**	**:**	**50**
	Exam	**:**	**4Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**30Hrs**		**Credits**	**:**	**01**

Professional Competency:

Effectively conduct the Fundamentals of Electronics and Communication Engineering Laboratory by guiding students in performing, analyzing, and interpreting experiments on semiconductor devices, rectifiers, transistors and basic digital logic circuits with proper safety and instrumentation practices.

Course Outcomes:

After completion of the course, student will be able to:

1. Demonstrate the ability to construct and analyze the V-I characteristics of diodes and BJT.
2. Analyze diode-based and transistor-based circuits and measure output parameters.
3. Verify the truth tables of logic gates.
4. Iimplement the basic adder/subtractor circuits.

List of Experiments

1. VI-characteristics of a PN junction diode.
2. Study of diode as half-wave and full-wave rectifier (with and without capacitor filter).
3. VI-characteristics of Zener diode.
4. Zener diode as voltage regulator.
5. Study of input and output characteristics of BJT in CE configuration.
6. Truth table verification of logic gates.
7. Implementation of Boolean expression using logic gates.
8. Implementation of half adder and full adder.
9. Implementation of half subtractor and full subtractor.
10. Implementation of parallel adder.

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3 (WK1, WK2, WK3, WK4)	2 (WK1, WK2, WK3, WK4)	1	2	1	-	-	-	-	-	2 (WK8)	-	-	-
CO2	3 (WK1,	2 (WK1,	3 (WK5)	2	2 (WK6)	-	-	-	-	-	2 (WK8)	-	-	-

	WK2, WK3, WK4)	WK2, WK3, WK4)												
CO3	3 (WK1, WK2, WK3, WK4)	2 (WK1, WK2, WK3, WK4)	3 (WK5)	2	2 (WK6)	-	-	-	-	-	1	-	-	-
CO4	3 (WK1, WK2, WK3, WK4)	2 (WK1, WK2, WK3, WK4)	3 (WK5)	2	1 (WK6)	-	-	-	-	-	2 (WK8)	-	-	-

Course Code: 1BCSA109L/ 1BCSA209L	C Programming Lab	Credits :01
Hours/Week (L:T:P) : 0:0:2		CIE Marks:50
(SH:SS) : 0:2		
Total Hours of Pedagogy: 28+2		SEE Marks:50

Course Objectives:

CO1 Explain the basic architecture and functionalities of a Computer.

CO2 Apply programming constructs of C language to solve the real-world problems.

CO3 Explore user-defined data structures like arrays and structures in implementing solutions to Problems.

Competency:

To gain proficiency in developing structured program using C by employing modular programming, manipulating and managing data.

PART – A CONVENTIONAL EXPERIMENTS

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 " found in the course description." Otherwise, display: "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

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 behaviors 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, 2 nd 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-clanguage-e187584209.html]
5. C Programming: The Complete Reference [https://viden.io/knowledge/programming-in-clanguage/attachment/28313/c-the-complete-reference-herbert-schildt-4th-edition-pdf/preview]

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% weight age (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.

Course Outcomes:

After completion of the course student will be able to

CO1: Develop programs in C to solve simple computational problems.

CO2: Make use of C language derived data types to solve simple real-world problems.

CO3: Build a document consisting of experiment setup, design, implementation and results with inferences.

CO and POs Mapping

Course Outcomes	Programme Outcomes											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	-	-	1	1	-	-	1	-	-	1	3	-	-
CO2	-	3	3	2	1	-	-	1	-	-	2	-	-	2
CO3	-	-	3	2	-	-	-	1	1	-	3	-	-	2

Course Code		**:**	**1BBTA109L/ 1BBT209L**	**Elements of Biotechnology Laboratory**	**Semester**	**:**	**1/2**
L:T:P*		**:**	**0:0:2**		**Course Type**	**:**	**PSC**
Hours/Sem.	**Teaching**	**:**	**20Hrs.**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**20Hrs.**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6Hrs.**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**46Hrs.**		**Credits**	**:**	**01**

Professional Competency:

Integrating biological domain knowledge with computational tools and statistical methods to solve complex life science problems. Building practical expertise bridges traditional lab work with IT, opening doors in biotechnology, pharmaceuticals, and precision medicine

Course Outcomes:

After completion of the course, student will be able to:
CO1-Understand basic instruments and handling of instruments used in biotechnology laboratory.
CO2-Carry out the sterilization of media, decontamination of the used media and individual skills in enumeration of microbial counts in food
CO3-Prepare various concentrations of solutions and can able to isolate probiotics using prebiotics.
CO4-To carry out mitosis and meiosis and can able to identify the cell stages, and understand how to explore biological databases and classify the genome using AI tools.

List of Experiments OR Programs List

1. Basic instruments in Biotechnology-Working principle and applications
2. Safety measures in Biotechnology laboratory
3. Sterilization Techniques: Dry heat and Moist Heat Sterilization
4. Microbiological examination of bakery food product (Bread)
5. Preparation of Standard Solutions-Molar, Normal and percent, pH
6. Evaluation of growth of probiotics bacteria in the presence of prebiotic substrate
7. Cell counting by Hemocytometer and Cell Viability
8. Mitosis/Meiosis and Karyotyping
9. Biological database search tools in bioinformatics
10. Genome search by NCBI Genbank and AI in sequence classification

Open Ended Experiment(s) OR Open Ended Program(s)

1. Calculations and **p**reparation of 0.1M NaoH solution, 0.1N HCL, 70% Alcohol
2. Cell counting using blood sample
3. Isolation of probiotic bacteria
4. Sterilization of glasswares by overkill method.

Reference Books:

Laboratory Manual

Course Code		**:**	**1BMEM103C/ 1BMEM203C**	**Computer Aided Engineering Drawing for ME Stream**	**Semester**	**:**	**01 / 02**
L:T:P		**:**	**2:0:3**		**Course Type**	**:**	**PCC**
Hours/Sem.	**Teaching**	**:**	**70 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**14 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:

Prepare and communicate accurate engineering drawings of geometric entities, solids, and engineering components using manual drafting and Computer Aided Engineering Drawing (CAED) tools in compliance with engineering standards and industry requirements.

Course Outcomes:

After successful completion of the course, the student will be able to apply engineering drawing principles through manual drafting and computer-aided drafting (CAD) tools to:

CO1:Construct geometrical shapes and draw orthographic projections of points, lines and plane surfaces in different orientations with respect to the principal planes.

CO2:Draw orthographic projections of right regular solids in different orientations with respect to the principal planes.

CO3:Develop lateral surfaces of right regular solids, their truncated forms and orthographic to isometric projections of solids.

CO4: Create basic 2D/ 3D drawings of mechanical engineering components.

UNIT–I	**25 Hrs.**

Introduction

Introduction, Significance of engineering drawing, Different types of lines used in engineering drawing, Dimensioning: - elements and systems of dimensioning, Geometrical Constructions: -triangles and regular polygons, Orthographic Projections: - principal planes, principal views, four quadrants, systems of projection, symbol of projection. Introduction to Computer Aided Drafting software.

Orthographic Projections of Points, Lines and Planes

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).

UNIT–II	**15 Hrs.**

Orthographic Projection of Solids

Orthographic projection of right regular solids (Resting on HP only and axis inclined to HP only); prisms, pyramids, cylinders and cones.

UNIT-III	**24 Hrs.**

Development of lateral surfaces of Solids:

Development of lateral surfaces of right regular prisms, pyramids, cylinders and cones with base on HP and their truncations (no problems on lateral surfaces of trays, tetrahedrons, spheres and transition

pieces).

Isometric projections (Using Isometric Scale only)

Introduction, isometric scale, isometric projection of simple geometrical shapes, isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres, frustums and combination of two co-axial solids.

UNIT-IV	**06 Hrs.**

Concept of Part Design (free hand sketch)

2D Examples: Simple and compound gear train, open and crossed belt drives and Hexagonal headed bolt and nut assembly. 3D Examples: Wind mill, Piston and connecting rod of an IC engine.

Text Books:

1. K. R. Gopalakrishna and Sudhir Gopalakrishna, "A Textbook of Computer Aided Engineering Drawing", Subash Stores Bangalore, 39th Edition, 2017.
2. N. D. Bhatt, "Engineering Drawing-Plane and Solid Geometry", Charotar Publishing House Pvt. Limited, 56th Revised and Enlarged Edition, 2025.

Reference Books:

1. S. N. Lal and T. Madhusudhan, "Engineering Visualisation", Cengage Learning India Pvt. Ltd., 1st Edition, 2022.
2. Prof. P. J. Shah, "Computer Aided Engineering Drawing", S. Chand Publishing, 2021.
3. M. B. Shah and B. C. Rana, "Engineering Drawing", Pearson Education, 2nd Edition, 2009.

Web Links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/112104172
2. https://nptel.ac.in/courses/112102304
3. https://nptel.ac.in/courses/112105294
4. https://www.coursera.org/courses?query=3d%20modeling&utm
5. https://www.classcentral.com/subject/sheet-metal-design?utm

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	**Program Outcomes and (WKs)**											**Program Specific Outcomes (PSOs)**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	**3 (WK 1 and WK3)**	**2 (WK 1 and WK3)**	**-**	**-**	**3 (WK6)**	**-**	**1 (WK 9)**	**1**	**-**	**-**	**1**	**2**	**-**
CO2	**3 (WK 1 and WK3)**	**2 (WK 1 and WK3)**	**-**	**-**	**3 (WK6)**	**-**	**1 (WK 9)**	**1**	**-**	**-**	**1**	**2**	**-**

CO3	**3 (WK 1 and WK3)**	**2 (WK 1 and WK3)**	**-**	**-**	**3 (WK6)**	**-**	**1 (WK 9)**	**1**	**-**	**-**	**1**	**2**	**-**
CO4	**2 (WK 1 and WK3)**	**2 (WK 1 and WK3)**	**-**	**-**	**1 (WK6)**	**-**	**1 (WK 9)**	**1**	**-**	**-**	**1**	**2**	**-**

Course Code		**:**	**1BMAS201C**	**DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS FOR CSE STREAM**	**Semester**	**:**	**II**
L:T:P		**:**	**3 : 1 : 0**		**Course Type**	**:**	**BSC**
Hours/Sem.	**Teaching**	**:**	**42+28Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**44Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**120Hrs**		**Credits**	**:**	**04**

Professional Competency:

Apply differential equations and numerical methods in engineering applications.

Course Outcomes

After the completion of the course student will be able to

CO1: Determine the solutions of first and higher-order differential equations using analytical methods.

CO2: Apply numerical methods to solve algebraic, transcendental equations and perform interpolation.

CO3: Apply numerical methods to find approximate solution of ordinary differential equations and numerical integration in engineering contexts.

CO4: Employ Numerical methods to solve system of linear equations

UNIT-I **11 Hrs.**

Differential Equations

Linear and Bernoulli`s differential equations. Exact and reducible to exact differential equations with integrating factors on $1/N\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $1/M\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$. 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. Cauchy's homogeneous differential equation.

UNIT–II **10 Hrs.**

Numerical Methods-1

Solution of algebraic and transcendental equations: Regular falsi and Newton-Raphson methods.

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

UNIT–III **11 Hrs.**

Numerical Methods-2

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

Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method**,** Modified Euler's method, Runge-Kutta method of fourth order.

UNIT–IV **10 Hrs.**

Numerical Solutions for System of Linear Equations

Norms: Vector norms and Matrix norms-L1, L2 and L∞, Ill conditioned linear system, condition number. Solution of system of linear equations: Jacobi's method, Gauss Seidel method and LU-decomposition method. Eigen values and Eigen vectors by Rayleigh power method.

Text Books

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

Reference Books

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

Sl.	Course	Course	Teaching-Learning Scheme	Examination	Total	Examination Scheme	Credit

https://drive.google.com/file/d/1KtCtZmnJnOvV1S68wXS9FZPXUFvRktBQ/view?usp=sharing

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3 (WK1, WK2, WK3,and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO2	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO3	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		
CO4	3 (WK1, WK2, WK3, and WK4)	2 (WK1, WK2 and WK3)						1			1		

No.	Code	Title	L Hrs/Week (Hrs/Sem.)	T Hrs/Week (Hrs/Sem.)	P Hrs/Week (Hrs/Sem.)	Term Work (TW) and Self Learning (SL) (TW+SL) Hrs/Sem.	Duration (Hrs/Sem.)		Hours	and Evaluation			s (C)= Total Hours/30
							CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1	1BMAS201C	Differential equations and numerical methods for CSE stream	3(42)	28	0	44	3	3	120	50	50	100	4= 120/30