B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

BACHELOR OF ENGINEERING

SCHEME & SYLLABUS

I & II SEMESTERS

2025-26

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

VISION

PROMOTING PROSPERITY OF MANKIND BY AUGMENTINGHUMAN RESOURCE CAPITAL THROUGH QUALITY TECHNICAL EDUCATION &TRAINING

MISSION

ACCOMPLISH EXCELLENCE IN THE FIELD OF TECHNICAL EDUCATION THROUGH EDUCATION, RESEARCH AND SERVICE NEEDS OF SOCIETY

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
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Content

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
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Scheme & Syllabus for UG Program – I & II Semesters ABBREVIATIONS

AY	Academic Year
AAT	Alternative Assessment Tools
BOE	Board of Examiners
BOS	Board of Studies
CBCS	Choice Based Credit System
CGPA	Cumulative Grade Point Averages
CIE	Continuous Internal Evaluation
HS	Humanity and Social Science Courses
L-T-P-S	Lecture-Tutorial- Practical-Self study
NFTE	Not Fit for Technical Education
SEE	Semester End Examination
SGPA	Semester Grade Point Average
BS	Basic Science
NC	No Credit
PP	Pass in Non-Credit Course

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Scheme of Instruction for First Semester B.E. 2025 – 26 (PHYSICS CYCLE)

Sl. No.		Course Type	Course Code	Course Title	L	T	P	Total credits
1.	1	ASC1	25MA1BSMCS	Mathematical foundation for Computer Science Stream– 1	3	2	0	4
2.			25MA1BSCEM	Mathematical Foundation for Civil, Electrical and Mechanical Engineering stream– 1				
3.	2	ASC2	25PH1BSPCS	Quantum Physics and Computation for Computer Science Engineering Stream	3	0	2	4
4.			25PH1BSPEC	Quantum Physics and Sensors for Electronics Engineering				
5.			25PH1BSPEE	Physics of Materials for Electrical Engineering				
6.			25PH1BSPCV	Physics of Structural Systems for Civil Engineering				
7.	3	ESC	25ME1ESCED	Computer-Aided Engineering Drawing	1	0	4	3
8.	4	ESC-I	25CV1ESBSM	Building Science and Mechanics	3	0	0	3
9.			25EE1ESIEE	Introduction to Electrical Engineering				
10.			25EC1ESIEL	Introduction to Electronics & Communication Engineering				
11.			25ME1ESIME	Introduction to Mechanical Engineering				
12.			25CS1ESEIT	Essentials of Information Technology				
13.	5	PSC	25CV1PSENM	Engineering Mechanics	3	0	2	4
14.			25EE1PSBEE	Basics of Electrical Engineering				
15.			25EC1PSECE	Fundamentals of Electronics & Communication Engineering				
16.			25CS1PSSPC	Structured Programming in C				
17.			25BT1PSEBB	Elements of Biotechnology and Biomimetics				
18.	6	NCMC	25MA1HSSSK	Soft Skills	1	0	0	PP
19.	7	SDC	25ME1AEIDT	Innovation and Design Thinking	1	0	0	1
20.	8	HSMC	25MA1HSBAK	Balake Kannada	1	0	0	1
21.			25MA1HSSAK	Samskrutika Kannada				
Total					**20**			

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Scheme of Instruction for First Semester B.E. 2025-26 (CHEMISTRY CYCLE)

Sl. No.		Course Type	Course Code	Course Title	L	T	P	Total credits
1.	1	ASC1	25MA1BSMCS	Applied Mathematics-l for CSE Stream-1	3	2	0	4
2.			25MA1BSCEM	Mathematical Foundation for Civil, Electrical and Mechanical Streams - 1				
3.	2	ASC2	25CY1BSCCS	Applied Chemistry for Smart Systems	3	0	2	4
4.			25CY1BSCEE	Applied Chemistry for Emerging Electronics and Futuristic Devices				
5.			25CY1BSCME	Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems				
6.	3	ETC	25CS1ETIAA	Introduction to AI Applications	3	0	0	3
7.	4	ESC1	25CV1ESBSM	Building Science and Mechanics	3	0	0	3
8.			25EE1ESIEE	Introduction to Electrical Engineering				
9.			25EC1ESIEL	Introduction to Electronics & Communication Engineering				
10.			25ME1ESIME	Introduction to Mechanical Engineering				
11.			25CS1ESEIT	Essentials of Information Technology				
12.	5	PLC[IC]	25CS1ESICP	Introduction to C Program	3	0	2	4
13.			25CS1ESIPP	Introduction to PYTHON Programming				
14.	6	AEC	25MA1AECEN	English Communication Skills	1	0	0	1
15.	7	NCMC	25MA1HSICE	Indian Constitution & Engineering Ethics	1	0	0	1
16.	8	SDC	25ME1AEIDL	IDEA Lab (Multidisciplinary)	0	0	2	1
	Total							**20**

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Scheme of Instruction for Second Semester B.E. 2025-26 (PHYSICS CYCLE)

Sl. No.		Course Type	Course Code	Course Title	L	T	P	Total credits
1.	1	ASC2	25MA2BSMCS	Applied Mathematics-II for CSE Stream	3	2	0	4
2.			25MA2BSCEM	Mathematical Foundation for Civil, Electrical and Mechanical Streams - 2				
3.	2	ASC2	25PH2BSPCS	Quantum Physics and Computation for Computer Science Engineering Stream	3	0	2	4
4.			25PH2BSPEC	Quantum Physics and Sensors for Electronics Engineering				
5.			25PH2BSPME	Physics of Materials for Mechanical Engineering Stream				
6.		ESC-2	25ME1ESCED	Computer-Aided Engineering Drawing	1	0	4	3
7.	4	ESC2-II	25CV1ESBSM	Building Science and Mechanics	3	0	0	3
8.			25EE1ESIEE	Introduction to Electrical Engineering				
9.			25EC1ESIEL	Introduction to Electronics & Communication Engineering				
10.			25ME1ESIME	Introduction to Mechanical Engineering				
11.			25CS1ESEIT	Essentials of Information Technology				
12.	5	PSC2	25ME2PSEME	Elements of Mechanical Engineering	3	0	2	4
13.			25EC2PSECE	Fundamentals of Electronics & Communication Engineering				
14.			25CS2PSSPC	Structured Programming in C				
15.			25CH2PSCHE	Elements of Chemical Engineering				
16.	6	NCMC2	25MA2HSSSK	Soft Skills	1	0	0	PP
17.	6	SDC2	25ME2AEIDT	Innovation and Design Thinking	1	0	0	1
18.	7	HSMC	25MA2HSBAK	Balake Kannada	1	0	0	1
19.			25MA2HSSAK	Samskrutika Kannada	1	0	0	1
Total								**20**

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
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Scheme of Instruction for Second Semester B.E. 2024-25 (CHEMISTRY CYCLE)

Sl. No.		Course Type	Course Code	Course Title	L	T	P	Total credits
1.	1	ASC1	25MA2BSMCS	Applied Mathematics-II for CSE Stream	3	2	0	4
2.			25MA2BSCEM	Mathematical Foundation for Civil, Electrical and Mechanical Streams - 2				
3.	2	ASC2	25CH2BSCCS	Applied Chemistry for Smart Systems	3	0	2	4
4.			25CH2BSCEE	Applied Chemistry for Emerging Electronics and Futuristic Devices				
5.			25CH2BSCCV	Applied Chemistry for Sustainable Structures & Material Design				
6.	3	ETC2	25CS2ETIAA	Introduction to Al Applications	3	0	0	3
7.	4	ESC2-II	25CV2ESBSM	Building Science and Mechanics	3	0	0	3
8.			25EE2ESIEE	Introduction to Electrical Engineering				
9.			25EC2ESIEL	Introduction to Electronics & Communication Engineering				
10.			25ME2ESIME	Introduction to Mechanical Engineering				
11.			25CS2ESEIT	Essentials of Information Technology				
12.	5	PLC[IC]2	25CS2ESICP	Introduction to C Program	3	0	2	4
13.			25CS2ESIPP	Introduction to PYTHON Programming				
14.	6	AEC2	25MA2AECEN	English Communication Skills	1	0	0	1
15.	7	NCMC2	25MA2HSICE	Indian Constitution & Engineering Ethics	1	0	0	PP
16.	8	SDC2	25ME2AEIDL	IDEA Lab (Multidisciplinary)	1	0	0	1
Total								**20**

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Course Type Abbreviations	
L-Lecture (1 credit=1 contact hr.) **T**-Tutorial (1 credit=2 contact hrs.) **P**-Practical (1 credit=2 contact hrs.)	
ASC	Applied Science Course
ESC	Engineering Science Course
PSC	Programme Specific Courses with Lab
AEC	Ability Enhancement
SDC	Skill Development Course
PLC	Programming Language Course
ETC	Emerging Technology Course
NCMC	Non-Credit Mandatory Course
HSMC	Humanities Course

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Course Title: Mathematical Foundation for Computer Science Stream - 1		**Semester**	I
Course Code	25MA1BSMCS	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3-1-0	**SEE Marks**	50
Total Hours of Pedagogy		**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course successfully, students will be able to:

CO 1: Apply the concepts of Calculus and Matrix theory in solving problems.

CO 2: Relate the importance of Calculus and Matrix theory in computer science stream

CO 3: Demonstrate the understanding of Calculus and Matrix theory through programming skills using modern tool.

Module-1: Matrices and System of Linear Equations **10 Hours**

Prerequisites: Operations on matrices and determinants. Elementary row transformation of a matrix

Echelon form, rank of a matrix, consistency and solution of system of linear equations - Gauss-elimination method, approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors, Rayleigh's power method to find the dominant eigenvalue and eigenvector.
Applications: Balancing chemical equations, Traffic flow.
Self-Study: Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem

Module-2: Multivariable Calculus **10 Hours**

Prerequisites: Calculus of one variable

Partial differentiation, total derivatives - differentiation of composite functions, Jacobian, Taylor's and Maclaurin's series expansion for two variables (statement only) – problems.
Applications: Maxima and minima for a function of two variables.
Self-study: Indeterminate forms-L'Hospital's rule, Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.

Module-3: Vector Calculus **10 Hours**

Prerequisites: Scalars, vectors and its operations, multivariable calculus, basic integration.

Scalar and vector fields. Gradient, divergence and curl – physical interpretation, solenoidal vector fields, irrotational vector fields.
Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality. **Applications:** Directional derivatives and scalar potential.
Self – study: Expression for gradient, divergence and curl in curvilinear systems.

Module-4 : Ordinary Differential Equations (ODEs) of First Order	**09 Hours**
Prerequisites: Basic integration, linear ODE, solution by separation of variables	
Bernoulli's differential equations. Exact and reducible to exact differential equations- Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$. **Applications**: Orthogonal trajectories, Newton's law of cooling. **Self-Study:** Nonlinear differential equations - Introduction to general and singular solutions, solvable for p, for x and y. Clairaut's equations.	
Module-5: Ordinary Differential Equations of Higher Order	**09 Hours**
Prerequisites: Roots of a polynomial	
Higher-order linear ordinary differential equations with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre's differential equations. **Applications:** Solution of differential equation in fundamental forms (homogeneous equations). **Self-Study:** Method of undetermined coefficients	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 45th Ed., 2024.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **D. C. Lay:** "Linear Algebra and its Applications", Pearson Publishers, 5th Ed., 2024.

II. Reference books:

1. **B. V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. **S. Pal and S. C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
5. **J. Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.
6. **G. Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
7. **D.G. Zill and W.S.Wright:** "Advanced Engineering Mathematics", Jones

Bartlett Publishers Inc.,7th Ed., 2020

III. Web links and Video Lectures (e-Resources):

1. http://academicearth.org/
2. VTU e-Shikshana Program
3. VTU EDUSAT Program
4. https://nptel.ac.in/courses/111106135
5. https://nptel.ac.in/courses/111105160
6. https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
7. https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/
8. Vector Calculus: https://www.classcentral.com/course/mit-opencourseware-multivariable-calculus-fall-2007-40962/classroomand https://www.classcentral.com/course/vector-calculus-engineers-17387

Teaching-Learning Process (Innovative Delivery Methods):

1. Chalk and talk method / Power Point Presentation

Assessment Structure:

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

1. CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
2. The best two scores out of three tests will be considered for CIE

Semester End Examination:

1. Two complete questions will be given from each unit.
2. One complete question from each unit to be answered.

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Course Title: Mathematical Foundation for Civil, Electrical and Mechanical Streams– 1		Semester	I
Course Code	25MA1BSCEM	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3-1-0	**SEE Marks**	50
Total Hours of Pedagogy		**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course successfully, students will be able to:

CO 1: Apply the concepts of Calculus and Matrix theory in solving problems

CO 2: Relate the importance of Calculus and Matrix theory concepts to Civil, Electrical & Mechanical Streams

CO 3: Demonstrate the understanding of Calculus and Matrix theory concepts through programming skills using modern tool

Module-1: Matrices and System of equations	**10 Hours**
Pre-requisites: Operations on matrices and determinants, elementary row transformations of a matrix	
Echelon form, rank, consistency and solution of system of linear equations - Gauss-elimination method, approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors, Rayleigh's power method to find the dominant eigenvalue and eigenvector. **Applications:** Balancing chemical equations, Traffic flow. **Self-Study:** Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem	
Module-2: Calculus of One Variable	**10 Hours**
Pre-requisites: Trigonometric functions and identities, differentiation and its rules.	
Introduction to polar coordinates, polar curves, angle between radius vector and tangent, angle between two curves. Length of perpendicular from pole to the tangent, pedal equations. **Applications**: Curvature and Radius of curvature – cartesian and polar forms. **Self-study:** Taylor's and Maclaurin's series expansion for one variable, radius of curvature in parametric form.	
Module-3: Multivariable Calculus	**10 Hours**
Pre-requisites: Higher-order derivatives, chain rule and determinants	
Partial differentiation, total derivatives - differentiation of composite functions, Jacobian, Taylor's and Maclaurin's series expansion for two variables (statement only) – problems. **Applications:** Maxima and minima for a function of two variables. **Self-study:** Indeterminate forms-L'Hospital's rule, Euler's theorem and problems. Method of	

Lagrange's undetermined multipliers with single constraint. Errors and approximations
Module-4 : Ordinary Differential Equations (ODEs) of First Order 09 Hours
Pre-requisites: Basic integration, linear ODE, solution by separation of variables.
Bernoulli's differential equations. Exact and reducible to exact differential equations- Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$. **Applications**: Orthogonal trajectories, Newton's law of cooling. **Self-Study:** Nonlinear differential equations - Introduction to general and singular solutions, solvable for p, for x and y. Clairaut's equations
Module-5: Ordinary Differential Equations of Higher Order 09 Hours
Pre-requisites: Roots of a polynomial
Higher-order linear ordinary differential equations with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre's differential equations. **Applications:** Spring-Mass system and L-R-C series circuits **Self-Study:** Method of undetermined coefficients

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7. **D.G. Zill and W.S.Wright:** "Advanced Engineering Mathematics", Jones Bartlett Publishers Inc., 7th Ed., 2020

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3. VTU EDUSAT Program
4. https://nptel.ac.in/courses/111106135
5. https://nptel.ac.in/courses/111105160
6. https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
7. https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/

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	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

1. CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
2. The best two scores out of three tests will be considered for CIE.

Semester End Examination:

1. Two complete questions will be given from each unit.
2. One complete question from each unit to be answered

Course Title: Quantum Physics and Computation For Computer Science Engineering Stream		**Semester**	I/II
Course Code	25PH1BSPCS / 25PH2BSPCS	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	04	**Exam Hours**	03
Examination type (SEE)			

Course Outcomes (Course Skill Set)

CO1: Understand and Apply the principles of quantum mechanics, quantum computing, transport phenomena in metals, semiconducting and superconducting materials, construction and working principle of LASERs and optical fibers.

CO2: Use appropriate Tools to develop the concept of physics, perform as a member of team to design a model and make an oral presentation.

CO3: Conduct, Analyze and Interpret the data and results from Physics experiments.

Module-1: QUANTUM MECHANICS **8 Hours**

de-Broglie hypothesis – derivation by analogy. Definition of phase velocity and group velocity. Relation between group velocity and phase velocity, relation between group velocity and particle velocity, relation between group velocity, phase velocity and velocity of light (qualitative). Heisenberg's uncertainty principle - statement and physical significance. Application of uncertainty principle – non-existence of electron in the nucleus.

Wave function-properties, physical significance. Born Interpretation, expectation value, and its physical significance. Probability density and normalization of wave function. Setting up of one-dimensional time independent Schrödinger's wave equation. Particle in a one-dimensional potential well of infinite height and finite width (particle in a box) - Eigen functions, probability density and Eigen values for the first two states. Problems.

Self-study: Ehrenfest theorem, Quantum dots

Module-2: Electrical Properties Of Metals And Semiconductors **8 Hours**

Introduction to classical free electron theory and its failures. Mechanisms of electron scattering in solids, Matheissen's rule. Assumptions of Quantum Free Electron Theory, density of states (qualitative), Fermi energy, expression for Fermi energy (qualitative), Fermi velocity, Fermi temperature. Fermi factor, variation of Fermi factor with temperature and energy. Merits of quantum free electron theory.

Introduction to Semiconductors, expression for concentration of electrons in conduction band, expression for hole-concentration in valance band (qualitative). Expression for intrinsic carrier concentration. Fermi level for intrinsic (derivation) and extrinsic semiconductor (qualitative), expression for electrical conductivity of semiconductors and energy band gap. Hall effect, expressions for Hall voltage, Hall coefficient, and its applications. Problems.

Self-study: Semiconductors in electronics applications

Module-3: Superconductivity **8 Hours**

Introduction to superconductors – Zero resistance state, temperature dependence of resistivity, persistent current, three critical parameters - critical temperature, critical magnetic field and critical current: Silsbee effect. Derivation of critical current for a cylindrical wire using ampere's law. Meissner effect. Type-I and Type-II superconductors. Formation of vortices.

BCS Theory - two-fluid model, formation of Cooper pairs, phase coherent state. Limitations of BCS theory, examples of systems with low and high electron-phonon coupling. Cooper pair tunneling (Andreev reflection). Josephson junction, flux quantization, DC and AC SQUIDs (qualitative), MAGLEV vehicle. Problems.

Self-study: Principle and working of MRI

Module-4: Photonics **8 Hours**

LASERs: Introduction, characteristics of LASERs. Interaction of radiation with matter – Einstein's A and B coefficients. Expression for energy density of a system under thermal equilibrium in terms of Einstein's A and B coefficients. Conditions for Laser action. Requisites of a LASER system. Construction and working of He-Ne LASER. Applications of LASERs: Mach-Zehnder interferometer.

Optical Fiber: Introduction, principle of propagation, angle of acceptance, and numerical aperture. Expression for numerical aperture and condition for propagation. Number of modes: V-number. Classification of optical fibers. Attenuation- attenuation coefficient (qualitative), causes of attenuation. Applications of optical fibers: fiber optic displacement sensor and fiber optic temperature sensor. Problems.

Self-study: Various applications of LASERs

Module-5: QUANTUM COMPUTATION **8 Hours**

Introduction, Moore's law - limitation of VLSI. Difference between classical and quantum computation. Bit, Qubit and its properties. Bloch sphere (qualitative).

Dirac Notation: Matrix form of wave function, identity operator (I), determination of $I|0\rangle$ and $I|1\rangle$, Pauli matrices and its operations on $|0\rangle$ and $|1\rangle$ states. Mention of conjugate, transpose and unitary matrix. Inner product of 2x2 matrices. Probability and orthogonality.

Quantum Gates: Single qubit gates: quantum NOT gate, Pauli Z gate, Hadamard gate, Phase gate (or S Gate), T gate.

Multiple Qubit Gates: Controlled gate - CNOT Gate, (discussion of 4 different input states). Representation of swap gate, controlled - Z gate, Toffoli gate. Problems.

Self-study: Quantum Entanglement, quantum teleportation and quantum computers

Suggested Learning Resources:

I. Text books:

1. Engineering Physics, Satyendra Sharma and Jyotsna Sharma, Pearson, 2018.
2. Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBS Publishers and Distributers Pvt. Ltd., 2018.
3. Solid State Physics, S. O. Pillai, New Age International, 2022.
4. Quantum Computing, Parag K Lala, McGraw Hill, 2020.

II. Reference books / Manuals:

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

III. Web links and Video Lectures (e-Resources):

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

11. Lecture 08 – Quantum Gates and Circuits Part 1: https://www.youtube.com/watch?v=nGPr1QM_XrY
12. **Virtual LAB:** https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
13. **Virtual LAB:** https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1

Activity-Based Learning/Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in
3. https://virtuallabs.merlot.org/vl_physics.html
4. https://phet.colorado.edu
5. https://www.myphysicslab.com

Teaching-Learning Process (Innovative Delivery Methods):

1. Chalk and Talk
2. Blended Mode of Learning
3. Simulations, Interactive Simulations and Animations
4. NPTEL and Other Videos for theory topics
5. Smart Class Room
6. Flipped Class
7. Lab Experiment Videos

Assessment Structure:

Component	Type of assessment	Max. Marks	Reduced to	Total	Total Marks
CIE – Theory	CCA	10	05	50	50
	Test 1	40	10		
	Test 2	40	10		
CIE – Lab	Test	50	25		
SEE	Semester End Exam	100	50		50
Grand Total Marks					100

Course objectives:

1. To impart the knowledge of concept and applications of quantum mechanics and quantum computation
2. To provide insight to the electrical properties of metals, semiconductors, and superconductors, and

their engineering applications

3. To understand the principles of LASERs and optical fibers, and explore their practical implications

CO-PO mapping with strength:

COs	POs										
	1	2	3	4	5	6	7	8	9	10	11
CO1	3	2									
CO2					1				1	1	
CO3				3							

List of Lab activities:

1. Wavelength of LASER by diffraction
2. Divergence angle of a LASER
3. Numerical aperture of an optical fiber
4. Wavelength of LEDs/Planck's constant
5. Fermi energy of copper
6. Dielectric constant of a material by charging and discharging of a capacitor
7. Energy gap of a semiconductor using four probe method
8. V-I characteristics of a photodiode
9. Frequency response of series and parallel LCR circuits
10. Black box
11. Attenuation coefficient of OFC
12. GNU step interactive simulations
13. Study of motion using spread sheet
14. PHET Interactive Simulations (https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype)
15. Quantum Experiments using Qiskit

Curriculum Structure:

Course Code	Course Title	Teaching and Learning Scheme				
		Classroom Instruction (CI) (in hours per semester)	Lab Instruction (LI) (in hours per semester)	Team Work (TW) and Self Learning (SL) (TW + SL) (in hours per semester)	Total No. of Hours per Semester	Total Credits (C) * (Total Hours/30)
25PH1BSPCS / 25PH2BSPCS	QUANTUM PHYSICS AND COMPUTATION FOR COMPUTER SCIENCE ENGINEERING STREAM	40	30	10 + 40 = 50 (CCA=10 hrs) (SL=8*5=40 hrs)	120	4

Course Title: Quantum Physics and Sensors for Electronics Engineering		**Semester**	I/II
Course Code	25PH1BSPEC / 25PH2BSPEC	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	04	**Exam Hours**	03
Examination type (SEE)			

Course Outcomes (Course Skill Set)

CO1: Understand and Apply the principles of quantum mechanics, transport phenomena in metals, properties of semiconducting and superconducting materials, construction and working principle of LASERs, optical fibers, and electronic sensors.

CO2: Use appropriate **Tools** to develop the concept of physics, perform as a **member of team** to design a model and make an oral presentation.

CO3: **Conduct**, **Analyze** and **Interpret** the data and results from Physics experiments.

Module-1: Quantum Mechanics **8 Hours**

de-Broglie hypothesis – derivation by analogy. Definition of phase velocity and group velocity. Relation between group velocity and phase velocity, relation between group velocity and particle velocity, relation between group velocity, phase velocity and velocity of light (qualitative). Heisenberg's uncertainty principle - statement and physical significance. Application of uncertainty principle – non-existence of electron in the nucleus.

Wave function-properties, physical significance. Born Interpretation, expectation value, and its physical significance. Probability density and normalization of wave function. Setting up of one-dimensional time independent Schrödinger's wave equation. Particle in a one-dimensional potential well of infinite height and finite width (particle in a box) - Eigen functions, probability density and Eigen values for the first two states. Problems.

Self-study: Ehrenfest theorem, Quantum dots

Module-2: Electrical Properties Of Metals And Semiconductors **8 Hours**

Introduction to classical free electron theory and its failures. Mechanisms of electron scattering in solids, Matheissen's rule. Assumptions of Quantum Free Electron Theory, density of states (qualitative), Fermi energy, expression for Fermi energy (qualitative), Fermi velocity, Fermi temperature. Fermi factor, variation of Fermi factor with temperature and energy. Merits of quantum free electron theory.

Introduction to Semiconductors, expression for concentration of electrons in conduction band, expression for hole-concentration in valance band (qualitative). Expression for intrinsic carrier concentration. Fermi level for intrinsic (derivation) and extrinsic semiconductor (qualitative), expression for electrical conductivity of semiconductors and energy band gap. Hall effect, expressions

for Hall voltage, Hall coefficient, and its applications. Problems.

Self-study: Semiconductors in electronics applications

Module-3: Superconductivity **8 Hours**

Introduction to superconductors – Zero resistance state, temperature dependence of resistivity, persistent current, three critical parameters - critical temperature, critical magnetic field and critical current: Silsbee effect. Derivation of critical current for a cylindrical wire using ampere's law. Meissner effect. Type-I and Type-II superconductors. Formation of vortices.

BCS Theory - two-fluid model, formation of Cooper pairs, phase coherent state. Limitations of BCS theory, examples of systems with low and high electron-phonon coupling. Cooper pair tunneling (Andreev reflection). Josephson junction, flux quantization, DC and AC SQUIDs (qualitative), MAGLEV vehicle. Problems.

Self-study: Principle and working of MRI

Module-4: Photonics **8 Hours**

LASERs: Introduction, characteristics of LASERs. Interaction of radiation with matter – Einstein's A and B coefficients. Expression for energy density of a system under thermal equilibrium in terms of Einstein's A and B coefficients. Conditions for Laser action. Requisites of a LASER system. Construction and working of He-Ne LASER. Applications of LASERs: Mach-Zehnder interferometer.

Optical Fiber: Introduction, principle of propagation, angle of acceptance, and numerical aperture. Expression for numerical aperture and condition for propagation. Number of modes: V-number. Classification of optical fibers. Attenuation- attenuation coefficient (qualitative), causes of attenuation. Applications of optical fibers: fiber optic displacement sensor and fiber optic temperature sensor. Problems.

Self-study: Various applications of LASERs

Module-5: Semiconductor Devices And Sensors **8 Hours**

Classification of semiconductors: Direct and indirect band gap with E-K diagram. Application of direct band gap semiconductor- construction and working of semiconducting diode LASER.

Devices: Photodiode and power responsivity, experimental determination of energy gap (E_g) using four probe method.

Sensors: Light Dependent Resistor (LDR), Resistance Temperature Detectors (RTD), Sensing mechanisms, Piezo-electric sensors, Metal Oxide Semiconductor (MOS) sensors for gas sensing. Problems.

Self-Study: Electronic devices, VLSI and embedded systems

Suggested Learning Resources:

I. Text books:

1. Engineering Physics, Satyendra Sharma and Jyotsna Sharma, Pearson, 2018.
2. Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBS Publishers and Distributers Pvt. Ltd.
3. Solid State Physics, S. O. Pillai, New Age International, 2022.
4. Basic Electronics, B L Theraja, Multi-color Edition, S Chand, 2006.

II. Reference books / Manuals:

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

III. Web links and Video Lectures (e-Resources):

1. NPTEL – Quantum Mechanics I (IIT Madras): https://nptel.ac.in/courses/115106066
2. NPTEL – Physics: Introductory Quantum Mechanics (NOC): https://archive.nptel.ac.in/courses/115/104/115104096
3. Solid State Physics – NPTEL (IIT Madras) https://nptel.ac.in/courses/115106127
4. A Brief Course on Superconductivity – NPTEL IIT Guwahati (Prof. Saurabh Basu)
5. Playlist Introduction Video: https://www.youtube.com/watch?v=SHoGV-sezNI
6. Full playlist available via the YouTube channel description or archive link.
7. Concepts in Magnetism and Superconductivity – NOC (IIT Kharagpur)Series start (Lecture 1): https://digimat.in/nptel/courses/video/115105131/L01.html
8. Introduction to Photonics – NPTEL (IIT Madras, Prof. Balaji Srinivasan) Lecture 03 to Lecture 12 cover: Direct video link (start Lecture 03): https://nptel.ac.in/courses/108106135/03
9. Semiconductor Optoelectronics – NPTEL (IIT Delhi, Prof. M. R. Shenoy)Direct video link (start relevant lecture): https://nptel.ac.in/courses/108108174/05
10. Sensors and Actuators – NPTEL (IISc Bangalore, Prof. Hardik J. Pandya) Lecture Introduction to Sensors, Transducers & Actuators, incl. Hall, RTDs, Thermistors https://digimat.in/nptel/courses/video/108108147/L01.html
11. Smart Sensors – NPTEL Lecture 34 – Covers various sensors including gas, pressure, MOS sensors, photodetectors like SNSPD https://www.youtube.com/watch?v=oRydUfgMdgA
12. Lecture 32 – Superconducting Qubits (includes Charge Qubit / Cooper-Pair Box) https://www.youtube.com/watch?v=iYo8ALJ-Mls
13. **Virtual LAB:** https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
14. **Virtual LAB:** https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1

Activity-Based Learning/Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in
3. https://virtuallabs.merlot.org/vl_physics.html
4. https://phet.colorado.edu
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Course objectives:

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Curriculum Structure:

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25PH1BSPEC / 25PH2BSPEC	Quantum Physics and Sensors For Electronics Engineering	40	30	10 + 40 = 50 (CCA=10 hrs) (SL=8*5=40 hrs)	120	4

Course Title: Physics of Materials for Electrical Engineering		Semester	I
Course Code	25PH1BSPEE	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	04	**Exam Hours**	03
Examination type (SEE)			

Course Outcomes (Course Skill Set)

CO1: Understand and Apply the principles of quantum mechanics, transport phenomena in metals, properties of dielectric, magnetic, semiconducting and superconducting materials, construction and working principle of thermoelectric devices.

CO2: Use appropriate Tools to develop the concept of physics, perform as a member of team to design a model and make an oral presentation.

CO3: Conduct, Analyze and Interpret the data and results from Physics experiments.

Module-1: Quantum Mechanics **8 Hours**

de-Broglie hypothesis – derivation by analogy. Definition of phase velocity and group velocity. Relation between group velocity and phase velocity, relation between group velocity and particle velocity, relation between group velocity, phase velocity and velocity of light (qualitative). Heisenberg's uncertainty principle - statement and physical significance. Application of uncertainty principle – non-existence of electron in the nucleus.

Wave function-properties, physical significance. Born Interpretation, expectation value, and its physical significance. Probability density and normalization of wave function. Setting up of one-dimensional time independent Schrödinger's wave equation. Particle in a one-dimensional potential well of infinite height and finite width (particle in a box) - Eigen functions, probability density and Eigen values for the first two states. Problems.

Self-study: Ehrenfest theorem, Quantum dots

Module-2: Electrical Properties of Metals And Semiconductors **8 Hours**

Introduction to classical free electron theory and its failures. Mechanisms of electron scattering in solids, Matheissen's rule. Assumptions of Quantum Free Electron Theory, density of states (qualitative), Fermi energy, expression for Fermi energy (qualitative), Fermi velocity, Fermi temperature. Fermi factor, variation of Fermi factor with temperature and energy. Merits of quantum free electron theory.

Introduction to Semiconductors, expression for concentration of electrons in conduction band, expression for hole-concentration in valance band (qualitative). Expression for intrinsic carrier concentration. Fermi level for intrinsic (derivation) and extrinsic semiconductor (qualitative), expression for electrical conductivity of semiconductors and energy band gap. Hall effect, expressions for Hall voltage, Hall coefficient, and its applications. Problems.

Self-study: Semiconductors in electronics applications

Module-3: Superconductivity	**8 Hours**
Introduction to superconductors – Zero resistance state, temperature dependence of resistivity, persistent current, three critical parameters - critical temperature, critical magnetic field and critical current: Silsbee effect. Derivation of critical current for a cylindrical wire using ampere's law. Meissner effect. Type-I and Type-II superconductors. Formation of vortices. BCS Theory - two-fluid model, formation of Cooper pairs, phase coherent state. Limitations of BCS theory, examples of systems with low and high electron-phonon coupling. Cooper pair tunneling (Andreev reflection). Josephson junction, flux quantization, DC and AC SQUIDs (qualitative), MAGLEV vehicle. Problems. **Self-study:** Principle and working of MRI	
Module-4: Dielectric and Magnetic Materials	**8 Hours**
Dielectric Materials: Introduction, electrical polarization, types of polarization, expression for electronic polarizability. Expression for internal field in one dimensional liquids and solids, Lorentz field. Clausius–Mossotti relation. Applications of dielectrics in capacitors, transformers (oils), SF6 in high voltage application. **Magnetic Properties of Materials:** Classification of magnetic materials. Ferromagnetic materials – Weiss's domain theory. Importance of Curie temperature, ferromagnetic hysteresis and its explanation using domain theory. Soft and hard magnetic materials. Applications: transformer cores, armature, inductors and chokes, permanent magnets. Problems. **Self-study:** Dielectric and magnetic materials in electrical appliances	
Module-5: Thermoelectric and Electrical Engineering Materials	**8 Hours**
Thermo emf and thermo current, Seebeck effect, Peltier effect, Seebeck and Peltier coefficients, figure of merit and its tuning (qualitative). Thermocouple and thermopiles (qualitative). Construction and working of thermoelectric generators (TEG) and thermoelectric coolers (TEC), Applications: exhaust of automobiles and refrigerator. Ceramics: types, materials, applications. Electrostriction: strain proportional to square of the electric field, materials, applications. Magnetostriction: materials, applications. Piezoelectric effect, materials, applications. Problems. **Self-Study**: Radioisotope thermoelectric generator (RTG), wearable flexible devices	

Suggested Learning Resources:

I. Text books:

1. Solid State Physics-S O Pillai, 8th Ed- New Age International Publishers-2018.
2. Engineering Physics, Satyendra Sharma and Jyotsna Sharma, Pearson, 2018.
3. A Text book of Engineering Physics by M.N. Avadhanulu, P G. Kshirsagar, S Chand, 2014, Revised Edition.
4. Smart Materials and Structures, M. V. Gandhi and B. S. Thompson, Chapman & Hall.

I. Reference books / Manuals:

1. Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBS Publishers and Distributers Pvt. Ltd., 2018.
2. Tinkham, M. (2004). Introduction to Superconductivity (2nd ed.). Dover Publications.
3. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017.
4. Electrical Engineering Materials, R. K. Shukla, Tata McGraw-Hill Education, India, 2017 reprint edition.

II. Web links and Video Lectures (e-Resources):

1. Mod-02 Lec-20: Dielectrics – Prof. D. K. Ghosh, IIT Bombay https://www.youtube.com/watch?v=P9VyW2wq9ZE
2. Mod-01 Lec-16: Dielectric (Insulating) Solids – Prof. G. Rangarajan, IIT Madras https://www.youtube.com/watch?v=etjZmdmrjSU
3. Lecture 41: Thermoelectric Generators – Functioning and Applications https://www.youtube.com/watch?v=G9NgoxHMPwk
4. NPTEL course: Solid State Physics – Prof. A.K. Raychaudhuri, IIT Kharagpur Course link: https://archive.nptel.ac.in/courses/115/105/115105099
5. Mod-01 Lec-27: Superconductivity – Perfect Conductivity & Diamagnetism – Prof. G. Rangarajan, IIT Madras https://www.youtube.com/watch?v=GglT1RoBPzg
6. Lecture 01: PMMC Instrument – https://www.youtube.com/watch?v=n1MinLtvnPY
7. Lecture 02: Electrodynamic / Moving Iron Instruments – https://www.youtube.com/watch?v=n1MinLtvnPY&list=PLbRMhDVUMngcoKrA4sHzvbNVSE6IpEio & index=2
8. Lecture 03: Measurement Systems Characteristics – https://www.youtube.com/watch?v=Hlvbr5DCEfM
9. Electrical Measurement course Prof Avishek Chatterjee IIT Kharagpur : https://www.youtube.com/playlist?list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio
10. **Virtual LAB:** https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
11. **Virtual LAB:** https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1

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Assessment Structure:

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Grand Total Marks					100

Course objectives:

1. To impart the knowledge of quantum mechanics and its applications
2. To provide insight to the electrical properties of metals, dielectric, semiconductors and superconductors, and their engineering applications
3. To understand the essentials of thermoelectric, magnetic and engineering materials for practical applications

CO-PO mapping with strength:

COs	POs										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CO1	**3**	**2**									
CO2					**1**				**1**	**1**	
CO3				**3**							

List of Lab activities:

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Curriculum Structure:

Course Code	Course Title	Teaching and Learning Scheme				
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25PH1BSPEE	Physics Of Materials For Electrical Engineering	40	30	10 + 40 = 50 (CCA=10 hrs) (SL=8*5=40 hrs)	120	4

Course Title: Physics of Structural Systems for Civil Engineering		Semester	I
Course Code	25PH1BSPCV	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	04	**Exam Hours**	03
Examination type (SEE)			

Course Outcomes (Course Skill Set)

CO1: Understand and Apply the concept of vibrations, elastic properties of materials, natural hazards and their safety measures, acoustic design, various material characterization techniques to obtain the desired parameters.

CO2: Use appropriate Tools to develop the concept of physics, perform as a member of team to design a model and make an oral presentation.

CO3: Conduct, Analyze and Interpret the data and results from physics experiments.

Module-1: Oscillations **8 Hours**

Theory of free vibrations: Periodic motion, simple harmonic motion (SHM), equation of a simple harmonic oscillator, expressions for period and frequency, energy considerations-total energy, conversion of energy from kinetic to potential energy in SHM.

Theory of damped vibrations: Resistive forces, equation of motion-expression for decaying amplitude, three cases of damping. Logarithmic decrement, relaxation time and quality factor (qualitative).

Theory of forced vibrations: Equation of motion-expression for amplitude and Phase, three cases of forcing.

Resonance: Phenomenon of resonance. Example of resonance, LCR circuit. Problems.

Self-study: Coupled vibrations, Musical instruments, ESR and NMR

Module-2: Elasticity **8 Hours**

Stress, strain and their types. Hooke's law. Stress-strain diagram. Young's Modulus (q), bulk modulus (k), rigidity modulus (η) and Poisson's ratio (σ). Relation between Young's modulus (q), Bulk modulus (k) in terms of α and β (or σ). Relation between Rigidity modulus (η), Young's modulus (q) in terms of α and β (or σ). Relation between σ, k and η. Relation between all the three-elastic modulus (q, k and η). Work done per unit volume in a strain. Expression for twisting couple per unit twist.

Beams: Bending moment and derivation of expression.

Cantilever: Expression for depression at free end of Cantilever. Problems.

Self-study: Types of pendulums, various types of bridges and structures

Module-3: Waves And Their Role In Structural Behavior **8 Hours**

Types of waves, wave propagation in beams, rods, and 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.

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), seismometer and seismograph. Landslide - causes such as excess rainfall, geological structure change, human excavation. Problems.

Self-study: Ultrasonic waves and applications, natural hazards

Module-4: Acoustics, Radiometry and Photometry **8 Hours**

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, sound insulation and its measurements. Noise and its measurements, impact of noise in multi-storied buildings. Radiometry and photometry: radiation quantities, spectral quantities, relation between luminance and radiant quantities, reflectance and transmittance. Photometry (cosine law and inverse square law). Problems.

Self-study: Design of auditorium and radiation hazards

Module-5: Materials Characterization and Instrumentation Techniques **8 Hours**

Materials properties: introduction, crystal systems, planes in a crystal. Miller indices – expression for interplanar spacing in terms of Miller indices. Relation between lattice constant and bulk density. Co-ordination number, relation between atomic radius and lattice constant. Atomic packing factor for simple cubic, BCC and FCC lattices.

Instrumentation techniques: Bragg's law, X-ray diffractometer (XRD), crystallite size determination by Scherrer equation. Principle, construction, working and applications of Scanning Electron Microscope (SEM). Problems.

Self-Study: Analysis using XPS, AFM, FTIR and UV-Vis

Suggested Learning Resources:

I. Reference books / Manuals:

1. Physics, Oscillations and Waves, Optics and Quantum Mechanics, H M Agarwal and R M Agarwal, Pearson, 2025.
2. Engineering Physics, Satyendra Sharma and Jyotsna Sharma, Pearson, 2018.
3. Dynamics of Structures - Theory and Applications to Earthquake Engineering Anil K. Chopra, University of California at Berkeley, Fourth Edition. Prentice Hall.
4. Vibrations and Waves, A P French, MIT introductory Physics, 2003
5. Engineering Physics by R. K. Gaur and S. L. Gupta, 2010 Edition, Dhanpat Rai Publications Ltd., New Delhi-110002.
6. Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBS Publishers and Distributers Pvt. Ltd., 2018.

7. Introduction to Seismology, Earthquakes, and Earth Structure, Stein, Seth, and Michael Wysession. Blackwell Publishing, 2003.
8. Photometry Radiometry and Measurements of Optical Losses, Micheal Bukshtab, Springer, 2nd Edition.
9. Engineering Physics, S Mani Naidu, Pearson, 2025.
10. Building Science: Lighting and Acoustics, B. P. Singh and Devaraj Singh, Dhanpat Rai Publications (P) Ltd.
11. A Text book of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10th revised Ed, S. Chand. & Company Ltd, New Delhi.
12. Timoshenko, S. and Goodier J.N. "Theory of Elasticity", 2nd Edition, McGraw Hill Book Co, 2001.
13. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 1997.
14. Solid State Physics - S O Pillai, 8th Ed- New Age International Publishers-2018.
15. Characterization of Materials- Mitra P. K. Prentice Hall India Learning Private Limited.
16. An Introduction to Disaster Management, Natural Disaster & Man-Made Hazards, S. Vaidyanathan, IKON Books.
17. Natural Hazards, Edward Bryant, Cambridge University Press, 2nd Edition.
18. Natural hazards, Earthquakes, Volcanoes, and landslides by Ramesh P Singh, and Darius Bartlett, CRC Press, Taylor and Francis group.
19. Principles of Fire Safety Engineering Understanding Fire & Fire Protection, Akhil Kumar Das, PHI Learning, II Edition.
20. Disaster Management, R. Subramanian, S. Chand Publishing, 2018.

II. Web links and Video Lectures (e-Resources):

1. **Simple Harmonic motion:** https://www.youtube.com/watch?v=k2FvSzWeVxQ
2. **Stress-strain curves:** https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
3. **Stress curves:** https://www.youtube.com/watch?v=f08Y39UiC-o
4. **Acoustics:** https://www.youtube.com/watch?v=fHBPvMDFyO8
5. **Fundamentals of Acoustics:** https://www.youtube.com/watch?pp=0gcJCfwAo7VqN5tD&v=rT9B44Q4Rko
6. **Fundamentals of Acoustics playlist:** https://www.youtube.com/playlist?list=PLgMDNELGJ1CYWnDbcbVET5zCbN4aLEbZQ
7. **Virtual lab:** https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
8. **Material characterization:** https://onlinecourses.nptel.ac.in/noc20_mm14/preview

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4. https://phet.colorado.edu
5. https://www.myphysicslab.com

Teaching-Learning Process (Innovative Delivery Methods):

1. Chalk and Talk
2. Blended Mode of Learning
3. Simulations, Interactive Simulations and Animations
4. NPTEL and Other Videos for theory topics
5. Smart Class Room
6. Flipped Class
7. Lab Experiment Videos

Assessment Structure:

Component	Type of assessment	Max. Marks	Reduced to	Total	Total Marks
CIE – Theory	CCA	10	05	50	50
	Test 1	40	10		
	Test 2	40	10		
CIE – Lab	Test	50	25		
SEE	Semester End Exam	100	50		50
Grand Total Marks					100

Course objectives:

1. 1. To impart the knowledge of elasticity and vibrations in advanced materials and mechanical structures
2. To provide overview of natural hazards and their prevention protocols
3. To understand the physics of waves and acoustics, and their implications in structural design
4. To emphasize on advanced characterization tools for analyzing materials properties

CO-PO mapping with strength:

COs	POs										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CO1	**3**	**2**									
CO2					**1**				**1**	**1**	
CO3				**3**							

List of Lab activities:

1. Young's modulus by single cantilever
2. Rigidity modulus by torsional pendulum
3. Series LCR circuits
4. Parallel LCR circuits
5. X-ray film analysis
6. Spring constant
7. Divergence angle of a LASER
8. Numerical aperture of an optical fiber
9. Wavelength of LASER by diffraction
10. Resistivity by four probe method
11. Fermi energy of copper
12. Study of motion using spread sheet
13. GNU step interactive simulations
14. PHET Interactive simulations (https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype)

Curriculum Structure:

Course Code	Course Title	Teaching and Learning Scheme				
		Classroom Instruction (CI) (in hours per semester)	Lab Instruction (LI) (in hours per semester)	Team Work (TW) and Self Learning (SL) (TW + SL) (in hours per semester)	Total No. of Hours per Semester	Total Credits (C) * (Total Hours/30)
25PH1BSPCV	Physics Of Structural Systems For Civil Engineering	40	30	10 + 40 = 50 (CCA=10 hrs) (SL=8*5=40 hrs)	120	4

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Physics of Materials for Mechanical Engineering Stream		**Semester**	II
Course Code	25PH2BSPME	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	04	**Exam Hours**	03
Examination type (SEE)			

Course Outcomes (Course Skill Set)

CO1: Understand and Apply the concept of vibrations, elastic properties of materials, thermoelectric effects, cryogenics and various material characterization techniques to obtain the desired parameter.

CO2: Use appropriate Tools to develop the concept of physics, perform as a member of team to design a model and make an oral presentation.

CO3: Conduct, Analyze and Interpret the data and results from physics experiments.

Module-1: Oscillations **8 Hours**

Theory of free vibrations**:** Periodic motion, simple harmonic motion, equation of a simple harmonic oscillator, expressions for period and frequency, energy considerations-total energy, conversion of energy from kinetic to potential energy in SHM.

Theory of damped vibrations: Resistive forces, equation of motion-expression for decaying amplitude, three cases of damping. Logarithmic decrement, relaxation time and quality factor (qualitative).

Theory of forced vibrations: Equation of motion-expression for amplitude and phase, three cases of forcing.

Resonance: Phenomenon of resonance. Example of resonance, LCR circuit. Problems.

Self-study: Coupled vibrations, Musical instruments, ESR and NMR

Module-2: Elasticity **8 Hours**

Stress, strain and their types. Hooke's law. Stress-strain diagram. Young's Modulus (q), bulk modulus (k) and rigidity modulus (η). Poisson's ratio (σ). Relation between Young's modulus (q), Bulk modulus (k) in terms of α and β (or σ). Relation between Rigidity modulus (η), Young's modulus (q) in terms of α and β (or σ). Relation between σ, k and η. Relation between all the three-elastic modulus (q, k and η). Work done per unit volume in a strain. Expression for twisting couple per unit twist.

Beams: Bending moment and derivation of expression.

Cantilever: Expression for depression at free end of cantilever. Problems.

Self-study: Types of pendulums, various types of bridges and structures

Module-3: THERMOELECTRIC MATERIALS AND PROPERTIES	**8 Hours**
Thermo emf and thermo current, Seebeck effect, Peltier effect, Seebeck and Peltier coefficients, figure of merit (Mention Expression), laws of thermoelectricity. Expression for thermo emf in terms of T_1 and T_2. Thermo couples and thermopile (Qualitative). Thermal conductivity, expression for thermal conductivity of a conductor using classical free electron theory. Wiedemann–Franz law, calculation of Lorentz number using classical and quantum assumptions. Theory and determination of thermal conductivity using Forbe's and Lee–Charlton's methods. Problems. **Self-study:** Transducers, exhaust of automobiles and refrigerators.	
Module-4: CRYOGENICS	**8 Hours**
Introduction to thermodynamics, Carnot's principle, efficiency, production of low temperature - Joule Thomson effect (Derivation with 3 cases), porous plug experiment with theory, thermodynamical analysis of Joule Thomson effect, liquefaction of oxygen by cascade process, Lindey's air liquefier, liquefaction of helium and its properties (superfluidity), platinum resistance thermometer, applications of cryogenics: aerospace, Dewar flask. Problems. **Self-study:** Cryogenic engines and CE-20 in GSLV	
Module-5: Materials Characterization and Instrumentation Techniques	**8 Hours**
Materials properties: Introduction, crystal systems, planes in a crystal. Miller indices – Expression for interplanar spacing in terms of Miller indices. Relation between lattice constant and bulk density. Co-ordination number, Relation between atomic radius and lattice constant. Atomic packing factor for Simple Cubic, BCC and FCC lattices. Instrumentation techniques: Bragg's law, X-ray diffractometer (XRD), crystallite size determination by Scherrer equation. Principle, construction, working and applications of Scanning Electron Microscope (SEM). Problems. **Self-Study**: Analysis using XPS, AFM, FTIR and UV-Vis	

Suggested Learning Resources:

I. Reference books / Manuals:

1. Physics, Oscillations and Waves, Optics and Quantum Mechanics, H M Agarwal and R M Agarwal, Pearson, 2025
2. Engineering Physics, Satyendra Sharma and Jyotsna Sharma, Pearson, 2018.
3. A Text book of Engineering Physics by M.N. Avadhanulu, P G. Kshirsagar, S Chand, 2014, Revised Edition.
4. Fundamentals of Cryogenic Engineering, Mamata Mukhopadhyay, PHI Learning (India).
5. Characterization of Materials - Mitra P.K. Prentice Hall India Learning Private Limited.
6. Vibrations and Waves (MIT introductory Physics Series), A P French, CBS, 2003 Edition.
7. Elements of Properties of Matter, D S Mathus, S Chand, Reprint 2016.

8. Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBS Publishers and Distributers Pvt. Ltd.
9. Cryogenics: A Text Book, S.S. Thipse, Alpha Science International, Limited 2013.
10. Treatise on Heat, M N Saha and B N Srivastava, 2nd Edition, Indian Press, 1935; Original from, the University of California.
11. Materials Characterization Techniques-Sam Zhang, Lin Li, Ashok Kumar, CRC Press, First Edition, 2008.
12. Solid State Physics - S O Pillai, 8th Ed- New Age International Publishers - 2018.

II. Web links and Video Lectures (e-Resources):

1. **Simple Harmonic motion:** https://www.youtube.com/watch?v=k2FvSzWeVxQ
2. **Stress-strain curves:** https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
3. **Stress curves:** https://www.youtube.com/watch?v=f08Y39UiC-o
4. **Cryogenic Engineering:** https://www.youtube.com/watch?v=4gGMBNEzeuc
5. **Liquefaction of gases:** https://www.youtube.com/watch?v=aMelwOsGpIs
6. **Virtual lab:** https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
7. **Material characterization:** https://onlinecourses.nptel.ac.in/noc20_mm14/preview

Activity-Based Learning/Practical-Based Learning:

1. http://nptel.ac.in
2. https://swayam.gov.in
3. https://virtuallabs.merlot.org/vl_physics.html
4. https://phet.colorado.edu
5. https://www.myphysicslab.com

Teaching-Learning Process (Innovative Delivery Methods):

1. Chalk and Talk
2. Blended Mode of Learning
3. Simulations, Interactive Simulations and Animations
4. NPTEL and Other Videos for theory topics
5. Smart Class Room
6. Flipped Class
7. Lab Experiment Videos

Assessment Structure:

Component	Type of assessment	Max. Marks	Reduced to	Total	Total Marks
CIE – Theory	CCA	10	05	50	50
	Test 1	40	10		
	Test 2	40	10		
CIE – Lab	Test	50	25		
SEE	Semester End Exam	100	50		50
Grand Total Marks					100

Course objectives:

1. To impart the knowledge of elasticity and vibrations in advanced materials and mechanical structures
2. To provide insight to the principles of thermoelectric for realization in thermo-electric appliances
3. To understand the physics of low-temperature and its implications in cryogenic engineering
4. To emphasize on advanced characterization tools for analyzing materials properties

CO-PO mapping with strength:

COs	POs										
	1	2	3	4	5	6	7	8	9	10	11
CO1	3	2									
CO2					1				1	1	
CO3				3							

List of Lab activities:

1. Young's modulus by single cantilever
2. Rigidity modulus by torsional pendulum
3. Series LCR circuits
4. Parallel LCR circuits
5. Thermal conductivity of a good conductor by Forbe's method
6. Thermal conductivity of a poor conductor by Lee Charlton's method
7. Spring constant
8. X-ray film analysis
9. Fermi energy of copper
10. Numerical aperture of an optical fiber

11. Wavelength of LASER by diffraction
12. Divergence angle of a LASER
13. Study of motion using spread sheet
14. GNU step interactive simulations
15. PHET Interactive Simulations
    (https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype)

Curriculum Structure:

Course Code	Course Title	Teaching and Learning Scheme				
		Classroom Instruction (CI) (in hours per semester)	Lab Instruction (LI) (in hours per semester)	Team Work (TW) and Self Learning (SL) (TW + SL) (in hours per semester)	Total No. of Hours per Semester	Total Credits (C) * (Total Hours/30)
25PH2BSPME	Physics Of Materials For Mechanical Engineering Stream	40	30	10 + 40 = 50 (CCA=10 hrs) (SL=8*5=40 hrs)	120	4

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Computer-Aided Engineering Drawing		Semester	I/II
Course Code	25ME1ESCED / 25ME2ESCED	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	1:0:2	**SEE Marks**	100
Total Hours of Pedagogy	65	**Total Marks**	100
Credits	3	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to ….

CO1: Draw orthographic and Isometric projections of geometrical entities in various positions.

CO2: Develop 2D, 3D models and lateral surfaces of solids.

CO3: Use modern engineering tool (CAD software) necessary for engineering visualization

CO4: Interpret and communicate with sketches and engineering drawings with enhanced spatial visualization skills.

Module-1: **19 Hours**

A: Introduction: Engineering Visualization, Principles of Engineering Graphics and their significance, BIS Conventions, dimensioning, scales, line conventions, material conventions, sketching.
Introduction to CAD software, standard tool bar menu and description of most commonly used tool bars, and navigational tools. **[1L + 0T+2P Hrs.]**

B: Orthographic Projections

Introduction, quadrant system, Planes of projection, reference line and conventions employed, Projections of points in First and Third quadrants. Projections of straight lines (located in first quadrant and without reference to traces), True and apparent lengths, True and apparent inclinations to reference planes, simple application problems. **[2L +0T+ 6P Hrs.]**

Projections of Plane Surfaces (First Angle Projection Only)

Introduction, Projections of plane surfaces: triangle, square, rectangle, rhombus, circle, regular pentagon and regular hexagon in different positions by change of position method.

[2L + 0T+ 6P Hrs.]

Module-2: **17 Hours**

Projections of solids (First Angle Projection Only)

Introduction, Projections of regular upright solid: tetrahedron, cube, prism, pyramid, cylinder and cone in different positions by change of position method.

Module-3: **15 Hours**

A: Isometric Projection (Using Isometric Scale only)

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron, right regular prisms, pyramids, cylinders, cones, spheres, cut spheres and combination of solids (maximum of two solids)

B: 3-D Modelling: Use of solid-modeling software for creating simple components: Solid and hollow right regular prisms and cylinders, solid pyramids, cones, spheres, and combination of solids and extracting orthographic views, sectional and Isometric views.

[3L+0T+ 12P Hrs.]

Module-4 :	**12 Hours**
Development of lateral surfaces of right regular prisms, cylinders, pyramids, and cones & their frustums and truncations (resting with base on HP only).	**[2L+ 0T+ 10P Hrs.]**
Module-5:	**02 Hours**
Multidisciplinary Applications Evaluation through Alternate assessment only 1. Civil stream: Modelling Basic Building Component (columns, beams, slabs, walls, doors, windows, staircase), drafting a 2D floor plan for a simple single-storey residential building, Converting the floor plan into 3D model with walls 2. Mechanical Stream: 3D Modelling of simple machine parts (Applying material properties and rendering for realistic visualization), Concept of Industrial drawing 3. Electric/Electronics Stream: 2D drawing of switches, sockets, panels, junction boxes, antenna: Single element patch antenna, antenna array, electric/electronics circuits 4. CSE stream: 2D Network drawing with wired and wireless, Network topology - wired and wireless, Modelling of Raspberry Pi / Arduino boards, Router & switches, IoT devices **[0L+ 0T+ 02P Hrs.]**	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. Engineering Drawing Vol 1 & 2 Combined, K. R. Gopala Krishna, ISBN 39789383214235, Subhas Stores, Bangalore,2017.
2. Textbook of Computer Aided Engineering Drawing by K.R. Gopalakrishna, Sudhir Gopalakrishna, ISBN-135551234102489, 2017.

II. Reference books:

1. Engineering Drawing, N.D. Bhat& V.M. Panchal, 45 Edition, Charotar Publishing, Gujarat, 2000
2. Fundamental of Engineering Drawing & Graphics Technology, French, Thomas E., Vierck, C. J. and Foster, R. J., McGraw Hill Book Company (2005).
3. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production- Luzadder Warren J., Duff John M Eastern Economy Edition, 2005- Prentice-Hall of India Pvt. Ltd., New Delhi.
4. A Primer on Computer Aided Engineering Drawing-2006, Published by VTU, Belagavi.
5. Electrical Engineering Drawing, Bhattacharya S. K., New Age International publishers, second edition 1998, reprint 2005.
6. Printed Circuit Board Design using AutoCAD, Chris Schroder, Newnes, 1997.
7. Introduction to Architectural and Technical Drawing: Roksaneh Rahbarianyazd – Hourakhsh A. Nia, 2020

III. E-Books:

1. Siemens Solid Edge Exercises 200 Practice Drawings for Solid Edge and Other Feature-Based Modelling Software y Sachidanand Jha · 2019, ISBN:9781096479147, 1096479141, Amazon Digital Services LLC - KDP Print US.
2. Solid Edge 2020 for Designers, 17th Editionbooks.google.co.in., Prof. Sham Tickoo, CADCIM Technologies, 2020.

IV. Web links and Video Lectures (e-Resources):

1. NPTEL course on ENGINEERING DRAWING AND COMPUTER GRAPHICS https://nptel.ac.in/courses/112/105/112105294/#

Teaching-Learning Process (Innovative Delivery Methods):

1. The Laboratory session shall be held every week as per the time table and the performance of the student shall be evaluated in every session the average of marks over number of units is considered for 20 marks.
2. Project/Assignment/Experiential Learning covering syllabus

Assessment Structure:

CIE marks are finalized as per the details given below

Sl. No	Evaluation Method	Unit	Marks	Weightage
1.	CIE-Test 1	1B	40	20
2.	CIE-Test 2	2	40	
3.	CIE-Test 3	3,4	40	
4.	Sketching and lab assignments	1B -4	60	20
5.	Stream based Experiential Learning	5	10	10
			100	**50**

SEE:

1. Manual sketching and drafting using CAD Software as in table
2. **UNIT** 1A & 5 shall not be considered for SEE
3. Candidate shall answer 4 full questions selecting one from each unit.

Sl. No	Unit	Number of questions	Weightage (To Answer one full question from each unit)		
			Sketching	Software	Total
1	1B	02	20	--	20
2	2	02	0	30	30

3	3	02	0	30	30
4	4	02	20	0	20
	Total	**08**	**40**	**60**	**100**

COs and POs Mapping

COs	POs										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CO1	3				2						
CO2	3				3						
CO3	3				3						

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Building Science and Mechanics		Semester	I/II
Course Code	25CV1ESBSM/25CV2ESBSM	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	03	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to ….

CO1: Define the scope of various civil engineering specializations and recognize the significance of construction materials and building components.

CO2: Understand the fundamentals of sustainable construction practice, selection of green materials and interpretation of rating systems

CO3: Apply the concepts of force and moments to solve problems related to resultant and equilibrium of coplanar force system.

CO4: Locate the centroid of simple and composite plane laminas using first principles

Module-1: Introduction to building science **08 Hours**

Importance and Scope of various Civil Engineering disciplines: Surveying, Structural Engineering, Geotechnical Engineering, Water Resources Engineering, Transportation Engineering, Environmental Engineering, Construction Planning and Project Management.

Basic Materials of Construction: Production and Quality requirements of Cement, Burnt Clay bricks, Concrete blocks; Applications of Mortar, Plain and Reinforced Concrete, Pre cast concrete, Structural Steel; Life cycle analysis (concept of 4 phase analysis only)

Building components: Concept and functionalities of Foundation, Plinth, Column, Beam, Slab, Lintel, Chejja, Masonry wall and Staircase.

Module-2: Sustainable Construction Practices **08 Hours**

Sustainability components: Green Buildings- Features, Necessity and benefits; Major Energy consumptive activities in buildings and efficient practices- Daylighting, Waste water treatment, Rain water harvesting.

Green Materials: Material selection criteria, Conventional construction materials and Green Materials, Carbon footprint, Availability and Applications of Green Materials: Stabilized Mud blocks, Lime pozzolana Cement, Lightweight/ Aerated Concrete (AAC) blocks, Bamboo.

Green building rating systems: IGBC, LEED – Purpose - Key highlights - Point System with Differential weightage.

Module-3: Force Systems: **Resultant of coplanar forces** **08 Hours**

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

Module-4: Force systems: Equilibrium of coplanar forces **08 Hours**

Free body diagram, Equations of equilibrium, Lami's Theorem, Equilibrium of Coplanar Concurrent force systems, Equilibrium of Non -concurrent force systems (Point load, UDL and Simple support beam cases): Numerical examples.
Module-5: Centroid of Plane lamina **08 Hours**
Centroid of Plane areas: Introduction, Locating the centroid of rectangle, triangle, circle, semicircle and quadrant of a circle using method of integration, centroid of composite areas and simple built-up sections, Numerical examples

Suggested Learning Resources:

I. 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

4. G Harihara Iyer, Green Building Fundamentals, 2022, Notion Press Publications, ISBN: 9798886416091

II. Reference books:

1. Beer F.P. and Johnston E. R., Mechanics for Engineers: Statics and Dynamics, 4th Edition, 1987, McGraw Hill, ISBN: 9780070045842

2. Meriam J. L. and Kraige L. G, Engineering Mechanics-Statics, Vol I–6th Edition,2008, Wiley publication.

3. Irving H. Shames, Engineering Mechanics-Statics and Dynamics, 4th Edition, 2002, Prentice-Hall of India(PHI).

4. Hibbler R. C., Engineering Mechanics: Principles of Statics and Dynamics, 2017, Pearson Press, New Delhi.

5. Timoshenko S, Young D. H., Rao J. V., Sukumar Patil, Engineering Mechanics, 5th Edition, 2017,McGraw Hill Publisher, ISBN: 9781259062667

6. Bhavikatti S S, Engineering Mechanics, 4th Edition, 2018, New Age International Publications.

7. Reddy Vijaykumar K and Suresh Kumar K, Engineering Mechanics, 3rd Edition 2013, BS Publications.

8. Dr. Adv. HarshulSavla, Green Building: Principles & Practices, 2021, Notion Press, ISBN: 9781685866044

III. Web links and Video Lectures (e-Resources):

1. NPTEL: Introduction to Civil Engineering Profession, https://nptel.ac.in/courses/105106201
2. NPTEL: Engineering Mechanics, https://nptel.ac.in/courses/112103108
3. NPTEL: Sustainable Materials and Green Buildings, https://nptel.ac.in/courses/105102195

Teaching-Learning Process:

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

1. Chalk and talk.
2. PowerPoint presentation, Site/ Laboratory visits for materials and building component demonstrations.
3. Flipped Classroom
4. NPTEL and other videos for theory topics

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

Assessment Structure:

Component	Type of Assessment	Max. Marks	Reduced Marks	Total	Min. Marks for Eligibility	Total marks
CIE- Theory	Quiz / AAT	20	10	**50**	**20**	**50**
	Test 1	40	20			
	Test 2	40	20			
	Test 3					
SEE	**Semester End Exam**	**100**	50		**35**	**50**
Grand Total						**100**

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 100 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**.

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

1. Case Study Presentation
2. Assignments
3. Quiz
4. Course Project
5. Any other relevant and innovative academic activity
6. Use of MOOCs and Online Platforms

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

1. Case-Based Teaching
2. Flipped Classroom
3. Problem-Based Learning (PBL)
4. ICT-Enabled Teaching

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Introduction to Electrical Engineering		Semester	I/II
Course Code	25EE1ESIEE / 25EE2ESIEE	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40 Hours	**Total Marks**	100
Credits	03	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

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

1. Understand the concepts of various energy sources, electric circuits and electromagnetism
2. Apply knowledge of mathematics to solve problems related to electrical circuits.
3. Analyse the behaviour of electric circuits, transformers, DC motors and electric vehicles.
4. Analyse electricity billing and concepts of protective devices and safety measures

Engage in individual/team work to make effective technical presentation on electrical concepts and communicate effectively to the audience

Module-1: **08 Hours**

Power Generation: Conventional and non-conventional energy sources, (Wind, Hydro, Solar, Nuclear: block diagram approach) Single-line diagram of power supply system showing power station, transmission system and distribution system. Definition of power grid.

DC circuits: Ohm's law and its limitations, Kirchhoff's laws, analysis of series, parallel and series-parallel circuits. Power and energy. Numerical. (Only Branch current method approach and current source numerical not included).

Module-2: **08 Hours**

AC Circuits: Types of supplies (single phase and three phases), advantages, limitations and its applications. Generation of single-phase system. Equation of AC voltage and current, average value, RMS value, form factor, peak factor and their relations. Voltage and current relationships in R, L and C circuits, analysis of R-L, R-C and R-L-C series circuits (No-power derivations), concept of power, reactive power, apparent power and power factor. Illustrative examples.

Module-3: **08 Hours**

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

DC Motor: Principle of operation, back emf and its significance. Torque equation, types of motors (series and shunt), and applications of DC motors. Numerical.

Module-4 : **08 Hours**

Transformers: Introduction to transformers, necessity of transformer, principles of operation, constructional features, types (shell and core) of single phase transformers. EMF equation, losses, variation of losses with respect to load. Calculation of efficiency at different loads, condition for maximum efficiency, numerical.

Electric Vehicle: Introduction, block diagram approach, types of EV, Advantages and its limitations.

Module-5:	**08 Hours**
Domestic Wiring: Two-way and three-way control of loads. **Electricity Bill:** Definition of "unit" used for consumption of electrical energy, power rating of common household appliances. Two-part electricity tariff, simple problems. **Equipment Safety measures:** Working principle of fuse and miniature circuit breaker (MCB), merits and demerits. Definitions of rated current, fusing current, fusing factor. **Personal safety measures:** Electric shock, safety precautions to avoid shock. Earthing and types: Plate earthing and pipe earthing.	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

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

II. Reference books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill 4th edition, 2019
2. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI, 3rd edition, 2014
3. Electrical Technology by E. Hughes, Pearson, 12th Edition, 2016
4. Basic Electrical and Electronics Engineering, K.Vijayarekha, et al, Cengage. Reprint 2023
5. Handbook of Electrical Engineering formulae, Harish C Rai, CBS Publications, 2018

III. Web links and Video Lectures (e-Resources):

1. www.nptel.ac.in
   A. Principle of Electrical Sciences, Prof Sanjay Agrawal, Indira Gandhi National Open University.
   B. Electricity and Electrical Wiring, Dr. Antara Mahanta Barua, Krishna Kanta Handiqui State Open University, Guwahati

Teaching-Learning Process (Innovative Delivery Methods):

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

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

Assessment Structure:

Component	Type of assessment	Max. Marks	Total	Reduced Marks	Total	Min. Marks required for eligibility	Total Marks
CIE – Theory	Quiz/AAT	10	10	10	50	20	50
	Test 1	40	80 (Best 2 of 3 tests)	40			
	Test 2	40					
	Test 3	40					
	CIE			50		20	
SEE	End Exam	100		50		35	50
Grand Total Marks						40	100

Two best scores out of the three tests will be considered for CIE. CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- Ten questions to be set; two questions from each unit with internal choice.
- Student should answer one question from each unit

Continuous Comprehensive Assessments (CCA):

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

Rubrics for Learning Activity

Rubrics for Learning Activity – 1, Maximum Marks:10 (Based on the nature of learning activity, design the rubrics for each activity)						
Activity type	**Performance Indicator**	**Excellent**	**Very Good**	**Good**	**Fair**	**Needs Improvement**
Presentation/ Seminar (10)	Communicate effectively both in written and oral form. (5)	Presents ideas confidently, clearly, and engagingly with excellent audience interaction. (5)	Presents clearly the topic contents but falters while delivering the content. (4)	Presents the contents properly but struggles to deliver. (3)	Presents imprecise contents and finds difficulty in delivery.(2)	Presents imprecise contents and fails to deliver. (1)
	Demonstrate professional and ethical behaviour. (5)	Adheres to high ethical standards, shows strong professional conduct. (5)	Mostly adheres to ethical standards with minor lapses. (4)	Understands ethics but inconsistently applies them. (3)	Shows limited awareness of ethical standards (2)	Shows disregard to ethics and professionalism (1)

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Introduction to Electronics and Communication Engineering		Semester	I/II
Course Code	25EC1ESIEL/25EC2ESIEL	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	03	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to ….

CO1: Apply the basic principles of electronics to solve analog and digital circuits**.**

CO2: Analyze and Identify a suitable electronic system for a given application.

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

CO4: Involve in independent/team learning on recent trends in applied electronics and communicate with effective presentations and report

Module-1: **08 Hours**

Basic Electronic devices: PN junction, Diode, Forward bias diode, Reverse biased diode, I-V Characteristics of diode, Diode approximations

Power Supplies –Block diagram, Half-wave rectifier, Full-wave rectifiers and filters, Voltage regulators, Output resistance and voltage regulation, Voltage multipliers.

Transistor: BJT structure and operation (NPN), circuit symbol, configurations, relation between transistor currents, BJT as a switch.

Amplifiers – Definition, Types of amplifier, gain, Input-Output Resistance, Multi-stage amplifier.

Module-2: **08 Hours**

Operational amplifiers - Ideal op-amp; characteristics of ideal and practical op-amp; Practical opamp circuits: Inverting and non-inverting amplifiers, voltage follower, summer, subtractor, integrator, differentiator

Oscillators – Barkhausen criterion, Classification of oscillators, Ladder network oscillator, Wein bridge oscillator, Crystal oscillator (Only Concepts, working, and waveforms. No mathematical derivations)**.**

Module-3: **08 Hours**

Communication: Modern communication system scheme, Information source, and input transducer, Transmitter, Channel or Medium – Wired and Wireless, Noise, Receiver, Multiplexing, Types of communication systems.

Modulation Schemes: Amplitude Modulation and Frequency Modulation

Introduction to Cellular Communication, Computer Communication Networks

Module-4: **08 Hours**

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

Sensors and Interfacing – Instrumentation and control systems, Transducers, Sensors, Actuators, LED, 7-Segment LED Display
Module-5: **08 Hours**
Boolean Algebra and Logic Circuits: Binary numbers, Number Base Conversion, octal & Hexa Decimal Numbers, Complements (1's and 2's complement), Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates **Combinational logic**: Introduction, Design procedure, Adders- Half adder, Full adder

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. Basic Electronics- Devices, circuits and IT fundamentals- By Santiram Kal- PHI, 2012
2. Op-amps and Linear Integrated Circuits, Ramakanth A Gayakwad, Pearson Education, 4th Edition
3. Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2008 ISBN-978-81-203-0417-8

II. Reference books:

1. Electronic Devices and Circuit Theory, R Nashelsky and L Nashelsky, 11th Edition, Pearson, 2012
2. D.P Kothari and I J Nagrath, Basic electronics, Second Edition, McGraw Hill Education Pvt ltd, 2018
3. John G. Proakis, Masoud Saleh, Fundamentals of Communication Systems, Second Edition, Pearson Educations, Inc., 2014

III. Web links and Video Lectures (e-Resources):

1. https://www.elsevier.com/books/basic-electronics/holbrook/978-0-08-006865-7
2. http://www.worldcat.org/title/basic-electronics/oclc/681543319
3. https://nptel.ac.in/courses/122106025
4. https://onlinecourses.swayam2.ac.in/nou23_ec06/preview

Teaching-Learning Process (Innovative Delivery Methods):

1. Technology Integration
2. Collaborative (Team) learning

3. Learning through simulation

Assessment Structure:

Component	Type of assessment	Max. Marks	Total	Reduced Marks	Total	Min. Marks required for eligibility	Total Marks
Theory	Self - Learning (simulation)	10	10	10	10	20	50
	Test 1	40	80	20	40		
	Test 2	40		20			
	Test 3	40		20			
CIE				50		**20**	
SEE	End Exam	100		50		35	50
Grand Total Marks						**40**	**100**

Two best scores out of the three tests will be considered for CIE.
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy
as per the outcome defined for the course.

Semester End Examination:

1. Each unit consists of two full questions.
2. Five full questions to be answered

Continuous Comprehensive Assessments (CCA):

I. Simulation based Self-Learning

Proteus is an **Electronic Design Automation (EDA) software tool** widely used for simulating, designing, and testing electronic circuits without physical hardware. It supports analog, digital, and embedded system circuits. It provides schematic capture, circuit simulation, PCB layout design, and virtual testing tools like oscilloscopes and logic analyzers.

1. **Learning of Tool**: 10 Hours
2. **Design of experiment**: 10 Hours
3. **Simulation in EDA tool**: 10 Hours
4. **Demonstration and Documentation**: 20 Hours

II. List of Simulation Experiments for Self-learning

1. Half wave rectifier with and without capacitor filter

2. Voltage doubler
3. Voltage Tripler
4. Transistor as a switch
5. Demonstrating characteristics of transistor in CE configuration.
6. Op-amp circuits – Inverting and Non-Inverting
7. Op-amp circuits – Summing and Subtractor
8. Op-amp circuits – Integrator and Differentiator
9. Simplification and realization of Boolean expression using basic logic gates
10. Simplification and realization of Boolean expression using universal gates

Self-Learning Evaluation Rubrics

Rubrics	Description	4	3	2	1
R1 (05)	Demonstrates an understanding of electronics systems and Simulation tool **(PO1, PO5)**	Explains concepts clearly, accurately, and with insightful connections	Explains concepts accurately with minor gaps in detail	Shows basic understanding of concepts but lacks depth or has some inaccuracies	Understanding is limited, with errors or confusion
R2 (03)	Technical writing ability (Report) **(PO9)**	report is clear, specific, and well justified with context	report is clear and specific but lacks strong justification	report is understandable but somewhat vague or incomplete	report is unclear or too broad
R3 (02)	Individual contribution to the entire project **(PO8)**	Active participation	Good participation	Fair participation	Minimal participation

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Introduction To Mechanical Engineering		Semester	I/II
Course Code	25ME1ESIME/25ME2ESIME	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	**3-0-0**	**SEE Marks**	100
Total Hours of Pedagogy		**Total Marks**	100
Credits	03	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

CO1: Describe & discuss fundamental principles of Mechanical Engineering as applied in the domains of machining, thermal, automotive and futuristic technologies.

CO2: Differentiate and compare among various mechanical systems (such as energy, metal joining, IC engines etc.)

CO3: Determine performance-related parameters for IC engines.

Module-1: **8 Hours**

Introduction to Mechanical Engineering:
Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors and contribution to GDP (Not for CIE/SEE).

Energy Sources and Power Plants:
Introduction and application of energy sources, Construction and working of Hydel power plant, Solar power plant (Helio-thermal process, flat and parabolic collectors), Wind power plant, and Biogas Plant, Environmental issues like Global warming and ozone depletion

Module-2: **8 Hours**

Fundamentals of Machine Tools and Operations:
(Machine tool sketches are not included for CIE/SEE)
Working principle of Lathe, Milling and Drilling machine tools.
Lathe Operations: Turning, Facing, Taper Turning and Knurling,
Drilling Operation: drilling, boring, and reaming.
Milling Operation: Plane milling and slot milling.

Modern Manufacturing Tools and Techniques:
CNC: Introduction, components of CNC, advantages and applications of CNC.
3D printing: Introduction and steps involved

Module-3: **8 Hours**

Introduction to IC Engines: Classification, Working of 4-Stroke (petrol and diesel) engines, numerical on Power and Mechanical efficiency calculations, applications.

Insight into future mobility technology: Introduction to Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles (block diagram only). Advantages and disadvantages of EVs and Hybrid vehicles.

Module-4 :	**8 Hours**
Materials and its Industrial Applications: (*Definitions, types and list of applications only*) Metals- Ferrous: Tool steels and stainless steels, Non-ferrous: Aluminium. Ceramics- Glass, optical fibre glass, cermet's. Composites- Fibre reinforced composites, Metal matrix composites Smart materials: Piezoelectric materials, shape memory alloys, semiconductors and super-insulators. **Metal Joining Processes:** Soldering, Brazing and Welding**:** Classification, definitions and principles of operation. Procedure followed in soldering, brazing and welding. Brief description of arc welding.	
Module-5:	**7 Hours**
Introduction to Robotics and Mechatronics: Robot anatomy, Joints & links, common robot configurations. Applications of Robotics. Concept of open-loop and closed-loop control systems, examples of Mechatronic systems. **Automation in Industry**: Definition, types - fixed, programmable and flexible automation, basic elements with block diagrams and advantages Drones, UAV, Types of UAV, fixed wing and multi-rotors, Applications	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. Elements of Mechanical Engineering, K R GopalaKrishna, Subhash Publications, 2019.
2. Elements of Mechanical Engineering, V. K. Manglik, PHI Learning, 2019

II. Reference books:

1. Textbook of Elements of Mechanical Engineering, S. Trymbaka Murthy, Medtech, 2019.
2. Elements of Mechanical Engineering, Kestoor Praveen, Suggi Publishing, 2019
3. Thermal Management in Electronic Equipment, HCL Technologies, 2010
4. Fundamentals of Robotics: Analysis and Control, Robert J. Schilling, Pearson Education (US).

III. Web links and Video Lectures (e-Resources):

1. **https://www.tlv.com/global/TI/steam-theory/principal-applications-for-steam.html**
2. **https://www.forbesmarshall.com/Knowledge/SteamPedia/About-**

Steam/Fundamental-Applications-of-Steam
3. https://rakhoh.com/en/applications-and-advantages-of-steam-in-manufacturing-and-process-industry/
4. Videos | Makino **(For Machine Tool Operation)**
5. Mechanisms and mechanical devices 4e.pdf **(e-book- Mechanical Linkages)**

Teaching-Learning Process (Innovative Delivery Methods):

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Arrange visits to show the live working models other than laboratory topics.
3. Adopt collaborative (Group Learning) Learning in the class.
4. Adopt Problem Based Learning (PBL), which foster student analytical skills and develops thinking/ analyzing skills

Assessment Structure:

Component	Type of assessment	Max. Marks	Total	Reduced Marks	Total	Min. Marks required for eligibility	Total Marks
CIE – Theory	Quiz/AAT	10	10	10	50	20	50
	Test 1	40		20			
	Test 2	40		20			
	Test 3	40		20			
SEE	End Exam	100		50			50
Grand Total Marks							100

Semester End Examination: (QP PATTERN)

- Answer five full questions selecting one from each module.

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3						2					
CO2	3						2					
CO3	2											

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Essentials of Information Technology		Semester	I/II
Course Code	25CS1ESEIT/25CS2ESEIT	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3-0-0	**SEE Marks**	50
Total Hours of Pedagogy	39	**Total Marks**	100
Credits	03	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

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

CO1: Illustrate different information representation and manipulation schemes

CO2: Use of Information Technology (IT) infrastructure for effective communication

CO3: Apply basic software engineering concepts for Website and application development

CO4: Develop queries for quick insert, access and updating of structured information

CO5: Identify role of cybersecurity and ethics issues in Information Technology (IT)

Module-1:	**8 Hours**
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)	
Module-2:	**8 Hours**
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)	
Module-3:	**8 Hours**
Networking and the Internet: Network Fundamentals, The Internet, The World Wide Web, Internet Protocols, Security. **Cybersecurity: Overview**—What is Cybersecurity?, Brief History of Cybersecurity Events, The Basic Information Security Model, Cyber Hygiene, Teams in Cybersecurity. **Ethical Issues in Information Technology:** Overview, Ownership Rules, Ethics and Online Content. Textbook 1: Chapter-4 Textbook 2: Chapter-16, Chapter-17	
Module-4 :	**8 Hours**

Software Engineering: The Software Engineering Discipline, The Software Life Cycle, Software Engineering Methodologies, Modularity, Tools of the Trade. **Database Systems:** Database Fundamentals, The Relational Model. Textbook 1: Chapter-7 (7.1-7.5), Chapter-9 (9.1-9.2)
Module-5: **Hours**
Introduction to HTML and Website Development: What is HTML?, Cascading Style Sheets (CSS), Website Design and Storyboarding, Structure of a Website. **Computer Graphics:** The Scope of Computer Graphics, Overview of 3D Graphics, Modeling, Rendering. Textbook 2: Chapter-12. Textbook 1: Chapter-10 (10.1-10.4)

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. J. Glenn Brookshear and Dennis Brylow, Computer Science: An Overview, 12th Edition, Pearson Education Limited, 2017
2. Roy, Shambhavi; Daniel, Clinton; and Agrawal, Manish, "Fundamentals of Information Technology", Digital Commons at The University of South Florida (2023)

II. Reference books:

1. V. Rajaraman, “Introduction to Information Technology”, Third Edition, PHI Learning, 2018
2. “INTRODUCTION TO INFORMATION TECHNOLOGY”, 2ND EDN, Pearson, 2012
3. Pelin Aksoy, Information Technology in Theory, First Edition, Cengage

III. Web links and Video Lectures (e-Resources):

1. Information Technology: https://onlinecourses.swayam2.ac.in/cec20_cs05/preview
2. Computer Organization and Architecture: https://nptel.ac.in/courses/106103068
3. Introduction To Internet: https://nptel.ac.in/courses/106105084

List of Lab activities:

1. Locate the templates available for a word processing application that you have access to. Search the templates for a “Resume”. Review the “Resume” template of your choice. Identify all the word processing features used in the “Resume” template. Use the “Resume” template to create your own resume. As you fill out the template, be sure to use the application to check your spelling and grammar. Verify the print layout of your

resume. Save the resume and print a copy

2. Consider the following data: Student First Name, Student Last Name, Student Age, Student Grade, Student School, Telephone Number, Sport (Volleyball, Basketball, Softball, Baseball, Soccer, or Football). Considering the data required in the list above, create a spreadsheet and add at least 10 rows of data to your spreadsheet. Once you add all the data to the spreadsheet, calculate the average age of the students under each category of sports
3. Create a Power point presentation that meets the requirements of marketing of brand-new product. Apply a theme, background, and professional layout for chosen product
4. Create a Web page with basic HTML elements (tags). Insert lists, images, drop down lists and tables. Apply CSS properties for the web page
5. Create a relational database model (MS Access or any other) for storing information about courses taken by students. Develop suitable queries to insert data onto tables, update fields, delete rows and query relevant information from the database model

Assessment Structure:

Activity -1: Quiz (05 Marks)
Activity -2: Self-Learning Activity - Practical Assignment (Individual) (Marks- 05)

Instruction: Students must demonstrate the solutions to the course instructor for the below list of experiments and submit the record containing method (steps), program (if applicable), document (if applicable) and results/output

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Engineering Mechanics		Semester	I
Course Code	25CV1PSENM	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:1:0	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	03	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to ….

CO1: Apply the concepts of force and moments to solve problems related to resultant and equilibrium of coplanar force system.

CO2: Apply the principles of friction to solve problems related the concepts of friction.

CO3: Locate the centroid of plane laminas using first principles

CO4: Compute the second moment of area of laminas.

CO5: Analyze coplanar force systems by analytical and experimental methods

CO6: Identify and understand the properties of various construction materials.

Module-1: Coplanar force system: Resultant of Forces **08 Hours**

Basic dimensions and units, Idealization, Force, Classification of force system, Composition and resolution of forces, Principle of transmissibility of a force, , Free body diagrams, Resultant of coplanar concurrent and non-concurrent force system, Moment, Couple and Characteristics of couple, Varignon's theorem: Numerical Examples.

Module-2: Coplanar force system: Equilibrium of Forces **08 Hours**

Conditions of static equilibrium, Equilibrium of coplanar concurrent force systems, Lami's theorem, Equilibrium of coplanar non-concurrent force system, Numerical examples. Types of supports, loadings and beams, Concept of statically determinate and indeterminate beams. Support reactions for statically determinate beams subjected to various loadings: Numerical examples.

Module-3: Friction **08 Hours**

Introduction, Types of friction, Concept of static friction, Kinetic (Dynamic) friction, Laws of friction, Angle of repose, Cone of friction, Equilibrium of blocks on horizontal and inclined plane, Ladder friction: Numerical examples.

Module-4: Centroid	**08 Hours**
Introduction, definitions of centroid and centre of gravity. Axes of symmetry, Locating the centroid of square, rectangle, triangle, circle, semicircle, quadrant and sector of a circle using method of integration, Centroid of composite areas and simple built up sections: Numerical examples.	
Module-5: Moment of Inertia of plane Areas:	**08 Hours**
Introduction, Moment of inertia about an axis, Parallel axes theorem, Perpendicular axes theorem, Polar moment of inertia, Radius of gyration, 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.	

Suggested Learning Resources:

I. Textbooks:

1. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, 3rd Edition, 2015, Laxmi Publications, ISBN: 9789380856674.
2. Kolhapure B K, Elements of Civil Engineering and Engineering Mechanics, 11th Edition, 2018, Eastern Book Promoters Belgaum [EBPB], ISBN: 5551234003896
3. Ramamrutham.S, Engineering Mechanics, Dhanpat Rai Books, 2013,ISBN: 9789352164271.
4. M. L. Gambhir : Concrete Manual : Dhanpat Rai & sons New – Delhi, ISBN-135551234001965.
5. Soil Mechanics and foundation Engineering by B C Punmia, Ashok kumar jain, Arun kumar jain, 18th edition, 2023, Laxmi Publications New Delhi.

II. Reference books:

1. Beer F.P. and Johnston E. R., Mechanics for Engineers: Statics and Dynamics, 4th Edition, 1987, McGraw Hill, ISBN: 9780070045842
2. Meriam J. L. and Kraige L. G, Engineering Mechanics-Statics, Vol I–6th Edition,2008, Wiley publication.
3. Irving H. Shames, Engineering Mechanics-Statics and Dynamics, 4th Edition, 2002, Prentice-Hall of India(PHI).
4. Hibbler R. C., Engineering Mechanics: Principles of Statics and Dynamics, 2017, Pearson Press, New Delhi.
5. Timoshenko S, Young D. H., Rao J. V., Sukumar Patil, Engineering Mechanics, 5th Edition, 2017,McGraw Hill Publisher, ISBN: 9781259062667
6. Bhavikatti S S, Engineering Mechanics, 4th Edition, 2018, New Age International Publications.
7. Reddy Vijaykumar K and Suresh Kumar K, Engineering Mechanics, 3rd Edition 2013, BS Publications.
8. J K Gupta and S K Gupta, Engineering Mechanics and Applied Mechanics, first edition, 2021,

Cengage learning. ISBN: 9789353505851.

Web links and Video Lectures (e-Resources):

1. NPTEL: Introduction to Civil Engineering Profession, https://nptel.ac.in/courses/105106201
2. NPTEL: Engineering Mechanics, https://nptel.ac.in/courses/112103108

Laboratory Component

I. PART -A: Conventional 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
7. Visual identification of building materials: Bricks, Stones, Tiles, M-Sand, Bitumen, Fly-Ash, GGBS, Steel Bars of Various Sizes.

II. 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. Support Reactions.
2. Field tests on cement.
3. Particle size distribution.
4. Grading of aggregates.

Teaching-Learning Process (Innovative Delivery Methods):

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

1. Chalk and talk.
2. PowerPoint presentation, Site/ Laboratory visits for materials and building component demonstrations.
3. Flipped Classroom
4. NPTEL and other videos for theory topics
5. Individual teachers can device innovative pedagogy to improve teaching-learning.

Assessment Structure:

Component	Type of Assessment	Max. Marks	Reduced Marks	Total	Min. Marks for Eligibility	Total marks
CIE- Theory	Quiz / AAT	10	5	**25**	**10**	**50**
	Test 1	40	10			
	Test 2	40	10			
CIE- Lab	Record and Performanc e	10	10	**25**	**10**	
	Lab test	15	15			
CIE				50	20	
SEE	**Semester End Exam**	**100**	50		35	**50**
Grand Total						100

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,** combined from both Theory and Lab component**, ensuring a minimum of 10 marks is scored individually in both Theory and Lab component**.
- To pass the **SEE**, a student must score at least **35% of 100 marks.**

Not with standing 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**.

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

1. Case Study Presentation
2. Assignments
3. Quiz
4. Course Project
5. Any other relevant and innovative academic activity
6. Use of MOOCs and Online Platforms

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

1. Case-Based Teaching
2. Flipped Classroom
3. Problem-Based Learning (PBL)
4. ICT-Enabled Teaching

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Basics of Electrical Engineering		Semester	I
Course Code	25EE1PSBEE	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	03	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

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

CO1: Apply the basic laws for analysis of DC circuits and Electromagnetism.

CO2: Apply Network theorems for solving DC circuits

CO3: Analyse the single-phase and three phase AC circuits.

CO4: Analyse electricity billing, domestic wiring and safety measures against electricity.

CO5: Conduct the experiments and study the performance of AC and DC circuits

Engage in individual/team work to make effective technical presentation on electrical concepts and communicate effectively to the audience

Module-1:	**8 Hours**
DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits. Power and energy. (Branch Current method only), Star-delta transformation., Source transformation, numerical. **Electromagnetism:** Faraday's laws of Electromagnetic induction, Lenz's law, dynamically and statically induced emf, Fleming's right-hand rule, Fleming's left-hand rule. Inductance and mutual inductance, coefficient of coupling, energy stored and its applications, numerical.	
Module-2:	**8 Hours**
Network Theorem: Thevenin's theorem, Superposition theorem, Norton's Theorem, Maximum Power Transfer Theorem. Numerical.	
Module-3:	**8 Hours**
Single-phase Circuits: Generation of sinusoidal voltage, frequency of generated voltage, Expression of average value, RMS value, form factor and peak factor of sinusoidal voltage and current. Phasor representation of alternating quantities. Analysis of R, L and C circuits. Series and parallel R-L, R-C and R-L-C circuits with phasor diagrams, calculation of real power, reactive power, apparent power, and power factor, illustrative examples.	
Module-4 :	**8 Hours**
Three- phase Circuits: Generation of three-phase system, definition of phase sequence, star and delta (mesh) connections, relation between phase and line values of voltages and of currents of star and delta connections, considering the phasor diagram. Definition of balanced and unbalanced source and load. Power, reactive power and power factor. Problems on balanced loads. Measurement of 3-phase power by 2-wattmeter method. Expression of power factor in terms wattmeter readings. Effect of power factor on wattmeter readings. Comparison between single phase and three-phase systems	

Module-5:	**8 Hours**
Domestic 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 [as per Electricity Supply Companies (escom)]: Tariff method considered: two-part tariff. Particulars considered for billing: sanctioned load and units consumed. 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. Definition for current rating, fusing current and fusing factor. **Personal safety measures:** Electric shock, possible effects of shocks. Safety precautions to avoid personal shock while dealing with electricity. Earthing: Pipe and plate.	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. A textbook of Electrical Technology by B.L. Theraja, Volume-1, S Chand and Company, Reprint Edition 2014. [Covers modules 1 to 4]
2. Basic Electrical Engineering, D.C. Kulshreshtha, McGraw Hill, 2nd Edition, 2024. [Covers all modules]

II. Reference books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, McGraw Hill 2nd edition, 3rd Reprint 2024.
2. Principles of Electrical Engineering & Electronics by V. K. Mehta, Rohit Mehta, S. Chand and Company Publications, 2nd edition, 2015.
3. Electrical Technology by E. Hughes, Pearson, 12th Edition, 2016.
4. Basic Electrical and Electronics Engineering, S.K Bhattacharya, et al, Pearson. 2nd edition, 2017.
5. Handbook of Electrical Engineering formulae, Harish C Rai, CBS Publications, 2018.

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

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

List of Lab activities:

Note:

1. The laboratory syllabus consists of PART-A and PART-B. While PART-A has 6 conventional experiments, PART-B has 6 typical open-ended experiments. The maximum marks for laboratory course is 100.
2. Both PART-A and PART-B are considered for CIE.
3. Students have to answer 1(one) question from PART-A and 1(one) question from PART-B.
4. PART-A is evaluated for 70 marks out of the maximum 100 marks.
5. The open-ended question shall be evaluated for 30 marks.

PART – A CONVENTIONAL EXPERIMENTS
1. Verification of Ohm's law and Kirchhoff's laws. 2. Measurement of low range resistance using voltmeter-ammeter method. Verification of resistance value using multimeter/LCR meter. 3. Measurement of earth's resistance by 3-electrode method. 4. Measurement of resistance, inductance, impedance and power factor using voltmeter, ammeter and wattmeter in single-phase AC circuits. 5. Measurement of three-phase power of an inductive load by 2-wattmeter method, when the load is (a) star connected and (b) delta connected. Calculation of resistance, reactance, impedance and power factor. 6. Verify Superposition Theorem for a given circuit.
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. Creation of short circuit to determine the time taken by a fuse of different length. Documenting the test data and the conclusions. 2. Trouble shooting experiments in simple DC circuits. The trouble may be due to loose connection, faulty component leading to open circuits or short circuits. Detection of fault and the reasons for that and conclusion. 3. Measurement of voltage between line and neutral, ground and line, ground and neutral in respect of heathy and unhealthy 3-pin socket. Conclusions arrived for the faulty wiring. Allowable ground voltage. 4. Wiring an appropriate electric circuit, understanding the basic principle used for 2-way and 3-way control of load. 5. Only three ammeters and standard resistance are available in the laboratory. Using the same measure the single phase power consumed by an inductive load. 6. Only three voltmeters and standard resistance are available in the laboratory. Using the same measure the single phase power consumed by an inductive load.

Teaching-Learning Process (Innovative Delivery Methods):

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

1. Flipped Classroom
2. Problem-Based Learning (PBL)
3. Case-Based Teaching
4. Simulation and Virtual Labs
5. Partial Delivery of course by Industry expert/ industrial visits
6. ICT-Enabled Teaching
7. Role Play

Assessment Structure:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max. Marks</th><th>Total</th><th>Reduced Marks</th><th>Total</th><th>Min. Marks required for eligibility</th><th>Total Marks</th></tr>
<tr><td rowspan="5">CIE – Theory</td><td>Quiz/AAT</td><td>10</td><td>10</td><td>5</td><td rowspan="4">25</td><td rowspan="4">10</td><td rowspan="7">50</td></tr>
<tr><td>Test 1</td><td>40</td><td rowspan="3">80 (Best 2 of 3 tests)</td><td rowspan="3">20</td></tr>
<tr><td>Test 2</td><td>40</td></tr>
<tr><td>Test 3</td><td>40</td></tr>
<tr><td rowspan="2">CIE – Lab</td><td>Record</td><td>10</td><td rowspan="2">25</td><td>10</td><td rowspan="2">25</td><td>10</td></tr>
<tr><td>Lab Test – Write up, Conduction, Results, Viva</td><td>15</td><td>15</td><td>10</td></tr>
<tr><td></td><td>CIE</td><td></td><td></td><td colspan="2">50</td><td>20</td></tr>
<tr><td>SEE</td><td>End Exam</td><td colspan="2">100</td><td colspan="2">50</td><td>35</td><td>50</td></tr>
<tr><td>Grand Total Marks</td><td></td><td colspan="2"></td><td colspan="2"></td><td>40</td><td>100</td></tr>
<tr><td colspan="8">Two best scores out of the three tests will be considered for CIE. CIE methods/question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.
Semester End Examination:
• Ten questions to be set; two questions from each unit with internal choice.
• Student should answer one question from each unit</td></tr>
</table>

Continuous Comprehensive Assessments (CCA):

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

Learning Activity -1: (Marks- 5)

Rubrics for Learning Activity 1, Maximum marks:5 (Based on the nature of learning activity, design the rubrics for each activity)						
Activity type	**Performance Indicator**	**Excellent**	**Very Good**	**Good**	**Fair**	**Needs Improvement**
Presentation/ Seminar (5)	**PO10.1**: Communicate effectively both in written and oral form. (5)	Presents ideas confidently, clearly, and engagingly with excellent audience interaction. (5)	Presents clearly the topic contents but falters while delivering the content. (4)	Presents the contents properly but struggles to deliver. (3)	Presents imprecise contents and finds difficulty in delivery.(2)	Presents imprecise contents and fails to deliver. (1)
	PO8.1: Demonstrate professional and ethical behaviour. (5)	Adheres to high ethical standards, shows strong professional conduct. (5)	Mostly adheres to ethical standards with minor lapses. (4)	Understands ethics but inconsistently applies them. (3)	Shows limited awareness of ethical standards (2)	Shows disregard to ethics and professionalism (1)

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Course Title: Fundamentals of Electronics & Communication Engineering		Semester	I/II
Course Code	25EC1PSECE/25EC2PSECE	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2:2	**SEE Marks**	50
Total Hours of Pedagogy	120	**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to ….

CO1: Apply the basic principles of Electronics to comprehend Analog and Digital circuits.

CO2: Analyze the characteristics and performance parameters of basic Electronic devices and Circuits.

CO3: Design Electronic Circuits for the given basic applications.

CO4: Conduct hardware-based experiments to design, implement, and validate the performance of analog and digital circuits.

CO5: Involve in independent and team learning by exploring modern Tool or Software to simulate electronic circuits, and document the results.

Module-1: Semiconductor Diode & Applications	**08 Hours**

Diode: Working principle Characteristics, Parameters and Specifications, Shockley's Equation. Half-Wave and Bridge Rectifier: Working principle and parameters Ripple Factor and Efficiency Derivations, Peak Inverse Voltage, shunt Capacitor Filter. **Zener Diode:** Zener Diode Characteristics and ratings, Application as Voltage Regulator, Regulated Power Supply.

Module-2: Bipolar Junction Transistors	**08 Hours**

Introduction, BJT Voltages & Currents, BJT Amplification, Common Base and Common Emitter Characteristics, BJT Biasing, Fixed Biasing and Voltage Divider, DC Load line and Bias point, Transistor as a Switch. **Feedback:** Feedback Principle, types of feedback: Positive and Negative feedback, advantages of negative feedback

Module-3: Operational Amplifiers	**08 Hours**

Introduction, The Operational Amplifier, Block Diagram Representation of Typical Op-Amp, Schematic Symbol, Op-Amp parameters - Gain, input resistance, Output resistance, CMRR, Slew rate, Bandwidth, input offset voltage, input bias Current and Input Offset Current, The Ideal Op-Amp, Equivalent Circuit of Op-Amp, Open Loop Op-Amp, Closed Loop Configurations: Inverting and Non-Inverting Amplifiers. Basic Op-Amp Applications: Summing, scaling and averaging circuit, subtractor, Voltage Follower, Basic Integrator and Differentiators.

Module-4: Communication	**08 Hours**

Modern communication system scheme, Information source, and input transducer, Transmitter, Channel or Medium –Wired and Wireless, Noise, Receiver, Multiplexing, Types of communication systems. Types of modulation-: Amplitude Modulation, Frequency and Phase Modulation, Waveforms. Applications: Introduction to Cellular Communication, Computer Communication Networks.

Module-5: Digital Electronics and Number Systems	**08 Hours**
Number Systems (Binary, Octal, Decimal and Hexadecimal), Number Base Conversion, 1's and 2's Complement Operations, Binary Addition and Subtraction, Binary Logic. **Boolean Algebra:** Basic Definitions, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates, NAND And NOR as Universal Gates, **Applications:** Combinational logic, Design procedure, Adders- Half adder, Full adder Sequential logic: Introduction, flip-flops- SR, D, T and JK flip-flops, 2-bit Binary Counters	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. **Basic Electronics- Devices, circuits and IT fundamentals-** By Santiram Kal- PHI, 2012
2. **Op-amps and Linear Integrated Circuits,** Ramakanth A Gayakwad, Pearson Education, 4th Edition
3. **Digital Logic and Computer Design,** M. Morris Mano, PHI Learning, 2008 ISBN-978-81-203-0417-8

II. Reference books:

1. **Electronic Devices and Circuit Theory**, R Nashelsky and L Nashelsky, 11th Edition, Pearson, 2012
2. D.P Kothari and I J Nagrath, **Basic electronics**, Second Edition, McGraw Hill Education Pvt ltd, 2018
3. John G. Proakis, Masoud Saleh, **Fundamentals of Communication Systems**, Second Edition, Pearson Educations, Inc., 2014

III. Web links and Video Lectures (e-Resources):

1. https://www.elsevier.com/books/basic-electronics/holbrook/978-0-08-006865-7
2. http://www.worldcat.org/title/basic-electronics/oclc/681543319
3. http://nptel.ac.in/courses/117103063/
4. https://swayam.gov.in/course/3595-basic-electronics

Teaching-Learning Process (Innovative Delivery Methods):

1. Technology Integration
2. Collaborative (Team) learning
3. Hands-on experience.
4. Learning through hardware components.

Assessment Structure:

Component	Type of assessment	Max. Marks	Total	Reduced Marks	Total	Min. Marks required for eligibility	Total Marks
Theory	Self - Learning (simulation)	10	10	05	05	10	50
	Test 1	40	80	10	20		
	Test 2	40		10			
	Test 3	40		10			
Lab	CIE	10	10	10	25	10	
	Test	15	15	15			
CIE				50		**20**	
SEE	End Exam	100		50		35	50
Grand Total Marks						**40**	**100**

Two best scores out of the three tests will be considered for CIE.
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. Each module consists of two full questions.
2. Five full questions to be answered, selecting one full question from each module

Continuous Comprehensive Assessments (CCA):

Simulation based Self-Learning

I. **Proteus** is an **Electronic Design Automation (EDA) software tool** widely used for simulating, designing,
and testing electronic circuits without physical hardware. It supports analog, digital, and embedded system
circuits. It provides schematic capture, circuit simulation, PCB layout design, and virtual testing tools like oscilloscopes and logic analyzers.

1. **Learning of Tool**: 10 Hours
2. **Design of experiment**: 10 Hours
3. **Simulation in EDA tool**: 10 Hours
4. **Demonstration and Documentation**: 20 Hours

II. **List of Simulation Experiments for Self-learning**

1. Half wave rectifier with and without capacitor filter
2. +5V power supply unit
3. Transistor as an amplifier

4. Demonstrating characteristics of transistor in CB configuration.
5. Op-amp circuits – Summing and Subtractor
6. Op-amp circuits – Integrator and Differentiator
7. Simplification and realization of Boolean expression using basic logic gates
8. Simplification and realization of Boolean expression using universal gates
9. SR and D Flip flop
10. T and JK Flip flop
11. 2-bit Binary Counter

Self-Learning Evaluation Rubrics

Rubrics	Description	4	3	2	1
R1 (05)	Demonstrates an understanding of electronics systems and Simulation tool **(PO1, PO5)**	Explains concepts clearly, accurately, and with insightful connections	Explains concepts accurately with minor gaps in detail	Shows basic understanding of concepts but lacks depth or has some inaccuracies	Understanding is limited, with errors or confusion
R2 (03)	Technical writing ability (Report) **(PO9)**	report is clear, specific, and well justified with context	report is clear and specific but lacks strong justification	report is understandable but somewhat vague or incomplete	report is unclear or too broad
R3 (02)	Individual contribution to the entire project **(PO8)**	Active participation	Good participation	Fair participation	Minimal participation

List of Lab activities:

PART – A **CORE/BASIC HARDWARE EXPERIMENTS**
1. Measurement of Amplitude, Time Period, and Frequency using CRO 2. Study of V–I Characteristics of a PN Junction Diode 3. Design and Testing of a Bridge Rectifier with and without Filter 4. Investigation of Inverting and Non-Inverting Op-Amp Configurations 5. Verification of Truth Tables of Basic Logic Gates 6. Verification of De-Morgan's Laws using Logic Gates 7. Design and Implementation of Half Adder and Full Adder Circuits
PART – B **OPEN ENDED HARDWARE/ SIMULATION EXPERIMENTS**
1. Analysis of BJT Characteristics in Common Emitter Configuration. 2. Verification of BJT Operation as a Switching Device. 3. Implementation of Boolean Expressions using Logic Gates. 4. Testing of Op-Amp as Voltage Follower and Weighted Summer with Waveform Analysis.

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Autonomous Institute, Affiliated to VTU

Course Title: Structured Programming in C		Semester	I/II
Course Code	25CS1PSSPC/25CS2PSSPC	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:1	**SEE Marks**	50
Total Hours of Pedagogy	40 Hours	**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)	Theory		

Course Outcomes (Course Skill Set)

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

CO1: Understand fundamental programming concepts and develop structured and error-free C programs.

CO2: Implement logical solutions using control structures, arrays, and functions to solve basic computational problems.

CO3: Develop modular and reusable programs using user-defined functions and recursion techniques.

CO4: Organize data efficiently using pointers, structures, and unions.

Module-1: An Overview of C, Expressions, Console I/O **08 Hours**

Algorithm and Flowchart. 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. 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. Reading and Writing Characters, Reading and Writing Strings, Formatted Console I/O, Printf(), Scanf()

Textbook 1 : Chapter 1,2,8 & Textbook 2 :Chapter 1

Module-2: Statements **08 Hours**

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

Textbook1: Chapter 3

Module-3: Arrays, Strings and Pointers **08 Hours**

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

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

Textbook1: Chapter 4,5

Module-4 : Functions **08 Hours**

The General Form of a Function, Understanding the Scope of a Function, Function Arguments, argc and argv—Arguments to main( ), The return Statement, What Does main() Return?, Recursion, Function

Prototypes, Declaring Variable Length Parameter Declarations, The inline Keyword, pointers to Functions, C's Dynamic Allocation Functions, restrict-Qualified Pointers, Problems with Pointers.

Textbook1: Chapter 6

Module-5: Structures, Unions, Enumerations, and typedef **08 Hours**

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

Textbook1: Chapter 7

PART – A

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 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.

5. 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.

6. 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.

7. 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.

8. 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.

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

10. 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.

11. 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

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). Write 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. Combine 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 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. Demonstrate both behaviours. (Call by Value and Call by reference).

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 display a list of all books entered.

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. Schildt, Herbert. "C the complete reference." (2021), 4th Edition
2. E Balgurusamy, Programming in ANSI C , 9th Edition , McGraw Hill

II. Reference books:

1. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Prentice Hall of India
2. Reema Thareja, Programming in C, 2nd Edition, Oxford University Press, 2015
3. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw-Hill Education

III. Web links and Video Lectures (e-Resources):

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

Teaching-Learning Process (Innovative Delivery Methods):

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

1. Flipped Classroom
2. Interactive Coding Platforms

Assessment Structure:

Component	Type of assessment	Max. Marks	Total	Reduced Marks	Total	Min. Marks required for eligibility	Total Marks
CIE – Theory	AAT	10	10	5	25	10	50
	Test 1	40	120	20			

	Test 2	40					
	Test 3	40					
CIE – Lab	Lab Test1 (10)	20	20	20	25	10	
	Lab Test2 (10)						
	Record & Performance	5	5	5			
CIE				50		**20**	
SEE		100		50		35	50
Grand Total Marks						**40**	**100**

Self-Learning Activity -1: (Marks- 10): Think Pair & Implement

INSTRUCTIONS (Conducted for 10M and reduced to 5M)

Think-pair & Implement is a collaborative learning strategy where students work together to analyse and implement the application in a given stipulated time(The problem to be implemented should be chosen from the co-courses such as Physics or Electrical Engineering, etc.,). These activities enhance the learning ability, problem solving skills, programming skills, presentation skills and documentation of report.

1. A group of 2 students are given to develop an application by the respective faculty. Students as a team of 2 are made to implement the application with suitable outputs.
2. Students shall present their code. Marks will be awarded based on their understanding of concepts and code.
3. A report of maximum 5 pages be submitted by each group comprising front page, Description (Abstract), Design (Flowchart/Sequence Diagram) and Outcome of the application (Result and Conclusion).
4. Submission of the code through Github

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Course Title: Elements of Biotechnology and Biomimetics		Semester	I
Course Code	25BT1PSEBB	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	**SEE Marks**	100
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	4	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to ….

CO1: Understand the fundamental concepts of biotechnology.

CO2: Demonstrate a foundational understanding of core biotechnological techniques (PO1)

CO3: Apply interdisciplinary thinking to address challenges in engineering sectors using biotechnology and biomimetics (PO1, PO5, PO6)

CO5: Conduct experiments on biotechnological techniques, biomimicry and interpret the data (PO2, PO4, PO9, PO10).

Module-1: Basics of Biology **09 Hours**

Structure and functions of prokaryotic and eukaryotic cells. Central dogma of Biology (DNA to RNA to Protein), Biomolecules of life - Carbohydrates (examples of Mono, Di, Polysaccharides), Proteins (examples of enzymes, structural proteins, transport proteins, regulatory proteins, and hormones), Structure and types of DNA
& RNA, vitamins and enzymes.

Module-2: Overview of Biotechnology **07 Hours**

History, scope, and branches/types of biotechnology such as medical biotechnology (red) - focusing on healthcare; agricultural biotechnology (green): improving crops; basics of industrial biotechnology, basic concepts of environmental biotechnology, yellow biotechnology (food production):probiotics and basics of bioinformatics

Module-3: Biotechnology Processes & Sustainability **06 Hours**

Bioprocess stages: Bio Ethanol production from Agri-waste, Biosafety levels, containment, cGMP/GLP and IPR issues). Circular bioeconomy and biotechnology's role in UN SDGs, Ethical, legal, and social issues in biotechnology, GI tags, specific case studies related to Basmati or Turmeric.

Module-4 : AI in Biological Research **10 Hours**

Role of AI in genomics. Role of AI in drug development, AI-assisted target 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.

Module-5: Bioinspired Engineering and applications	**08 Hours**
Basics, history, and scope of biomimetic, Levels and approaches of biomimetic Bioinspired materials: nacre, bone, spider silk, cuticle-based composites, Self-cleaning surfaces and living materials. Bioinspired mechanisms: hygromorphic actuators, fish/bird locomotion, termite mound passive cooling, Seashell-based, spider web-inspired, and insect eye-inspired innovations, mosquito proboscis inspired needles, drug delivery inspired by biology, Bioinspired energy and solar systems	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. P. K. Gupta, Elements of Biotechnology, Rastogi Publications, 468, 2010
2. Vogel, Steven. Cats' Paws and Catapults: Mechanical Worlds of Nature and People. W. W. Norton & Company, 2000

II. Reference books:

1. Singh B.D., Biotechnology: Expanding Horizons, Kalyani Publishers, 768 pages, 2019
2. Barnum, Susan R., Biotechnology: An Introduction, Cengage Learning, 432 pages, 2021
3. Bar-Cohen, Yoseph, Biomimetics: Nature-Based Innovation, CRC Press, 788 pages, 2012
4. Mukherjee, A.K., and Ghosh, S.K., Biomimicry: Nature Inspired Solutions, Narosa Publishing House, 260 pages, 2018
5. Vincent, Julian F.V., Structural Biomaterials, Princeton University Press, 252 pages, 2012
6. Herren, Ray V., Introduction to Biotechnology, Cengage Learning, 672 pages, 2018
7. Nath, Bhaskar, Advances in Biotechnology, Atlantic Publishers, 300 pages, 2020

III. 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. Introduction to Biomimicry (Multi-Disciplinary), https://onlinecourses.nptel.ac.in/noc22_ge24/preview?utm_source=chatgpt.com.
3. Industrial Biotechnology, https://onlinecourses.nptel.ac.in/noc20_bt21/preview?utm_source=chatgpt.com
4. Fundamentals of Bioprocess Engineering, https://onlinecourses.nptel.ac.in/noc25_bt84/preview?utm_source=chatgpt.com.
5. Medical Biomaterials, https://onlinecourses.nptel.ac.in/noc20_bt12/preview?utm_source=chatgpt.com.

List of Lab activities:

I. COVENTIONAL EXPERIMENTS

1. Preparation of standard buffers
2. Estimation of carbohydrates and protein with error analysis Microbial techniques
3. Sterilization of glassware using dry and wet heat Microscopy & Staining
4. Onion root tip — stages of mitosis & mitotic index
5. Observation of prokaryotic and eukaryotic cells (Preparation of permanent slides
6. Observation of natural microstructures (leaf, insect wing, feather) under microscope.

II. 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.

Concept: Antimicrobial activity: Antimicrobial Sensitivity Testing using Plant Extracts or Antibiotics

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.

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

1. Flipped class
2. Chalk and talk
3. NPTEL and other videos for theory topics
4. Partial Delivery of course by Industry expert/ industrial visits
5. ICT-Enabled Teaching.
6. Activity based learning.
7. Keep fundamentals as the core teaching content.
8. Present recent trends as short “industry snapshot” segments at the end of each module (e.g., 15–20 minutes), not as examinable depth topics.
9. Use case studies, videos, or demonstrations for the advanced concepts so students see applications without getting bogged down in mechanisms. Example – Lotus leaf effect → self-cleaning surfaces, Shark skin → drag reduction in swimsuits.
10. Make the trends part of assessments via assignments, mini-seminars, or group presentations, so the main lecture hours focus on the basics.

Flipped Classroom: Students watch short video lectures before class; class time used for discussion/problem-solving.

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**.

The student's performance in a course shall be judged individually and together based on the results of CIE and SEE. The lab component will be included in CIE for 25 marks (Open ended and continuous evaluation). Both PART-A and PART-B are considered for CIE and SEE

Continuous Comprehensive Assessments (CCA):

Continuous Internal Evaluation (CIE): includes mid-term tests, weekly/fortnightly class tests, homework assignments, problem solving, group discussions, quiz, seminar, mini-project and other Alternate Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes.

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

Learning Activity - 1: Case Study / Practical Assignment (Marks – 25)

INSTRUCTIONS:

I. Course instructor will refer to relevant textbooks, NPTEL resources, or recent research articles to derive the questions for problem-solving and application.
II. Course instructor must identify problems or activities from these areas:
    1. Biotechnology Fundamentals (DNA/RNA structure, biomolecules, cell ultrastructure)
    2. Biotechnological Techniques (PCR, gel electrophoresis, blotting, gene transfer methods)
    3. Applications (insulin production, stress-resistant plants, bioremediation, gene therapy)
    4. Biomimetics Basics (natural materials, bioinspired designs)
    5. Applications of Biomimetics (civil engineering, medical devices, robotics, energy systems)
III. Course instructor will assign THREE tasks from the above areas to the students for:
    1. Background study of the concept
    2. Experimental design or application design

3. Data collection/analysis or feasibility study

IV. Students must demonstrate the solutions, experimental results, or design prototypes to the course instructor and submit the record containing:

1. Introduction & objectives
2. Methodology / approach used
3. Observations & results
4. Analysis & discussion
5. Conclusion & future scope

Course instructor must evaluate the student performance as per the rubrics provided for Learning Activity-1.

Rubrics for Learning Activity-1 (Case Study / Practical Assignment on Biotechnology & Biomimetics

Component & CO–PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Clarity & Accuracy of Concept Explanation [CO1] [PO9]	Concepts are explained with complete accuracy, well-structured, and free of ambiguity; strong linkage to syllabus topics.	Concepts are clear and mostly accurate; minor ambiguity present.	Concepts are somewhat clear but lack precision; moderate ambiguity.	Concepts are vague and missing important details; high ambiguity.	Concepts are unclear, incomplete, or irrelevant to the activity.
Appropriate Use of Scientific Terminology and Experimental/Design Approach[CO2, CO4] [PO1, PO3]	Demonstrates precise and context-appropriate use of biotechnology/biomimetics terminology; experimental/design approach is innovative and well-structured.	Correctly uses terminology with minor gaps; approach is clear but not highly innovative.	Uses terminology with partial understanding or inconsistent accuracy; approach is basic.	Limited understanding of terminology; approach is unclear or weak.	No evidence of correct terminology usage or relevant approach.
Data Collection, Analysis & Interpretation	Provides accurate results/data with detailed analysis for multiple cases; comparisons highlight strengths and weaknesses clearly.	Provides correct results/data with analysis for multiple cases, though slightly less	Provides correct results/data with limited analysis; comparisons are shallow.	Provides partially correct data; minimal analysis, weak or incomplete comparisons.	Results/data are incorrect or missing; no meaningful analysis.

		detailed.			
Creativity & Problem-Solving in Application [CO3, CO4] [PO3, PO11]	Demonstrates outstanding creativity and innovation in applying biotech/biomimetics concepts to solve real- world problems.	Shows creativity and some innovation; solutions are practical and relevant.	Shows moderate creativity; solutions are functional but not innovative.	Minimal creativity; solutions are repetitive or unimaginative.	No creativit y or problem-solving evident in the work.
Documentatio n & Reflection [CO1, CO4] [PO8, PO9, PO11]	Documentation is complete, well-organized, and includes deep reflection on improvements, challenges, and learning outcomes.	Documenta tion is complete with some reflection on refinement and learning.	Document ation is present but lacks detail or depth in reflection.	Incomplete documentation ; minimal reflection.	No documen tation or reflectio n provided as per schedule.

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

1. Course Project
2. Case Study Presentation
3. Tool/Software Exploration
4. Any other relevant and innovative academic activity
5. Use of MOOCs and Online Platforms

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

1. Flipped Classroom
2. Problem-Based Learning (PBL)
3. Case-Based Teaching
4. Simulation and Virtual Labs
5. Partial Delivery of course by Industry expert/ industrial visits
6. ICT-Enabled Teaching
7. Role Play

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Soft Skills		Semester	I/II
Course Code	25MA1HSSSK / 25MA2HSSSK	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	1-0-0	**SEE Marks**	50
Total Hours of Pedagogy	01	**Total Marks**	100
Credits		**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

CO 1: Apply social skills for clear communication, persuasion, self-awareness, and active listening

CO 2: Use emotional skills to build confidence, manage stress, and adapt to change

CO 3: Set ambitious goals, practice empathy, and apply creativity for problem-solving

CO 4: Demonstrate discipline, time management, and structured problem-solving

CO 5: Work in teams, negotiate, resolve conflicts, and think critically

Module-1: **03 Hours**

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

Active Listening: Paraphrasing, questioning techniques, and demonstrating attentiveness

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

Module-2: **03 Hours**

Emotional Skills I :

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

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

Module-3: **03 Hours**

Emotional Skills II:

- Ambition & Goal Setting: Defining personal and professional aspirations, creating SMART goals, and aligning actions with long-term vision.
- Sympathy & Empathy: Understanding emotional perspectives, differentiating between the two, and applying them in workplace and social interactions.
- Creativity & Innovation: Generating original ideas, problem-solving, and applying creative thinking techniques (mind-mapping, SCAMPER).

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach
Language Lab	Quicklrn.com
Experiential Learning Methods	• To embed skills, participants get hands-on through: • Guided reflections and explainers to connect

	concepts with relatable real-life situations • Guided visualization to prompt reflection and self-discovery • Role-plays and activities to practice behaviours in context Peer discussions to gain diverse perspectives.
Assessment Methods	Formative: Role-plays, activities, group discussions, peer feedback. Summative: Presentations, written reflections, problem-solving exercises.

Module-4 : **03 Hours**

Professional Skills I:

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

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

Module-5: **03 Hours**

Professional Skills II:

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

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

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

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

II. Reference books:

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

III. Web links and Video Lectures (e-Resources):

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

Assessment Structure:

Component	Type of assessment	Max. Marks	Total
CIE – Theory	CIE 1	25	100
	CIE 2	25	
SEE	End Exam	50	

Two CIEs will be conducted for 25 Marks each. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
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Course Title: Innovation And Design Thinking		Semester	I/II
Course Code	25ME1AEIDT/25ME2AEIDT	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	1-0-0	**SEE Marks**	100
Total Hours of Pedagogy		**Total Marks**	100
Credits	01	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

CO1: Identify the situations, which need application of concepts of design thinking.
CO2: Develop ideas to solve the identified societal and industrial problems through design thinking tools.
CO3: Demonstrate the qualities pertaining to design thinking process through group activities.

Module-1:	**03 Hours**
Introduction: Scope and importance, steps in design thinking- Empathize, Define, Ideate, Prototype and Test with examples	
Module-2:	**03 Hours**
Empathy: Introduction, its role in creation of a successful product/service/brand, its consideration in design of product/service, Skills needed to implement design thinking	
Module-3:	**02 Hours**
Tools for Design Thinking: Creativity and innovation-scope and importance, defining the problem, ideation methods- mind mapping, brainstorming, story boarding, journey mapping, root cause analysis, suggestion box, visualization etc.	
Module-4 :	**03 Hours**
Prototyping and Testing- virtual, conventional and 3D printing, simulation, look alike, functional models- clay, foam, wood etc. Testing: destructive, non-destructive, user testing, role of social media in concept testing during early stages	
Module-5:	**02 Hours**
Application of Design Thinking in IT: Design Thinking to Business Process modeling – Agile in Virtual collaboration environment	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009
2. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve– Apply", Springer, 2011
3. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013

II. Reference books:

1. Yousef Haik and Tamer M. Shahin, "Engineering Design Process",Cengage Learning, Second Edition, 2011.
2. Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author).

III. Web links and Video Lectures (e-Resources):

1. **www.tutor2u.net/business/presentations/**
2. https://support.google.com/docs/answer/179740?hl=en
3. www.designthinkingformobility.org

Teaching-Learning Process (Innovative Delivery Methods):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video films to explain concepts
3. Encourage collaborative (Group Learning) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Assessment Structure:

Component	Type of assessment	Max. Marks	Total	Reduced Marks	Total	Min. Marks required for eligibility	Total Marks
CIE	Quiz	20	50			20	50
	AAT	30					
SEE	Poster presentation	50				20	50
Grand Total Marks							100

Semester End Examination: (QP PATTERN)

The SEE shall include Viva-voce group wise through Poster Presentation/Concept Video/power point presentation.

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3											
CO2		3										
CO3									3	3		3

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Course Title: ಬಳಕೆ ಕನ್ನಡ		Semester	I/II
Course Code	25MA1HSBAK / 25MA2HSBAK	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	1-0-0	**SEE Marks**	50
Total Hours of Pedagogy	15 ಗಂಟೆಗಳು	**Total Marks**	100
Credits	01	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After successfully completing the course, the student will be able to understand the topics:

CO1: To create an awareness regarding the necessity of learning local language for a comfortable living and to know more about Kannada culture and literature

CO2: To develop proper speaking, reading and writing skills in Kannada

CO3: To engage as a member of a team and enhance the skill in group communication and presentation

Module-1: **03 Hours**

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities.
3. Key to Transcription. Kannada Language Script.
4. ವ್ಯಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯ ಸೂಚಕ / ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - Personal Pronouns, Possessive Forms, Interrogative words

Module-2: **03 Hours**

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತುಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು – Possesive forms of nouns, dubitive question and Relative nouns.
2. ಗುಣ ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣ ಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು Qualitative, Quantitative and colour Adjectives, Numerals.
3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು –ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) -Predictive Forms, Locative Case.

Module-3: **03 Hours**

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – Dative cases, and numerals.
2. ಸಂಖ್ಯಾವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು – Ordinal numerals and Plural markers.
3. ನ್ಯೂನ/ ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು & ವರ್ಣ ಗುಣವಾಚಕಗಳು -Defective/Negative Verbs & Colour Adjectives.

Module-4 : **03 Hours**

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು. Permission, Commands, encouraging and Urging words (Imperative words and sentences)

2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು. Accusative Cases and Potential Forms used in General Communication. 3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯ ಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು. – Helping verbs “iru and iralla”, corresponding Future and negation verbs.	
Module-5:	**03 Hours**
1 ಹೋಲಿಕೆ (ತರತಮ), ಸಂಬಂಧ ಸೂಚಕ, ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ. Comparitive, Relationship, Identification and Negation Words. 2 Kannada Vocabulary List: ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. **ಬಳಕೆ ಕನ್ನಡ:** ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ

Teaching-Learning Process (Innovative Delivery Methods):

1. ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.

Assessment Structure:

Component	Type of assessment	Max. Marks	Total
CIE – Theory	CIE 1	25	100
	CIE 2	25	
SEE	End Exam	50	

Two CIEs will be conducted for 25 Marks each. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

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Course Title: ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ		**Semester**	
Course Code	25MA1HSSAK / 25MA2HSSAK	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	1-0-0	**SEE Marks**	
Total Hours of Pedagogy	15 ಗಂಟೆಗಳು	**Total Marks**	100
Credits	01	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಪರಿಣಾಮಗಳು:

CO 1: ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.

CO 2: ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳ ಹಾಗೂ ಕನ್ನಡ ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿ ಮೂಡುತ್ತದೆ

CO 3: ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ, ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

ಘಟಕ - 1 **03 Hours**

ಲೇಖನಗಳು:

1. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ.
2. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಘಟಕ - 2 **04 Hours**

ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ:

1. ವಚನಗಳು: ಬಸವಣ್ಣ, ಅಕ್ಕ ಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಜೇಡರದಾಸಿಮಯ್ಯ , ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ. ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ.
2. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು
3. ತತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ

ಘಟಕ - 3 **03 Hours**

ಆಧುನಿಕ ಕಾವ್ಯ ಭಾಗ:

1. ಡಿ. ವಿ. ಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲ ಭಾಗಗಳು
2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ. ರಾ. ಬೇಂದ್ರೆ .
3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು

ಘಟಕ - 4 **03 Hours**

1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ: ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್
2. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ

ಘಟಕ - 5 **02 Hours**

ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ ಚಿ ಬೋರಲಿಂಗಯ್ಯ

Suggested Learning Resources: (Textbook/Reference Book):

I. ಪಠ್ಯ ಪುಸ್ತಕ:

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

ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ:

1. ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಟ್ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು

Assessment Structure:

Component	Type of assessment	Max. Marks	Total
CIE – Theory	CIE 1	25	100
	CIE 2	25	
SEE	End Exam	50	

Two CIEs will be conducted for 25 Marks each. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

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Course Title: Applied Chemistry for Smart Systems (Computer science engineering stream)		Semester	I/II
Course Code	25CY1BSCCS/25CY2BSCCS	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2:2	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	04	**Exam Hours**	03
Examination type (SEE)	Descriptive		

Course Outcomes (Course Skill Set)

After completing the course, students will be able to:

CO1: Apply the principles of chemistry involved in corrosion, energy systems, materials and sensors for smart systems.

CO2: Analyze the engineering problems and draw meaningful inferences through concepts of chemistry.

CO3: Implement sustainable solutions through concepts of applied chemistry in the field of materials, energy and environment.

CO4: Engage in self-study and make an effective presentation on contribution of chemistry to society.

CO5: Apply the knowledge of chemistry to investigate engineering materials by analytical techniques.

Module-1: Electrochemistry of corrosion and sensors **8 Hours**

Smart systems-introduction, types and importance.

Electrochemistry: Introduction, electrode potential, concentration cell, numerical problems. Reference electrodes-Calomel electrode-construction and working. Ion selective electrodes – pH electrode-construction and working.

Corrosion: Introduction, electrochemical theory of corrosion, types-differential metal and differential aeration corrosion, corrosion control by cathodic protection methods and corrosion inhibitors for computer circuit boards, corrosion penetration rate (CPR) - definition, importance and numerical.

Sensors: Introduction, terminologies - transducer, actuators and sensors, principle and applications of -conductometric sensors for the estimation of acid mixture and electrochemical gas sensors for the detection of NOx. Biosensor-principle and application for detection of glucose in biofluids.

Self learning: Galvanization and anodization.

Module-2: Sustainable energy systems **8 Hours**

Batteries: Introduction and classification of batteries. Construction, working and applications of Li-ion battery.

Next generation energy systems: Introduction, construction and working of sodium ion battery and redox flow battery for EV applications. Introduction to supercapacitors, construction and working of ultra-small asymmetric supercapacitor in IoT/wearable device applications.

Clean energy: Introduction, fuel cell, difference between fuel cell and battery. Construction, working, applications and limitations of solid-oxide fuel cell (SOFCs). Production of green hydrogen by photocatalytic water splitting using TiO_2 and its advantages.

Quantum Dots: Introduction, size dependent properties - quantum confinement effect, surface-to-volume ratio & band gap. Quantum dot sensitized solar cells (QDSSCs)-construction, working and

applications. **Self learning:** Synthesis and applications of Cd-Se quantum dots by wet chemical method.
Module-3: Polymers for advanced systems **8 Hours**
Polymers: Introduction, terminology, molecular weight of polymers - number and weight average molecular weight of polymers, numerical. Structure-property relationship of polymers, synthesis and properties of nylon-12 and its advantages in 3D printing applications. Synthesis and properties of CPVC and PMMA for device applications. **Conducting polymers-** Introduction, synthesis of polyaniline, conduction mechanism and its engineering applications. **Biomaterials**: Introduction, synthesis and properties of polylactic acid (PLA) and polyethylene glycol (PEG) for touch screen applications. Properties and applications of alginate hydrogel for Brain-Computer Interfaces (BCIs). **Self-learning:** Definition and significance of glass transition temperature.
Module-4: Functional materials for memory and display systems **8 Hours**
Memory devices: Introduction, difference between organic and inorganic memory devices, organic semiconductors; types of organic semiconductors used in memory devices - p-type semiconductors and n- type semiconductors. Construction, working and advantages of organic semiconductor chip. Resistive RAM (ReRAM) materials: Introduction, synthesis of nano-TiO_2 by sol-gel method, properties and applications in ReRAM. **Display systems:** Introduction, liquid crystals (LCs) - classification, properties and their applications in Liquid Crystal Displays (LCDs), Jablonski diagram. Construction, working and applications of OLEDs, and Quantum Light Emitting Diodes (QLEDs). **Self learning:** Active-Matrix Organic Light Emitting Diodes (AMOLEDs)
Module-5: Green materials and E-waste management **8 Hours**
Green materials: 12 principles of green chemistry (numerical on atom economy), 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. **E-waste:** Introduction, sources, composition of e-waste, effects of e-waste on environment and human health. Extraction of metals from e-waste – gold by bioleaching method, copper by hydrometallurgical method. Direct recycling method of lithium-ion batteries. **Self learning:** Role of artificial intelligence in e-waste management and its applications.

Suggested learning resources:

I. Textbooks:

1. Engineering Chemistry, Dr. S. Vairam and Dr. Suba Ramesh, 2nd Edition, 2013, Wiley.
2. Engineering Chemistry, Jain and Jain 2015, 17th edition, Dhanpat Rai Publishing Company.

II. Reference books:

1. Semiconducting Materials and Devices, Deepak Verma, 2022, Agrotech Publishing Academy, ISBN: 9789394777712
2. High Quality Liquid Crystal Displays and Smart Devices – Ishihara, Kobayashi & Ukai (2019, IET), ISBN: 9781785619397
3. Conducting Polymers, Fundamentals and Applications: Including Carbon Nanotubes and Graphene: Prasanna Chandrasekhar (IIT Delhi alumnus), Springer, 2019 (2nd ed.), ISBN 13: 978 3030098858.

III. Web links and Video Lectures (e-Resources):

1. http://nptel.ac.in/
2. https://swayam.gov.in/

Teaching-Learning Process (Innovative Delivery Methods):

1. Flipped classroom
2. Project based learning
3. Simulation and Virtual labs
4. Partial delivery of course content by industry expert

Assessment Structure:

<table>
<tr><th>Component</th><th>Type of assessment</th><th colspan="2">Max. Marks</th><th>Weightage</th><th>Total</th><th>Total Marks</th></tr>
<tr><td rowspan="4">Theory</td><td>AAT# (Alternative Assessment Tool)</td><td colspan="2">20</td><td>10</td><td rowspan="4">50</td><td rowspan="4">25</td></tr>
<tr><td>Test 1</td><td>40</td><td rowspan="3">Best of Two tests</td><td rowspan="3">40</td></tr>
<tr><td>Test 2</td><td>40</td></tr>
<tr><td>Test 3</td><td>40</td></tr>
<tr><td rowspan="2">Lab</td><td>Record and observation</td><td colspan="2">200 (100+100)</td><td>10</td><td rowspan="2">25</td><td rowspan="2">25</td></tr>
<tr><td>CIE</td><td colspan="2">50</td><td>15</td></tr>
<tr><td>SEE</td><td>Sem End Exam</td><td colspan="2">100</td><td>50</td><td></td><td>50 (SEE)</td></tr>
<tr><td colspan="6">Grand Total Marks</td><td>100</td></tr>
<tr><td colspan="7">#AAT includes assignment from self-study components
*Minimum CIE marks ≥ 20 to gain eligibility to write the SEE</td></tr>
</table>

Continuous Comprehensive Assessments (CCA):

1. A team of 4–5 students to collaborate for a presentation on a specific topic or work on a project and demonstrate in the class.
2. A detailed project report on the chosen topic or project to be submitted by the student group.
3. Self learning: To encourage the students to gather information on the specified topics for advanced learning.

Course objectives:

To impart the knowledge of Chemistry involved in Electrochemical cells, Corrosion and its control; sensors; electrochemical and renewable sources of energy; polymers; functional materials in memory and display systems; green materials; e-waste management; nanomaterials and water analysis.

CO-PO mapping with strength:

COs	POs										
	1	2	3	4	5	6	7	8	9	10	11
CO1	3										
CO2		2									
CO3						2					
CO4											1
CO5	2				1						

List of Lab activities:

I. Compulsory experiments:

1. Estimation of iron in rust sample using potentiometric sensor.
2. Determination of pKa of a weak acid using pH sensor.
3. Estimation of mixture of strong and weak acid using conductometric sensor.
4. Estimation of copper in e-waste by optical sensor.
5. Estimation of total hardness of water by EDTA method.
6. Determination of chemical oxygen demand (COD) of an industrial effluent sample.
7. Estimation of percentage of copper in brass by iodometry.
8. Estimation of iron in TMT bar by external indicator method.
9. Determination of calorific value of a solid fuel by bomb calorimeter.
10. Estimation of sodium in effluent by flame photometry.

II. Open-ended experiments:

1. Green synthesis of copper nanoparticles for conductive ink applications.
2. Determination of viscosity coefficient of lubricant using Ostwald's viscometer.
3. Determination of corrosion penetration rate (CPR) by weight-loss method.
4. Smartphone based colorimetric estimation of total phenolic content in beverages.
5. Chemical structure drawing using software: Chem Draw/ Chem Sketch.

Suggested Learning Activities:

1. Case Study Presentation
2. Tool/Software Exploration
3. Literature Review
4. Assignments
5. Use of MOOCs and Online Platforms

Curriculum Structure:

Course Code	Couse Title	Teaching and Learning Scheme					
		Classroom instruction (CL) (in hours per semester)		Lab instruction (CL) (in hours per semester)	Term work (TW) and self learning (SL) (TW+SL) (in hours per semester)	Total no. of hours per semester	Total Credits (C) (Total hours/30)
		L	T	P	SL		
25CY1BSCCS/ 25CY2BSCCS	Applied Chemistry for Smart Systems	40	0	30	50	120	4

Course Title: Applied Chemistry for Emerging Electronics and Futuristic Devices (Electrical and electronics engineering stream)		**Semester**	I/II
Course Code	25CY1BSCEE/25CY2BSCEE	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2:2	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)	Descriptive		

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to

CO1: Apply the principles of chemistry involved in corrosion, energy systems, materials, quantum dots, sensors for emerging electronics and futuristic devices.

CO2: Analyze the engineering problems and draw meaningful inferences through concepts of chemistry.

CO3: Implement sustainable solutions through concepts of applied chemistry in the field of materials, energy and electronic devices.

CO4: Engage in self-study and make an effective presentation on contribution of chemistry to society.

CO5: Apply the knowledge of chemistry to investigate engineering materials by analytical techniques.

Module-1: Electrode Systems and Corrosion Science **8 Hours**

Electrochemistry: Introduction, types of electrodes, concentration cell, numerical problems. Reference electrode-calomel electrode-construction, working. Ion selective electrode – pH electrode- construction, working, determination of pH using glass electrode.

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

Metal Finishing: Introduction, difference between electroplating & electroless plating, electroplating of gold, electroless plating of copper on PCBs.

Self learning: Galvanization and anodization.

Module-2: Energy – Sources, Conversion and Storage **8 Hours**

Chemical fuel: Calorific values, determination of calorific values by bomb calorimeter, numerical problems. Petroleum cracking- Definition with an example, Reformation of petrol- Definition with an example.

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

Energy Conversion Devices: Introduction, construction, working, advantages and applications

of photovoltaic (PV) cell. Introduction to MEMS-based energy harvesters, working principle and applications.

Self learning: Introduction, construction and working of sodium ion battery.

Module-3: Functional Polymers in Flexible Electronics **8 Hours**

Polymer: Introduction, terminology, molecular weight of polymers - number and weight average molecular weight of polymers, numerical problems. Conducting polymers: Introduction, synthesis, conduction mechanism and applications of polyaniline in electronic devices. Synthesis, properties and applications of polydimethylsiloxane (PDMS) in RFID (radio frequency identification). Synthesis, properties and applications of polyvinylidene fluoride (PVDF) in E-nose devices.

Polymeric semiconductors: Introduction, n-type and p-type polymeric semiconductor materials, organic photovoltaics - poly(3-hexylthiophene) (P3HT) as a donor and phenyl C61-butyric acid methyl ester (PCBM) as an acceptor, construction, working and applications.

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.

Self learning: Difference between organic and inorganic semiconductors.

Module-4: Quantum Dot Materials for Electronics Applications **8 Hours**

Nanomaterials: Introduction, size dependent properties of nanomaterials - surface area, catalytic, optical and electrical properties.

Quantum Dot Materials: Introduction, quantum confinement effect, band gap. 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 (QLED). Wet chemical synthesis, properties and applications of quantum dot-based copper conductive ink.

Quantum dot sensitized solar cells (QDSSCs)-construction, working principle and applications. Organic Quantum Dot Materials (OQDMs): Introduction, synthesis and properties of chitosan-carbon quantum dots hydrogel applications in next-generation flexible and wearable electronics. Synthesis, properties and applications of graphene quantum dots in emerging electronics.

Self learning: Construction and working of OLEDs.

Module-5: Advanced Electronic Materials and E-waste Management **8 Hours**

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

Sensing Methods: Introduction, principle and instrumentation of colorimetric sensors, application in the estimation of copper in PCB industry. Principle and working of potentiometric sensors- applications in the estimation of iron in steel. Conductometric sensors-application in the estimation of acid mixture in a sample.

E-waste: Introduction, need of e-waste management, sources & effects of e-waste on environment and human health, extraction of gold from e-waste from bioleaching method.

Self learning: Extraction of lithium from spent lithium-ion batteries

Suggested learning resources:

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

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Course objectives:

To impart the knowledge of Chemistry involved in electrochemical cells, Corrosion and its control; sensors; sources of energy; functional polymers; quantum dots; microelectronics; e-waste management; nanomaterials and water analysis.

CO-PO mapping with strength:

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Curriculum Structure

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25CY1BSCEE/ 25CY2BSCEE	Applied Chemistry for Emerging Electronics and Futuristic Devices	40	0	30	50	120	4

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Course Title: Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems (Mechanical engineering stream)		**Semester**	I
Course Code	25CY1BSCME	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2:2	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	04	**Exam Hours**	03
Examination type (SEE)	Descriptive		

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to

CO1: Apply the principles of chemistry involved in corrosion, energy systems, materials and sensors for advanced metal protection and sustainable energy.

CO2: Analyze the engineering problems and draw meaningful inferences through concepts of chemistry.

CO3: Implement sustainable solutions through concepts of applied chemistry in the field of materials, energy and metal protection.

CO4: Engage in self-study and make an effective presentation on contribution of chemistry to society.

CO5: Apply the knowledge of chemistry to investigate engineering materials by analytical techniques.

Module-1: Electrochemistry of corrosion and coating technologies **8 Hours**

Electrochemistry: Introduction, electrode potential, concentration cell, numerical problems. Reference electrode: Calomel electrode- construction and working. Ion selective electrode – pH electrode- construction and working.

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

Coating Technologies: Introduction, technological importance, electroplating - electroplating of chromium; hard and decorative, electroless plating - electroless plating of nickel, difference between electroplating and electroless plating.

Self learning: Galvanization and Tinning

Module-2: Conventional and sustainable fuels **8 Hours**

Fuels: Introduction, calorific value, determination of calorific value using bomb calorimeter, numerical problems on GCV and NCV. Petroleum cracking- definition with an example. Octane number and cetane number. Reformation of petrol- definition with an example. Knocking in petrol engine - knocking mechanism and anti-knocking agents - methyl tertiary butyl ether (MTBE).

Green Fuels: Introduction, biodiesel - synthesis by trans-esterification method, advantages and its applications. Production of green hydrogen by photocatalytic water splitting and its advantages, hydrogen storage – physical and chemical storage methods, advantages and limitations.

Self learning: Power alcohol – properties, applications and its limitations.

Module-3: Polymers for engineering applications	**8 Hours**
Engineering polymers: Introduction, terminology, molecular weight of polymers - numerical problems. Glass transition temperature (Tg), factor affecting Tg and its significance, structure and property relationship of polymers. Synthesis, properties and engineering applications of chlorinated-polyvinyl chloride (C-PVC), and polycarbonates. Polymer Composites: introduction, fiber-reinforced polymers (FRPs); Kevlar – Synthesis, properties and industrial applications. Carbon-fiber - preparation from polyacrylonitrile (PAN), properties and industrial applications. Biopolymers: Introduction, synthesis, properties and applications of polylactic acid (PLA) resin in 3D printing applications. **Self learning:** Synthesis, properties and applications of PMMA	
Module-4: Energy systems and sensors	**8 Hours**
Energy Systems: Batteries - Introduction, classification of batteries, characteristics-capacity, power density, and cycle life. Construction, working and applications of Li-ion battery. Fuel cells - Introduction, difference between fuel cell and battery, types of fuel cells, construction and working of solid oxide fuel cells (SOFCs), advantages and applications. Photovoltaic cells (PV cells) - construction, working, advantages and limitations of quantum dot thin film solar cells. Sensors: Introduction, potentiometric sensor - principle and its application in the estimation of iron in steel industry effluent. Conductometric sensor - principle and its application in the estimation of acids mixture. pH sensor - principle and its application in the estimation of pKa of weak acid. **Self learning:** Battery characteristics: Voltage, Shelf life	
Module-5: Fluid technology and nanomaterials	**8 Hours**
Lubricants: Introduction, classification, ideal properties and applications. Lubricant testing; Viscosity index - experimental determination of viscosity index, numericals. Industrial Coolants: Introduction, types- water and oil-based coolants, properties and industrial applications. Nanomaterials: Introduction, size-dependent properties of nanomaterial-surface area, catalytic, electrical and thermal conductivity. Synthesis of TiO_2 nanoparticles by sol-gel method. Carbon nanotubes (CNTs) - Synthesis by chemical vapor deposition method, properties and engineering applications, role of carbon nanotubes (CNTs) in energy devices. **Self learning:** Classification of nanomaterials based on dimensions with an example	

Suggested learning resources:

I. Textbooks:

1. Engineering Chemistry, Dr. S. Vairam and Dr. Suba Ramesh, 2nd Edition, 2013, Wiley.
2. Engineering Chemistry, Jain and Jain 2015, 17th edition, Dhanpat Rai Publishing Company.
3. Applied Chemistry for Mechanical Engineering and Allied Branches, C Manasa, Vrushabendra B, Srikantamurthy N, 2023, Astitva Prakashan.

II. Reference books:

1. Polymer Science, V R Gowariker, N V Viswanathan, Jayadev Sreedhar, 4th edition, 2023, Newage International Publishers.
2. Conducting Polymers, Fundamentals and Applications: Including Carbon Nanotubes and Graphene: Prasanna Chandrasekhar (IIT Delhi alumnus), Springer, 2019 (2nd ed.), ISBN 13: 978 3030098858.
3. Advances in Corrosion Science and Technology, M.G. Fontana and R.W. Staettle, Springer, 2012, ISBN: 9781461590620

III. Web links and Video Lectures (e-Resources):

1. http://nptel.ac.in/
2. https://swayam.gov.in/

Teaching-Learning Process (Innovative Delivery Methods):

1. Flipped classroom
2. Project based learning
3. Simulation and Virtual labs
4. Partial delivery of course content by industry expert

Assessment Structure:

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<tr><th>Component</th><th>Type of assessment</th><th colspan="2">Max. Marks</th><th>Weightage</th><th>Total</th><th>Total Marks</th></tr>
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*Minimum CIE marks ≥ 20 to gain eligibility to write the SEE</td></tr>
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Continuous Comprehensive Assessments (CCA):

1. A team of 4–5 students to collaborate for a presentation on a specific topic or work on a project and demonstrate in the class.
2. A detailed project report on the chosen topic or project to be submitted by the student group.

3. Self learning: To encourage the students to gather information on the specified topics for advanced learning.

Course objectives:

To impart the knowledge of Chemistry involved in Electrochemical cells, Corrosion and its control; sensors; chemical fuels; energy systems; polymers; fluid technology; nanomaterials and water analysis.

CO -PO mapping with strength:

COs	POs										
	1	2	3	4	5	6	7	8	9	10	11
CO1	3										
CO2		2									
CO3						2					
CO4											1
CO5	2				1						

List of Lab activities:

I. Compulsory experiments:

1. Estimation of iron in rust sample using potentiometric sensor.
2. Determination of pKa of a weak acid using pH sensor.
3. Estimation of mixture of strong and weak acid using conductometric sensor.
4. Estimation of copper in e-waste by optical sensor.
5. Estimation of total hardness of water by EDTA method.
6. Determination of chemical oxygen demand (COD) of an industrial effluent sample.
7. Estimation of percentage of copper in brass by iodometry.
8. Estimation of iron in TMT bar by external indicator method.
9. Determination of calorific value of a solid fuel by bomb calorimeter.
10. Estimation of sodium in effluent by flame photometry.

II. Open-ended experiments:

1. Green synthesis of copper nanoparticles for conductive ink applications.
2. Determination of viscosity coefficient of lubricant using Ostwald's viscometer.
3. Determination of corrosion penetration rate (CPR) by weight-loss method.
4. Smartphone based colorimetric estimation of total phenolic content in beverages.
5. Chemical structure drawing using software: Chem Draw/ Chem Sketch.

Suggested Learning Activities:

1. Case Study Presentation
2. Tool/Software Exploration
3. Literature Review
4. Assignments
5. Use of MOOCs and Online Platforms

Curriculum Structure:

Course Code	Couse Title	Teaching and Learning Scheme					
		Classroom instruction (CL) (in hours per semester)		Lab instruction (CL) (in hours per semester)	Term work (TW) and self learning (SL) (TW+SL) (in hours per semester)	Total no. of hours per semester	Total Credits (C) (Total hours/30)
		L	T	P	SL		
25CY1BSCME	Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems	40	0	30	50	120	4

Course Title: Applied Chemistry for Sustainable Structures & Material Design (Civil Engineering stream)		Semester	II
Course Code	25CY2BSCCV	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2:2	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	04	**Exam Hours**	03
Examination type (SEE)	Descriptive		

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to

CO1: Apply the principles of chemistry involved in corrosion, energy systems, materials, sensors and water treatment for sustainable structures & material design.

CO2: Analyze the engineering problems and draw meaningful inferences through concepts of chemistry.

CO3: Implement sustainable solutions through concepts of applied chemistry in the field of materials, energy and environment.

CO4: Engage in self-study and make an effective presentation on contribution of chemistry to society.

CO5: Apply the knowledge of chemistry to investigate engineering materials by analytical techniques.

Module-1: Electrochemistry of corrosion and surface protection **8 Hours**

Electrochemistry: Introduction, electrode potential, concentration cell, numerical problems. Reference electrode-Calomel electrode-construction, working. Ion selective electrode – pH electrode- construction, working.

Corrosion: Introduction, electrochemical corrosion of steel in concrete, types- differential metal corrosion and differential aeration corrosion, stress corrosion in civil structures. Factors affecting rate of corrosion (pH, temperature, nature of corrosion product, conductivity of the medium) Corrosion control by cathodic protection method. corrosion penetration rate (CPR) - definition, importance and numerical problems.

Metal Finishing: Introduction, technological importance of metal finishing, electroplating of Chromium-decorative and hard coating.

Self learning: Galvanization and anodization

Module-2: Advanced energy systems **8 Hours**

Chemical fuel: Calorific values, determination of calorific values by Bomb calorimeter, numerical. Petroleum cracking- Definition with an example, Reformation of petrol- Definition with an example.

Silicon based solar cell- construction, working, advantages, applications and limitations.

Green Fuels: Introduction, green hydrogen production by photocatalytic method.

Energy systems: Introduction, classification of batteries, characteristics of battery (capacity, energy density, power density and cycle life), construction & working of Lithium-ion battery, redox flow battery and its applications, fuel cell-definition, difference between battery and fuel

cell, construction and working of solid oxide fuel cell **Self learning:** Power alcohol – properties, applications and its limitations
Module-3: Conventional and sustainable structural materials **8 Hours**
Polymer: Introduction, terminology, molecular weight of polymers: number average and weight average molecular weight of polymers, numerical, synthesis, properties and engineering applications of Chlorinated - PVC, butyl rubber, Kevlar fiber and epoxy resin. Polymer composites-properties and industrial applications of graphene and carbon nano-tubes as reinforced composites. Nanomaterials: Introduction, size dependent properties viz; surface area, thermal properties, water absorption, permeability, and antimicrobial activity, composition of nano-concrete, synthesis of TiO_2 nanoparticles by sol-gel method and its applications in construction technology. **Self learning:** biopolymer (polylactic acid-synthesis and applications)
Module-4: Water chemistry and analytical techniques **8 Hours**
Water Chemistry: Introduction, significance of water quality parameters-pH, turbidity, chlorides, dissolved oxygen and alkalinity for environmental and construction applications. Hard water - types, determination of total hardness by EDTA method, numerical. Waste water-definition of domestic and industrial effluents. Determination of dissolved oxygen by Winkler's method, COD-definition, determination, significance and numerical. **Analytical Techniques:** Introduction, 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 water and industrial effluent, colorimetric sensor- principle, instrumentation and estimation of copper in industrial effluent. **Self learning:** Secondary treatment of sewage water
Module-5: Materials for structural integrity **8 Hours**
Metals and Alloys: Introduction, classification of metals: ferrous and non-ferrous, composition, properties, applications of iron and its alloys-wrought iron, cast iron, pig iron and steel, aluminium and its alloys-Duralumin and Magnalium. **Cement:** Introduction, composition, manufacturing process of cement-wet process, process of setting and hardening of cement, special cements-composition, properties and applications, concrete as composite material. **Geopolymer Concrete:** Introduction, mechanism of geopolymerization and manufacturing process. **Photochromic Coatings:** Introduction, spiropyran as photochromic coating, working principle with chemical reactions and applications in construction activities. **Self learning:** Properties and applications of smart concrete

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Introduction to AI and Applications		Semester	I/II
Course Code	25CS1ETIAA/25CS2ETIAA	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	3	**Exam Hours**	3
Examination type (SEE)	Theory		

Course Outcomes (Course Skill Set)

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

CO1: Explain the concepts and types of artificial intelligence.

CO2: Illustrate basic machine learning methods for regression, classification and clustering.

CO3: Identify real-world applications across different disciplines.

CO4: Make use of prompt engineering techniques to interact with generative AI tools.

CO5: Outline recent trends in artificial intelligence and machine learning.

Module-1:	**08 Hours**
Introduction to AI: Definition, history, and evolution of AI (Turing Test, milestones). Foundations of AI: Logic, probability, cognitive science, Types of Artificial Intelligence, Weak AI, Strong AI, Reactive Machines, Limited Memory, Theory of Mind, Self-Awareness. Agents and Environments: Intelligent agents, agent mechanisms, problem formulation, problem definition. Search Strategies: Uninformed Search (DFS, BFS, Uniform Cost Search).	
Module-2:	**08 Hours**
Heuristic Search: Generate-and-Test, Fundamentals of Hill Climbing Search, Means–Ends Analysis, Constraint Satisfaction Problems. Knowledge Representation: Propositional Logic and First-Order Logic – syntax, semantics, inference. Uncertainty in AI: Acting under uncertainty, case study – Wumpus World.	
Module-3:	**08 Hours**
Machine Learning Foundations: Supervised vs. Unsupervised learning, Regression, Classification, Clustering. Introduction to Algorithms : Naïve Bayes, Decision Trees, K-means Clustering. Neural Networks: Neuron Basics, Perceptron model, Multilayer perceptron, Role of activation functions. Applications: Case studies of Machine Learning in natural language processing, computer vision, and recommendation systems.	
Module-4 :	**08 Hours**
Introduction to Generative AI : Introduction, Large Language Models (LLMs), key use cases and tasks. Prompt Engineering: Introduction to Prompt Engineering, The Evolution of Prompt Engineering, Types of Prompts, How Does Prompt Engineering Work?, Zero, one, few-shot prompting, chain-ofthought prompting, role-based prompting. Applications: Reinforcement Learning from Human Feedback (RLHF), Responsible AI, LLM-powered applications	

Module-5:	**08 Hours**
Expert Systems and Applications: Architecture, roles, MYCIN, DART. Trends in AI and Applications: AIaaS, AIoT, No-Code AI, Low-Code AI, Robotics, Drones. Industrial and Societal Applications: 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.	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach* (4th Edition), Pearson Education, 2023
2. Reema Thareja, Artificial Intelligence: Beyond Classical AI, Pearson Education, 2023
3. Ajantha Devi Vairamani and Anand Nayyar, Prompt Engineering: Empowering Communication, 1st Edition, CRC Press, Taylor & Francis Group, 2024. (DOI: https://doi.org/10.1201/9781032692319)
4. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, *Artificial Intelligence*, McGraw Hill Education

II. Reference books:

1. Saptarsi Goswami, Amit Kumar Das and Amlan Chakrabarti, "AI for Everyone – A Beginner's Handbook for Artificial Intelligence", Pearson, 2024
2. Tom Taulli, *Prompt Engineering for Generative AI: ChatGPT, LLMs, and Beyond*, Apress, Springer Nature
3. Nilakshi Jain, Artificial Intelligence: Making A System Intelligent, First Edition, Wiley.

III. Web links and Video Lectures (e-Resources):

1. Elements of AI – *https://www.elementsofai.com*
2. CS50's Introduction to Artificial Intelligence with Python – Harvard *https://cs50.harvard.edu/ai/*
3. Google Machine Learning Crash Course – *https://developers.google.com/machine-learning/crash-course*
4. Learn Prompting (Open-Source Guide) – *https://learnprompting.org*
5. Google AI – Learn with Google AI *https://ai.google/education/*
6. Coursera – Machine Learning by Andrew Ng (Stanford University) *https://www.coursera.org/learn/machine-learning*
7. OpenAI Prompt Engineering Guide (for ChatGPT) *https://platform.openai.com/docs/guides/gpt-best-practices*

8. Prompt Engineering for Developers – DeepLearning.AI + OpenAI *https://www.deeplearning.ai/short-courses/chatgpt-prompt-engineering-for-developers/*
9. Ethics in AI – Google Responsible AI Practices *https://ai.google/responsibilities/responsible-ai-practices/*
10. Google Teachable Machine (Train AI models visually without code) https://teachablemachine.withgoogle.com
11. Course Link :
12. https://www.coursera.org/learn/generative-ai-with-llms/home/

Teaching-Learning Process (Innovative Delivery Methods):

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

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

Assessment Structure:

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

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

Continuous Comprehensive Assessments (CCA):

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

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

INSTRUCTIONS:

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

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

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

Rubrics for Learning Activity (Creating Effective Prompts):

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Appropriate Use of Prompting Technique [CO4] [PO1, PO5]	Demonstrates precise and creative application of the intended prompting technique (e.g., zero-shot, few-shot, role-based) with full alignment to objectives.	Correctly applies the prompting technique with minor gaps or missed opportunities.	Uses the prompting technique, but with partial understanding or inconsistent application.	Limited understanding of the technique; incorrect or weak application.	No evidence of correct prompting technique use.

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

	organized, and includes deep reflection on improvements across iterations.				

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Course Title: Introduction to C Program		Semester	I/II
Course Code	25CS1ESICP	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2	**SEE Marks**	50
Total Hours of Pedagogy	40 Hours	**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)	Theory		

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to

CO1: Understand the basic concepts of computer programming, including variables, data types, and dynamics of memory and write, Compile and debug programs in the C programming language using proper syntax and conventions.

CO2: Design simple programs involving decision structures, loops, functions, arrays, structures, pointers and files.

Module-1: Introduction to C	**05 Hours**
Basic Organization of a Computer, Program Design Tools (Algorithms, Flowcharts), Introduction to C, Structure of C program, Writing the first C Program, Compiling and Executing C Programs, C Tokens, Basic Data Types in C, Operators in C, Evaluating Expressions, Type Conversion and Typecasting, Example Programs. **(RBT Levels: L1, L2 and L3)**	
Module-2: Decision Control and Looping Statements	**05 Hours**
Introduction to Decision Control Statements, Conditional Branching Statements (if, if-else, if-else-if, switch), Iterative Statements (while, do-while, for), Nested Loops, Break and Continue Statements, Example Programs. **(RBT Levels: L1, L2 and L3)**	
Module-3: Arrays	**05 Hours**
Introduction, Declaration of Arrays, Accessing the elements of an Array, Storing values in Arrays, Operations on Arrays (Insertion, Deletion, Searching-Binary search, Linear search), Two-Dimensional Arrays, Operations on Two- Dimensional arrays -Sum, Difference. **(RBT Levels: L1, L2 and L3)**	
Module-4: Functions and Strings	**05 Hours**
Functions: Components of Functions (Function Declaration, Function Definition, Function Call), Passing Parameters to Functions, Example Programs. **Strings:** Introduction, Operations on Strings (Length of a String, Converting Lowercase to Uppercase and Vice Versa, String Concatenation, String Comparison Using built in functions). **(RBT Levels: L1, L2 and L3)**	

Module-5: Structures and Pointers	**05 Hours**
Structures: Introduction, Arrays of Structures, Example Programs. **Pointers:** Introduction to Pointers, Declaring Pointer Variables, Pointer Expressions and Pointer Arithmetic, Passing Arguments to Functions using Pointers, Example Programs. **(RBT Levels: L1, L2 and L3)**	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. **Reema Thareja**, "Computer Fundamentals and Programming in C", 2nd Edition, Oxford Higher Education, 2016

II. Reference books:

1. **E. Balaguruswamy**, "Programming in ANSI C", 7th Edition, McGraw-Hill Education, 2018.
2. **J. R. Hanly and E. B. Koffman**, "Problem Solving and Program Design in C", 7th Edition, Pearson Education, 2013.

III. Web links and Video Lectures (e-Resources):

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

List of Lab activities:

Weekly: 1 Session (2 hours) **Batch Strength: 15 Students**
Number of Labs: 12 (10 Sessions + 2 Lab Assessments)
Suggested Software: Code Blocks (Open Source)

Part A

1. Implement a C program to find the distance between two points.
2. Illustrate conditional branching statements to find the smallest of three numbers.
3. Develop a C program to solve simple arithmetic calculations, using arithmetic expressions and use of each operator leading to simulation of a commercial calculator. (No built-in math function).
4. Develop a C program to find all possible roots of a quadratic equation.
5. Develop a C program to print the sum of even numbers from M to N.
6. Develop a C program to compute the GCD of two numbers.

Part B

1. Develop a C program to search a Book ID from an organized bookshelf that has N number of books using appropriate searching technique.
2. Develop a C program to read a matrix and print the diagonal elements.
3. Write functions to implement String operations such as concatenation and String length using built-in functions.
4. Develop a C program for swapping values of two variables by using Parameter Passing techniques (Call by Value and Call by reference).
5. Develop a C program to read and display the student details using Structures.
6. Develop C program to test whether a number is positive, negative, or equal to zero using pointers.

Additional Programs

1. Develop a C program to convert Fahrenheit to Celsius.
2. A company decides to give a bonus to its employees on Diwali. A 5% bonus on salary is given to the Male workers and a 10% bonus on salary to the female workers. Write a program to enter the salary and gender of the employee if the salary of the employee is less than Rs.10,000 then the employee gets an extra 2% bonus on salary. Write a C program to calculate the bonus that has to be given to the employee and display the salary the employee will get.
3. Develop a C Program to display the following by reading the number of rows as input.

   1
   121
   12321
   1234321
4. Develop a C program to find the factorial of a number using functions.
5. Develop a program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of N real numbers.
6. Develop a C Program to Count the Number of Vowels, Consonants, digits, and special characters in a string. Implement structures to read, write and compute the average

salary of the employees, and list the employees earning a salary above and below the average salary for a department of N employees.

Teaching-Learning Process (Innovative Delivery Methods):

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

1. Flipped Classroom
2. Interactive Coding Platforms

Assessment Structure:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max. Marks</th><th>Total</th><th>Reduced Marks</th><th>Total</th><th>Min. Marks required for eligibility</th><th>Total Marks</th></tr>
<tr><td rowspan="4">CIE – Theory</td><td>AAT</td><td>20</td><td>20</td><td>5</td><td rowspan="4">25</td><td rowspan="4">10</td><td rowspan="7">50</td></tr>
<tr><td>Test 1</td><td>40</td><td rowspan="3">120</td><td rowspan="3">20</td></tr>
<tr><td>Test 2</td><td>40</td></tr>
<tr><td>Test 3</td><td>40</td></tr>
<tr><td rowspan="3">CIE – Lab</td><td>Lab Test1 (10)</td><td rowspan="2">20</td><td rowspan="2">20</td><td rowspan="2">20</td><td rowspan="3">25</td><td rowspan="3">10</td></tr>
<tr><td>Lab Test2 (10)</td></tr>
<tr><td>Record & Performance</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td colspan="3">CIE</td><td colspan="2">50</td><td>20</td><td></td></tr>
<tr><td colspan="3">SEE</td><td colspan="2">100</td><td colspan="2">50</td><td>35</td><td>50</td></tr>
<tr><td colspan="6">Grand Total Marks</td><td>40</td><td>100</td></tr>
</table>

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Introduction to PYTHON Programming		Semester	I/II
Course Code	25CS1ESIPP/25CS2ESIPP	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3: 0: 2	**SEE Marks**	50
Total Hours of Pedagogy	40 Hours	**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to ….

CO1: Apply knowledge of Python programming for various applications.

CO2: Analyse the given Python program to identify bugs.

CO3: Design Python programs/ applications for a given requirement.

CO4: Ability to conduct practical experiments for given requirements using python

Module-1: **05 Hours**

Python Basics: Variables, expressions, and statements: Values and types, Variables, Variable names and keywords, Statements, Operators and operands, Expressions, Order of operations, Modulus operator, String operations, Asking the user for input, Comments, Choosing mnemonic variable names, Debugging,

Conditional execution: Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Catching exceptions using try and except, Short circuit evaluation of logical expressions

Iteration: Updating variables, the while statement, Infinite loops, break, finishing iterations with continue, Definite loops using for, Loop patterns, Counting and summing loops, Maximum and minimum loops

Module-2: **05 Hours**

Strings: A string is a sequence, Getting the length of a string using len, Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, The in operator, String comparison, string methods, Parsing strings, Format operator

Lists: A list is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Deleting elements, Lists and functions, Lists and strings, Parsing lines, Objects and values, Aliasing, List arguments

Module-3: **05 Hours**

Dictionaries: Dictionary as a set of counters, Dictionaries and files, Looping and dictionaries, Advanced text parsing

Tuples: Immutable, comparing tuples, Tuple Assignment, Dictionaries and Tuples, Multiple Assignments with Dictionaries, Using Tuples as keys in Dictionary

Functions: Function calls, Built-in functions, Type conversion functions, Random numbers, Math functions, Adding new functions, Definitions and uses, Flow of execution, Parameters and

arguments, Fruitful functions and void functions, Why functions
Module-4 : **05 Hours**
Object-Oriented Programming: Managing Larger Programs, Getting Started, Using Objects, Starting with Programs, Subdividing a Problem, Our First Python Object, Classes as Types, Object Lifecycle, Many Instances, Inheritance, Classes and Methods, Operator overloads **Exceptions:** Exception Class Hierarchy, User-Defined Exceptions
Module-5: **05 Hours**
Regular expressions: Character matching in regular expressions, Extracting data using regular expressions, combining searching and extracting, Escape character **Files:** Persistence, Opening files, Text files and lines, Reading files, Searching through a file, Letting the user choose the file name, Using try, except, and open, Writing files

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. Python for Everybody: Exploring Data Using Python 3, Charles R. Severance, Fourth Edition, University of Michigan, 2016
2. Learning to Program using Python, Cody Jackson, Second Edition, Packt Publishing, 2018

II. Reference books:

1. Programming Python,MarkLutz,FirstEdition,O'Reilly Media,2010
2. Python Essential Reference,David M. Beazley,Fourth Edition,Pearson,2009
3. Core Python Applications Programming,Wesley J Chun,ThirdEdition,Pearson,2015

III. Web links and Video Lectures (e-Resources):

1. Think Python,Allen B. Downe,SecondEdition,Green Tea Press, Needham, Massachusetts,2014 [https://greenteapress.com/ thinkpython2/thinkpython 2.pdf]
2. A Hands-On, Project-Based Introduction to Programming,EricMatthes,FirstEdition,No Starch Press,2016 [https://t.ly/fEOq (URL Shortened)]

IV. MOOC Courses:

1. An Introduction to Interactive Programming in Python (Part 1),Coursera,2021 https://www.coursera.org/ course/interactivepython1
2. An Introduction to Interactive Programming in Python (Part 2),Coursera,2021 https://www.coursera.org/ course/interactivepython2
3. Introduction to Python Programming,edx,2021 https://www.edx.org/professionalcertificate/introduction- to python-programming

List of Lab activities:

1. Write a program that asks the user how many Fibonacci numbers to generate and then generates them. Make sure to ask the user to enter the number of numbers in the sequence to generate.
2. Write a program that asks the user for a number and then prints out a list of all the divisors of that number.
3. Write a program to compute distance between two points taking input from the user (Pythagorean Theorem).
4. Write a Program for checking whether the given number is a even number or not.
5. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
6. Write a program to find the sum of all primes below two million.
7. a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure.

7. b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

8. a) Write a Python program that takes this list and makes a new list that has only the even elements of this list in it.

8. b) Write a function that takes an ordered list of numbers (a list where the elements are in order from smallest to largest) and another number. The function decides whether or not the given number is inside the list and returns (then prints) an appropriate Boolean.

9. a) Write a program to combine lists that combines these lists into a dictionary.

9. b) Write a program to print each line of a file in reverse order.

10. a) Write a program to count frequency of characters in a given file.
10. b) Write a program to compute the number of characters, words and lines in a file.

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
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Course Title: Communication Skills		Semester	I/II
Course Code	25MA1AECEN/25MA2AECEN	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	1-0-0	**SEE Marks**	50
Total Hours of Pedagogy		**Total Marks**	100
Credits	01	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

CO 1 Build essential verbal, non-verbal, and phonetic communication skills for clarity and effectiveness

CO 2 Use interpersonal skills in group discussions, presentations, and professional interactions

CO 3 Apply formal writing, email etiquette, and creative content development for employability

CO 4: Communicate effectively in digital platforms, following netiquette and academic integrity

CO 5: Prepare job applications, resumes, and perform confidently in interviews

Module-1: **03 Hours**

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

Teaching Methodology	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	**Quiklrn.com**
Digital Tools	ALL 44 sounds of English in 75 minutes - https://www.youtube.com/watch?v=QxQUapA2w4&t=51s. AI-based grammar and writing tools (e.g., Grammarly, ChatGPT, Quillbot) to analyze and classify parts of speech. AI-based pronunciation tools (Google Speech-to-Text) for real-time feedback
Reading Material	"**The Chimney Sweeper" by William Blake** Martin Luther King Jr's "I Have a Dream" Speech
Assessment Techniques and Tools	**Role Play**: Formal/informal scenarios, **Group Discussion (GD), Case Studies Analysis**: Identify barriers and suggest solutions, **Mini-Presentation**: Focused on proxemics. Observation Rubric (for body language, tone, time cues), (Sample Rubric, please refer the annexure), Video Recording + Self-evaluation Sheet.

Module-2: **03 Hours**

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

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

Module-3: **03 Hours**

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

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

Module-4 : **03 Hours**

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

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

Module-5: **03 Hours**

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

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

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. Kumar, A. R. (2008). *English for engineers and technologists*. Orient BlackSwan.
2. Raman, M., & Sharma, S. (2015). *Technical communication: Principles and practice* (3rd ed.). Oxford University Press.

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

II. Reference books:

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

III. Web links and Video Lectures (e-Resources):

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

Teaching-Learning Process (General Instructions):

The strategies teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective:
Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological tools and software's to meet the present requirements of the Global employment market.

1. Direct instructional method (Low/Old Technology),
2. Flipped classrooms (High/advanced Technological tools),
3. Blended learning (Combination of both),
4. Enquiry and evaluation-based learning, (
5. Personalized learning,
6. Problems based learning through discussion,
7. Following the method of expeditionary learning Tools and techniques
8. Use of audio-visual methods through language Labs in teaching of LSRW skills.

Apart from conventional lecture methods, various types of innovative teaching techniques

through videos, animation films may be adapted so that the delivered lesson can progress the students in theoretical applied and practical skills in teaching of communicative skills in general.

Assessment Structure:

Component	Type of assessment	Max. Marks	Total
CIE – Theory	CIE 1	25	100
	CIE 2	25	
SEE	End Exam	50	

Two CIEs will be conducted for 25 Marks each. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Indian Constitution and Engineering Ethics		Semester	I/II
Course Code	25MA1HSICE /25MA2HSICE	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	1-0-0	**SEE Marks**	50
Total Hours of Pedagogy		**Total Marks**	100
Credits	NCMC	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course successfully, the student will be able to understand the topics:

CO 1: Understand the Constitution's origin, structure, principles, and its role in ensuring dignity and equal rights

CO 2: Analyze the government structure, the election process, the amendments, and the emergency provisions in the Indian democracy

CO 3: Develop an understanding of ethical responsibility through the principles of engineering ethics

Module-1:	**03 Hours**
Introduction to the Indian Constitution: The Importance of the Constitution. Introduction to the Indian Constitution, The Making of the Constitution, The Role of the Constituent Assembly. The Preamble of the Indian Constitution. Salient features of the India Constitution.	
Module-2:	**03 Hours**
FR's, FD's, and DPSP's: Fundamental Rights and their reasonable restrictions in various complex scenarios. Directive Principles of State Policy (DPSP). Fundamental Duties: Their Role and Importance in Nation-Building	
Module-3:	**03 Hours**
Union Executive & State Executive: Union Executive - President, Vice President, Prime Minister, Parliament, Supreme Court of India. State Executive - Governor, Chief Minister, State Legislative Assembly, and High Courts.	
Module-4 :	**03 Hours**
Elections, Amendments, and Emergency Provisions: Election Commission, Elections & Electoral Process. Constitutional Amendments: Importance and Key Changes in India. Emergency Provisions.	

Module-5:	**03 Hours**
Professional Ethics: Ethics & Values. Types of Ethics. Scope & Aims of Professional & Engineering Ethics. Clash of Ethics. Moral Development. The impediments to Responsibility. Trust & Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety, and Liability in Engineering.	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. An Introduction to Constitution of India and Professional Ethics" by Merunandan K.B. and B.R. Venkatesh, Meragu Publications, 3rd edition, 2011.
2. "Constitution of India & Professional Ethics & Human Rights" by Phaneesh K. R., Sudha Publications, 10th edition, 2016.
3. "Engineering Ethics", M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Prentice – Hall, 2004

II. Reference books:

1. "Samvidhana Odu" - for Students & Youths by Justice HN Nagamohan Dhas, Sahayana, kerekon.
2. "Constitution of India, Professional Ethics and Human Rights" by Shubham Singles, Charles E. Haries, and et al, published by Cengage Learning India, Latest Edition – 2019.
3. "Introduction to the Constitution of India", (Students Edition.) by Durga Das Basu (DD Basu): Prentice–Hall, 2008.
4. "Constitution of India" (for Competitive Exams) - Published by Naidhruva Edutech Learning Solutions, Bengaluru. – 2022

Teaching-Learning Process (Innovative Delivery Methods):

The strategies teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective:

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

1. Direct instructional method (Low/Old Technology),
2. Flipped classrooms (High/advanced Technological tools),
3. Blended learning (Combination of both),
4. Enquiry and evaluation-based learning,
5. Personalized learning,
6. Learning through discussion on Case studies

Assessment Structure:

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Test 1	25	50	25	50
	Test 2	25		25	

Question Paper Pattern:
CIE Multiple Choice Questions

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
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Course Title: IDEA Lab (Multidisciplinary)		Semester	I/II
Course Code	25ME1AEIDL/25ME2AEIDL	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	0:0:2	**SEE Marks**	50
Total Hours of Pedagogy		**Total Marks**	100
Credits	01	**Exam Hours**	3
Examination type (SEE)	Practical / Presentation / Seminar		

Course Outcomes (Course Skill Set)

CO1: Identify real-world problems and formulate technology-driven solutions using IoT, Robotics, AR/VR, Drones, and Prototyping.

CO2: Design and build working prototypes using advanced tools like Arduino, Raspberry Pi, 3D printers, sensors, VR headsets, drones, and PCB design tools.

CO3: Evaluate the practicality, scalability, and social impact of solutions, and communicate them effectively to diverse audiences

Module-1: IoT and Robotics

Introduction to robotics and components: Arduino, motor driver, sensors, chassis, wheels, and power supply setup, Basics of Arduino programming, Blink an LED, Circuit connections and assembling the robotic car chassis, Control DC motors, IR sensor, Pulse Width Modulation (PWM), Wireless control using Bluetooth / Wi-Fi modules, Troubleshooting, Assembly and Testing, Calibration of robotic movements.

Hands-on Project:
Building and programming autonomous and Bluetooth-controlled robotic cars with line-following and obstacle-avoidance features.

Module-2: Augmented and Virtual Reality (AR/VR)

Introduction to Unity, Working with physics (rigid body, collider), Camera and UI basics, creation of Assets and Prefabs, Basic Scripting with C# (movement and rotation), prompts to debug the components.

Hands on project: Developing simple AR apps using mobile platforms, VR environments demo

Module-3: Drones and UAV Technology

Understanding drone mechanics, aero dynamics, flight controllers, calibration and sensors.

Hands-on project: Assembling and disassembling of drones, calibration, simulation and fly experience.

Module-4 : Prototyping

Introduction to prototyping tools and workflow: from concept to 3D printed model, 3D scanning: capturing physical objects and generating STL files, Editing and refining scanned models using CAD software (Fusion 360 /SolidWorks /Mesh mixer),Using slicer software for print preparation, parameter setting, and G-code generation, Operating 3D printers: machine setup, filament loading, calibration, and printing process, Post-processing techniques: support removal, surface finishing, and part assembly

Hands-on Project: scanning, and fabricating a functional 3D printed prototype from a real-world object.

Assessment Structure:

1. **CIE**

Sl. No.	Module	CIE Marks
1	Lab projects	30
2	Minor projects	20
Total		50

2. **SEE**

Sl. No.	Parameter	Marks
1	Prototype Demonstration	20
2	Final Presentation & report	20
3	Viva Voce	10
Total		**50**

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Mathematical Foundation for Computer Science Stream-2		**Semester**	II
Course Code	25MA2BSMCS	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3-1-0	**SEE Marks**	50
Total Hours of Pedagogy		**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course successfully, students will be able to:

CO 1: Apply the concepts of Calculus, Linear Algebra and Numerical methods in solving problems

CO 2: Relate the importance of Calculus, Linear Algebra and Numerical methods in Computer science stream

CO 3: Demonstrate the understanding of Calculus, Linear Algebra and Numerical methods through programming skills using modern tool

Module-1: Integral Calculus	**11 Hours**
Prerequisites: **Definite and indefinite integrals** of single-variable functions, basic conic sections and polar coordinates.	
Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. **Applications:** Area by double integral (polar curves), Volume by triple integral. **Beta and Gamma functions:** Definitions, properties, relation between Beta and Gamma functions. **Self-Study:** Moment of Inertia along a particular direction, Duplication formula.	
Module-2: Vector Space	**10 Hours**
Prerequisites: Binary operations, groups, matrices and system of equations.	
Definition and examples, subspace, linear combinations, linear span, linearly independent and dependent sets, row space, column space and null space of a matrix, basis and dimension. **Applications:** Coordinate vector. **Self-study:** Verification of vector spaces.	
Module-3: Linear Transformations	**10 Hours**
Prerequisites: Functions, matrix algebra, system of linear equations and their solutions	
Definition and examples, Matrix of a linear transformation. Rank and nullity of a linear operator, rank-nullity theorem and eigen spaces of a linear transformation. **Applications:** Singular, non-singular and onto linear transformations, invertible linear transformation **Self-study:** Geometric linear transformation in R^2 for image processing	
Module-4 : Numerical Methods -1	**09 Hours**
Prerequisites: Algebraic and transcendental functions, roots of an equation.	

Solution of algebraic and transcendental equations: Newton-Raphson method. Finite differences, Newton's forward and backward interpolation. Lagrange's interpolation and Lagrange's inverse Interpolation. N**umerical integration:** Simpson's $(1/3)^{rd}$ rule, Simpson's $(3/8)^{th}$ rule and Weddle's rule. **Applications:** Estimating the velocity, acceleration, area, volume. **Self-Study:** Regula-Falsi method and Newton's divided difference formula.
Module-5: Numerical Methods -2 **08 Hours**
Prerequisites: Basic differentiation and integration, analytical solutions for initial value problem.
Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Picard's method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector method. **Applications:** Finding approximate solution of ODEs related to engineering field. **Self-Study:** Adam-Bashforth method and Numerical solution of higher order ODEs

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 45th Ed., 2024.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **D. C. Lay:** "Linear Algebra and its Applications", Pearson Publishers, 5th Ed., 2024

II. Reference books:

1. **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. **S. Pal & S. C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019
5. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
6. **D.G. Zill and W.S.Wright:** " Advanced Engineering Mathematics", Jones Bartlett Publishers Inc., 7th Ed., 2020

III. Web links and Video Lectures (e-Resources):

1. VTU e-shikshana Program
2. Integral Calculus: https://www.classcentral.com/course/youtube-integral-calculus-90616b and https://www.edx.org/course/mathtrackx-integral-calculus
3. Integral and Vector Calculus: https://onlinecourses.nptel.ac.in/noc22_ma03/preview
4. Vector Calculus: https://www.classcentral.com/course/mit-opencourseware-multivariable-calculus-fall-2007-40962/classroomand https://www.classcentral.com/course/vector-calculus-engineers-17387
5. Vector spaces and Linear Transformations: https://nptel.ac.in/courses/111104137, https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/ and

https://www.classcentral.com/subject/linear-algebra

6. Numerical Methods: https://www.classcentral.com/course/numerical-methods-engineers-32822,
7. https://nptel.ac.in/courses/111107105 and https://ocw.mit.edu/courses/18-335j-introduction-to numerical-methods-spring-2019/

Teaching-Learning Process (Innovative Delivery Methods):

1. Chalk and talk method / Power Point Presentation

Assessment Structure:

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

1. CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
2. The best two scores out of three tests will be considered for CIE.

Semester End Examination:

1. Two complete questions will be given from each unit.
2. One complete question from each unit to be answered.

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Mathematical foundation for Civil, Electrical and Mechanical Streams -2		Semester	II
Course Code	25MA2BSCEM	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3-1-0	**SEE Marks**	50
Total Hours of Pedagogy		**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course successfully, students will be able to:

CO 1: Apply the concepts of Calculus, Partial differential equations and Numerical methods in solving problems

CO 2: Relate the importance of Calculus, Partial differential equations and Numerical methods in Civil, Electrical and Mechanical streams

CO 3: Demonstrate the understanding of Calculus and Numerical methods through programming skills using modern tool

Module-1: Integral Calculus	**11 Hours**

Prerequisites: D**efinite and indefinite integrals** of single-variable functions, basic conic sections and polar coordinates.

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates.

Applications: Area by double integral (polar curves), Volume by triple integral.

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

Self-Study: Moment of Inertia along a particular direction, Duplication formula.

Module-2: Vector Calculus	**10 Hours**

Prerequisites: Scalars, vectors and its operations, multivariable calculus, basic integration

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

Vector Integration: Line integrals, Green's theorem and Stokes' theorem (statement only): problems.

Applications: Directional derivative and work done by a force.

Self-study: Velocity, acceleration of a moving particle and Gauss divergence theorem

Module-3: Partial Differential Equations (PDEs)	**10 Hours**

Prerequisites: Basics of differential equations

Formation of PDEs by elimination of arbitrary constants and functions. Solution of non- homogeneous PDE by direct integration, homogeneous PDE by the method of Separation of variables.

Applications: Mathematical modelling of one-dimensional heat and wave equations.

Self-study: Solution of one-dimensional heat and wave equations by the method of separation of variables.

Module-4 : Numerical Methods -1	**09 Hours**

Prerequisites: Algebraic and transcendental functions, roots of an equation.

Solution of algebraic and transcendental equations: Newton-Raphson method. Finite differences, Newton's forward and backward interpolation. Lagrange's interpolation and Lagrange's inverse Interpolation. **Numerical integration:** Simpson's $(1/3)^{rd}$ rule, Simpson's $(3/8)^{th}$ rule and Weddle's rule. **Applications:** Estimating the velocity, acceleration, area, volume. **Self-Study:** Regula-Falsi method and Newton's divided difference formula
Module-5: Numerical Methods -2 **08 Hours**
Prerequisites: Basic differentiation and integration, analytical solutions for initial value problem.
Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Picard's method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector method. **Applications:** Finding approximate solution of ODEs related to engineering field. **Self-Study:** Adam-Bashforth method and Numerical solution of higher order ODEs.

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2. **S. Pal & S. C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **C. R. Wylie, L. C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co., New York, 6th Ed., 2017
5. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.
6. **D.G. Zill and W. S. Wright:** "Advanced Engineering Mathematics", Jones Bartlett Publishers Inc., 7th Ed., 2020

III. Web links and Video Lectures (e-Resources):

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

Teaching-Learning Process (Innovative Delivery Methods):

1. Chalk and talk method / Power Point Presentation

Assessment Structure:

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

1. CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
2. The best two scores out of three tests will be considered for CIE.

Semester End Examination:

1. Two complete questions will be given from each unit.
2. One complete question from each unit to be answered.

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Elements of Chemical Engineering		Semester	II
Course Code	25CH2PSCHE	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	**SEE Marks**	100
Total Hours of Pedagogy	120 h	**Total Marks**	100
Credits	3-0-1 (Total 4)	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

After completing the course, the students will be able to ….

CO1: Understand the relevance of chemicals engineering and role of a Chemical Engineer.
CO2: Identify the modern chemical engineering plants and importance of simulation.
CO3: Evaluate the dimensionless analysis and its applications.
CO4: Evaluate and asses the environmental & safety aspects in Chemical Engineering.
CO5: Present the experimental observations in the form of a lab report.

Module-1: Introduction to Chemical Engineering & Role of a Chemical Engineer	**8 Hours**
Introduction: Chemical Engineering in Everyday life, History of Chemical Engineering, Major Chemical Engineering Contributions to Society, Significance of chemical engineering in food, health, energy and environment. Sustainable development framework; United Nations SDGs, Emerging Technologies to implement sustainable development goals.	
Module-2: Modern chemical engineering plants	**8 Hours**
Batch processing and continuous processing, transition from batch to continuous processing, Basic principles of chemical processes; Unit processes and unit operations; Case studies: Manufacture of paint, Sulfuric acid and Soda ash. Measurement of temperature, pressure, flow and level in a process.	
Module-3: Role and importance of Natural Sciences in Chemical Engineering	**8 Hours**
Introduction, Ideal gas law, Infinitesimal Control Volume, Macroscopic Control Volume, Closed Systems and Open Systems, Conservation of Mass and energy and related numerical, Fundamentals of mass transfer, Fick's law of diffusion. Heat transfer, modes of heat transfer and related numerical.	
Module-4 : Fluid flow phenomena and Dimensional Analysis	**8 Hours**
Types of fluids - shear stress and velocity gradient relation, Types of fluid flow, Measurement of fluid flow: Rotameter, pitot tube. Dimensionless Numbers, Primary and derived quantities, Dimensional homogeneity, Methods of dimensional analysis (Rayleigh's) and its applications, related numerical.	
Module-5: Safety in Chemical Process Industries	**7 Hours**
Safety in Chemical Process Industries, Lessons for the Management, Importance of Quantitative Information, Case Study 1: Bhopal gas tragedy; Case Study 2: Environmental Hazards of a Green Project. Case study 3: Bottling plant of Coco-Cola. Basic safety and process management (Process design for safety, introduction to HAZOP and safety management processes).	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. Pushpavanam S, Introduction to Chemical Engineering, PHI Learning Private Limited, New Delhi, 2010.
2. Morton Denn, Chemical Engineering: An Introduction, Cambridge University Press, 2011.

II. Reference books:

1. W. L. McCabe, J. C. Smith and P. Harriot, Unit Operations of Chemical Engineering, 7th Edition, McGraw Hill, New York, 2021.
2. Walter L. Badger, Julius T. Banchero , Julius T. Bancheo, Introduction To Chemical Engineering, Tata McGraw-Hill, 1955.
3. Richard M. Felder and Ronald W. Rousseau, Elementary Principles of Chemical Processes, John Wiley & Sons, 3 rd Edition, 2005.
4. Himmelblau, D.M., Basic Principles and Calculations in Chemical Engineering, 6 th Edition, Prentice Hall of India, New Delhi, 1997.
5. Uche, N. Introduction to Chemical Engineering. Scrivener Publishing, Wiley, 2019
6. Ghoshal, S.K., Sanjal, S.K. and Datta, S. Introduction to Chemical Engineering. Tata McGraw-Hill Publication, 2017.
7. Introduction to Sustainable Engineering, Rag. R.L. and Ramesh Lakshmi Dinachandran, PHILearning Pvt. Ltd., 2ndEdn, 2016

III. Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/103108097
2. https://onlinecourses.nptel.ac.in/noc25_ch07/preview
3. https://www.youtube.com/watch?v=SdP3BbCt4Ak

List of Lab activities:

1. Introduction to Microsoft excel spreadsheet, tool bars and its functions
2. Spread sheet for Unit Conversion and dimensional analysis
3. Spread sheet for Material Balance for a Mixing Process
4. Spread sheet for Steady-State Material Balance on a Tank
5. Spread sheet for Steady-State Energy Balance in a heating tank
6. Introduction to MATLAB, solving matrices, tool bars and its functions.
7. MATLAB Program for determining the regression coefficient.
8. MATLAB Program for the calibration of a rotameter.
9. MATLAB Program for variation of height with respect to time in a tank (Solution of a differential equation).
10. MATLAB Program for the solving ordinary differential equation.

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

1. Flipped class
2. Chalk and talk
3. NPTEL and other videos for theory topics
4. Partial Delivery of course by Industry expert/ industrial visits
5. ICT-Enabled Teaching.
6. Activity based learning.
7. Keep fundamentals as the core teaching content.
8. Present recent trends as short "industry snapshot" segments at the end of each module (e.g., 15–20 minutes), not as examinable depth topics.
9. Use case studies, videos, or demonstrations for the advanced concepts so students see applications without getting bogged down in mechanisms.
10. Make the trends part of assessments via assignments, mini-seminars, or group presentations, so the main lecture hours focus on the basics.

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 Assessments		Marks 100% (Weightage 50%)	Assessment
Theory Component	Three Internals (Best of Two)	40%	Course Instructor
	Quiz (One Quiz or AAT)	10%	

Laboratory Component	Laboratory Component	50%	
Semester End Examination (Written Examination for Three Hours)		Marks 100 (Weightage 50%)	

Component	**Theory (50%)**			**Practical (50%)**		**Total Marks**
	Test 1	**Test 2**	**Learning Activity-1**	**Records & Performances**	**Lab Test**	
Max. Marks	20	20	10	30	20	100
Reduced CIE	10	10	5	15	10	50

Continuous Comprehensive Assessments (CCA):

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

- Learning Activity 1: Case Studies Presentations related to implementation SDGs (5 Marks)

Rubrics for Learning Activity -1 (Based on the nature of learning activity, design the rubrics for each activity):
(10 Marks)

	Superior	**Good**	**Fair**	**Needs Improvement**	**Unacceptable**
Understanding of Case (10 Marks) (PO 1)	Demonstrates deep understanding (10)	Good understanding (8)	Adequate understanding. (6)	Limited understanding (4)	No clear understanding. (0-2)

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

1. Course Project
2. Case Study
3. Presentation Programming

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

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

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

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Title: Elements of Mechanical Engineering		Semester	II
Course Code	25ME2PSEME	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3-0-1	**SEE Marks**	100
Total Hours of Pedagogy		**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)			

Course Outcomes (Course Skill Set)

CO1: Describe and discuss fundamental principles of Mechanical Engineering as applied in the domains of machining, thermal, automotive and futuristic technologies such as non-conventional energy technology

CO2: Differentiate and compare among various mechanical systems (such as energy, metal joining, IC engines etc.)

CO3: Derive and determine parameters related to different type of mechanical systems

CO4: Demonstrate skills in fabrication techniques and experimental analysis related to different domains in Mechanical Engineering

Module-1: **05 Hours**

Introduction to Mechanical Engineering (Overview only):
Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors and contribution to GDP (*Not for CIE/SEE*).

Energy Sources and Power Plants:
Classification of energy sources, Construction and working of Hydel power plant, Solar power plant (Helio-thermal process, flat and parabolic collectors), Wind power plant, Hydrogen as fuel and list of applications.

Hydraulic turbines
Classification of Hydraulic turbines, Principle and Operation of Pelton Wheel and Francis Turbine.

Module-2: **05 Hours**

Metal Joining Processes:
Soldering, Brazing and Welding**:** Classification, definitions and principles of operation, Procedure followed in soldering, brazing and welding, Brief description of arc welding.

Steam Formation and Application:
Formation of steam and thermodynamic properties of steam (no numerical problems), Applications of steam in industries.

Refrigeration: Principle of refrigeration, Refrigeration Effect, Ton of Refrigeration, COP, Refrigerants and their desirable properties, Principles and Operation of Vapor Compression and Vapor Absorption Refrigeration (with block diagrams), Applications of Refrigeration

Module-3: **05 Hours**

Fundamentals of IC Engines: Classification of Internal Combustion Engines, Working of 4-Stroke (petrol and diesel) engines, Applications of IC Engines, Numerical on Power and Mechanical efficiency calculations.

Insight into future mobility technology: Introduction to Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles (block diagram only). Advantages and disadvantages of EVs and Hybrid vehicles. Drones, UAV, Types of UAV, fixed wing and multi-rotors, Applications

Module-4 :	**05 Hours**
Power Transmission – Belt Drives: Principle, working and application of flat and V-belt drives. Flat belt drives (Open and crossed), Simple numerical on flat belt drives involving velocity ratios (without the effect of belt thickness and slip). **Power Transmission – Gear Drives**: Types of gear, Gear Trains (simple and compound) and their application. **Introduction to Robotics:** Robot anatomy, Joints & links, common robot configurations, Applications of Robotics	
Module-5:	**05 Hours**
Fundamentals of Machine Tools and Operations: (*Machine tool sketches are not included for CIE/SEE*) Working Principle of Lathe, Milling and Drilling machine tools, Lathe Operations: Turning, Facing, Taper Turning and Knurling. **Introduction to Modern Manufacturing Tools and Techniques:** CNC: Introduction, components of CNC, advantages and applications of CNC, Additive Manufacturing: Introduction, classification, steps involved. **Introduction to Mechatronics:** Concept of open-loop and closed-loop control systems, Examples of Mechatronic systems	

Suggested Learning Resources: (Textbook/Reference Book):

I. Textbooks:

1. Elements of Mechanical Engineering, K R Gopala Krishna, Subhash Publications, 2019
2. Elements of Mechanical Engineering, V. K. Manglik, PHI Learning, 2019

II. Reference books:

1. Textbook of Elements of Mechanical Engineering, S. Trymbaka Murthy, Medtech, 2019
2. Elements of Mechanical Engineering, Kestoor Praveen, Suggi Publishing, 2019
3. Thermal Management in Electronic Equipment, HCL Technologies, 2010
4. Fundamentals of Robotics: Analysis and Control, Robert J. Schilling, Pearson Education (US).

III. Web links and Video Lectures (e-Resources):

1. https://www.tlv.com/global/TI/steam-theory/principal-applications-for-steam.html
2. https://www.forbesmarshall.com/Knowledge/SteamPedia/About-Steam/Fundamental-Applications-of-Steam
3. https://rakhoh.com/en/applications-and-advantages-of-steam-in-manufacturing-and-process-industry/
4. Videos | Makino (For Machine Tool Operation)
5. Mechanisms and mechanical devices 4e.pdf (e-book- Mechanical Linkages)

List of Lab activities:

1. One model preparation using arc welding
2. Preparation of a sheet metal model
3. One model preparation using soldering
4. One model preparation involving bench-drilling & tapping
5. One lathe model involving facing, turning and knurling
6. Hands on experience on CNC wood router and Laser cutting machine
7. Performance study of Pelton wheel turbine
8. Performance study of 4 stroke petrol engine

Teaching-Learning Process (Innovative Delivery Methods):

1. Power Point presentation,
2. Chalk and talk are used for problem solving (in-general).
3. Students are encouraged to practice only line diagrams for exams.
4. Video demonstration or simulations
5. Laboratory demonstrations and practical experiments

Assessment Structure:

<table>
<tr><th>Component</th><th>Type of assessment</th><th>Max. Marks</th><th>Total</th><th>Reduced Marks</th><th>Total</th><th>Min. Marks required for eligibility</th><th>Total Marks</th></tr>
<tr><td rowspan="4">CIE – Theory</td><td>Quiz/AAT</td><td>--</td><td>--</td><td rowspan="4">25</td><td rowspan="4">25</td><td rowspan="4">10</td><td rowspan="7">50</td></tr>
<tr><td>Test 1</td><td>40</td><td rowspan="3">80</td></tr>
<tr><td>Test 2</td><td>40</td></tr>
<tr><td>Test 3</td><td>40</td></tr>
<tr><td rowspan="2">CIE – Lab</td><td>Record & Performance/ Lab Test</td><td>15</td><td rowspan="2">25</td><td rowspan="2"></td><td rowspan="2">25</td><td rowspan="2">10</td></tr>
<tr><td>Experiential learning</td><td>10</td></tr>
<tr><td colspan="4">CIE</td><td colspan="2"></td><td></td></tr>
<tr><td>SEE</td><td>End Exam</td><td colspan="2">100</td><td colspan="2">50</td><td></td><td>50</td></tr>
<tr><td colspan="6">Grand Total Marks</td><td></td><td>100</td></tr>
</table>

Semester End Examination: (QP PATTERN)

Answer five full questions selecting one from each module. **Two questions will be set from each**

module.

COs and POs Mapping

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3						2					
CO2	3						2					
CO3	3											
CO4	2			3								