RV College of Engineering®

Bachelor of Engineering (B.E)

Scheme And Syllabus Of I & II Semester
(2025 Scheme)

B.E. Programs : AS, BT, CD, CH, CI, CS, CV, CY, EC, EE, ET, IM, ME.
M. Tech (13) MCA, M.Sc. (Engg.)
Ph.D. Programs : All Departments are recognized as Research Centres by VTU.

2025

RV College of Engineering®

SINCE 1963

NAAC GRADE A+ ACCREDITED INSTITUTION

SHAPING VISIONARIES, CRAFTING INNOVATORS

An autonomous institution affiliated with VTU, Belagavi, and approved by AICTE and UGC, New Delhi

- **RV SATELLITE-1 (RVSAT - 1)** India's First Microbiological Payload, launched by RVCE students in December 2024
- **NCC** - Best Institution Award of Karnataka and Goa Directorate (2019, 2022, 2023 & 2025)

₹50 Cr.

MoU with **TATA Technologies** to establish Centre for Invention, Innovation, Incubation & Training

Placements

₹92 LPA	250+	92%	₹10 LPA
Highest Package	Recruitment Partners	Placement Rate	Median Salary

Rankings

99th	1501+	601+	NBA	IIRF 2025	NPTEL
NIRF Ranking 2024 in Engineering Category	Times Higher Education World University Rankings-2025	Times Higher Education Asia University Rankings-2025	UG and PG programs accredited multiple times	Engineering ranking India National - 01 State - 01 Zone - 01	Local Chapter Ranking 2025 National – 09 State – 01

Research and Centres

37 Skill Labs

General Skills, Domain Skills, Interdisciplinary Skills

- Bosch Rexroth
- Mercedes Benz
- Morris Garage
- Boston AI System
- Toyota Kirloskar
- Vision Astra EV Academy

Outcome Based Education (OBE) emphasizing on experiential learning, research-based learning and skill-based learning

20	8	16
Centres of Excellence	Centres of Competence	Research Centres in niche areas

- Autonomous Vehicles
- Nanomaterials and Devices
- Hydrogen and Green Technology
- Extended Reality
- Healthcare
- E-mobility
- IoT and Sensors
- Smart Antenna System
- Computational Genomics
- Quantum Computing

80	65	46
Patents filed	Patents published	Patents granted

32	₹30 Cr.
Innovative & Cultural activity teams	Research and projects consultancy (last 5 years)

Programs and Faculty

- **13 UG** Programs; **1420 (2025)** annual sanctioned intake
- **13 PG** Programs **390 (2025)** annual sanctioned intake
- **Ph.D.** Programs in all departments
- **500+** Faculty Members and Staff

CET / KEA Code: **E005**
COMED-K Code: **E095**
PGCET Code (MTech): **T857**
PGCET Code (MCA): **C463**

State-of-the-Art infrastructure

- **Innovation Center**
- **Gymnatorium**
- **Hostels**
- **Labs & Workshops**

Alumni

36,000 +	100+
Alumni across the globe	RVCE alumni in civil service

RVCE Reconnect - USA edition, our first International Alumni Meet

NUMBER OF ATTENDEES

650	120
San Jose	Seattle

Mr. Suresh Katta, RVCE alumnus & Chairman Emeritus of Saama Group, USA and **Mr. Anil Kumble,** RVCE alumnus & former Indian cricketer, were the Guests of Honour at the alumni meets held in San Jose & Seattle, USA.

Collaborations with International universities

125 MoUs with Industry, Institutions & Research Establishments

thws · Fachhochschule Dortmund · Technische Hochschule Rosenheim · HTWD · The University of Iowa · FIU Florida International University · Saint Peter's University · Kennesaw State University · RWTH Aachen University

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Go, change the world®

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(2025 Scheme)

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2025

ABBREVIATIONS

Sl. No.	Abbreviation	Meaning
1.	**VTU**	Visvesvaraya Technological University
2.	**AI**	Artificial Intelligence & Machine Learning
3.	**AS**	Aerospace Engineering
4.	**BT**	Biotechnology
5.	**CD**	Computer Science & Engineering – Data Science
6.	**CH**	Chemical Engineering
7.	**CI**	Computer Science & Engineering – Artificial Intelligence and Machine Learning
8.	**CS**	Computer Science & Engineering
9.	**CV**	Civil Engineering
10.	**CY**	Computer Science & Engineering – Cyber Security
11.	**EC**	Electronics & Communication Engineering
12.	**EE**	Electrical & Electronics Engineering
13.	**ET**	Electronics & Telecommunication Engineering
14.	**IM**	Industrial Engineering & Management
15.	**IS**	Information Science & Engineering
16.	**ME**	Mechanical Engineering
17.	**PY**	Physics
18.	**CM**	Chemistry
19.	**MA**	Mathematics
20.	**ASC**	Applied Sciences Course
21.	**PC**	Professional Core Course
22.	**ES**	Engineering Science Course
23.	**PL**	Programming Language Lab Course
24.	**HSS**	Humanities and Social Sciences
25.	**CIE**	Continuous Internal Evaluation
26.	**SEE**	Semester End Examination

RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

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2025 SCHEME - CREDITS AND COMPONENTS

I SEMESTER: CHEMISTRY CYCLE (CS STREAM) CS, BT, CD, CY & CI

Sl. No.	Course Code	Course Title	BoS	Credit Allocation				Category	CIE Duration (H)	Max Marks CIE		SEE Duration (Hrs)	Max Marks SEE	
				L	T	P	Total			Theory	Lab		Theory	Lab
1	MA211TC	Fundamentals of Linear Algebra, Calculus and Statistics	MA	3	1	0	**4**	Theory	1.5	**100**	***	**3**	**100**	***
2	CM211IA	Chemistry of Smart Materials And Devices	CM	3	0	1	**4**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
3	ME112GL	Computer Aided Engineering Graphics	ME	1	0	2	**3**	Lab	1.5	***	**50**	**3**	***	**50**
4	XX113XTX	Engineering Science Course - I	XX	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
5	XX115XIX	Programming Languages Course	CS	2	0	1	**3**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
6	HS111EL	Communicative English-I	HS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
7	HS114TC	Fundamentals of Indian Constitution	HS	1	0	0	**1**	Theory	1	**50**	***	**2**	**50**	***
8	HS115YL	Scientific Foundations of Health-Yoga Practice	HS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
				13	**1**	**6**	**20**							

II SEMESTER: PHYSICS CYCLE (CS STREAM) CS, BT, CD, CY & CI

Sl. No.	Course Code	Course Title	BoS	Credit Allocation				Category	CIE Duration (H)	Max Marks CIE		SEE Duration (Hrs)	Max Marks SEE	
				L	T	P	Total			Theory	Lab		Theory	Lab
1	MA221TC	Number Theory, Vector Calculus and Computational Methods	MA	3	1	0	**4**	Theory	1.5	**100**	***	**3**	**100**	***
2	PY221IC	Quantum Physics for Engineers	PY	3	0	1	**4**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
3	CS222IA	Principles of Programming Using C	CS	3	0	0	**3**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
4	XX123XTX	Engineering Science Course-II	XX	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
5	CI114TA/CI124TA	AI Foundations for Engineers	CI	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
6	HS121EL	Communicative English-II	HS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
7	HS122KS/HS123KB	Samskrutika Kannada/ Balake Kannada	HS	1	0	0	**1**	Theory	1	**50**	***	**2**	**50**	***
8	ME121DL	IDEA LAB	ME	0	0	1	**1**	Lab	2	***	**50**	**2**	***	**50**
				15	**1**	**4**	**20**							

2025 SCHEME - CREDITS AND COMPONENTS

I SEMESTER: PHYSICS CYCLE (EC STREAM) EC, EE & ET

Sl. No.	Course Code	Course Title	BoS	Credit Allocation				Category	CIE Duration (H)	Max Marks CIE		SEE Duration (Hrs)	Max Marks SEE	
				L	T	P	Total			Theory	Lab		Theory	Lab
1	MA211TA	Fundamentals of Linear Algebra, Calculus and Numerical Methods	MA	3	1	0	**4**	Theory	1.5	**100**	***	**3**	***100***	***
2	PY211IA	Condensed Matter Physics for Engineers (Common to EC, & ET Programs)	PY	3	0	1	**4**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
	PY211IE	Physics of Electrical & Electronic Materials(Only for EE Program)						Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
3	EC112TA	Basic Electronics (Common to EC & ET Programs)	EC	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
	EE112TA	Elements of Electrical Engineering (Only for EE Program)	EE					Theory	1.5					
4	XX113XTX	Engineering Science Course - I	XX	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
5	CI114TA/CI124TA	AI Foundations for Engineers	CI	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
6	HS111EL	Communicative English-I	HS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
7	HS112KS/ HS113KB	Samskrutika Kannada/ Balake Kannada	HS	1	0	0	**1**	Theory	1	**50**	***	**2**	**50**	***
8	ME111DL	IDEA LAB	ME	0	0	1	**1**	Lab	2	***	**50**	**2**	***	**50**
				15	**2**	**3**	**20**							

II SEMESTER: CHEMISTRY CYCLE (EC STREAM) EC, EE & ET

Sl. No.	Course Code	Course Title	BoS	Credit Allocation				Category	CIE Duration (H)	Max Marks CIE		SEE Duration (Hrs)	Max Marks SEE	
				L	T	P	Total			Theory	Lab		Theory	Lab
1	MA221TA	Vector Calculus, Laplace Transform and Numerical Methods	MA	3	1	0	**4**	Theory	1.5	**100**	***	**3**	**100**	***
2	CM221IB	Chemistry of functional materials	CM	3	0	1	**4**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
3	ME122GL	Computer Aided Engineering Graphics	ME	2	0	1	**3**	Lab	1.5	***	**50**	**3**	***	**50**
4	XX123XTX	Engineering Science Course-II	XX	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
5	XX125XIX	Programming Languages Course	CS	2	0	1	**3**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
6	HS121EL	Communicative English-II	HSS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
7	HS124TC	Fundamentals of Indian Constitution	HSS	1	0	0	**1**	Theory	1	**50**	***	**2**	**50**	***
8	HS125YL	Scientific Foundations of Health-Yoga Practice	HSS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
				14	**1**	**5**	**20**							

2025 SCHEME - CREDITS AND COMPONENTS

I SEMESTER: PHYSICS CYCLE (ME STREAM) AS, CH, IM & ME

Sl. No.	Course Code	Course Title	BoS	Credit Allocation				Category	CIE Duration (H)	Max Marks CIE		SEE Duration (Hrs)	Max Marks SEE	
				L	T	P	Total			Theory	Lab		Theory	Lab
1	MA211TB	Fundamentals of Linear Algebra, Calculus and Differential Equations	MA	3	1	0	**4**	Theory	1.5	**100**	***	**3**	**100**	***
2	PY211IB	Classical Physics for Engineers	PY	3	0	1	**4**	Theory Lab	1.5	**100**	**50**	**3**	**100**	**50**
3	ME112TA	Elements of Mechanical Engineering	ME	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
4	XX113XTX	Engineering Science Course - I	XX	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
5	CI114TA/CI124TA	AI Foundations for Engineers	CI	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
6	HS111EL	Communicative English-I	HS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
7	HS112KS/ HS113KS	Samskrutika Kannada/ Balake Kannada	HS	1	0	0	**1**	Theory	1	**50**	***	**2**	**50**	***
8	ME111DL	IDEA LAB	ME	0	0	1	**1**	Lab	2	***	**50**	**2**	***	**50**
				15	**2**	**3**	**20**							

II SEMESTER: CHEMISTRY CYCLE (ME STREAM) AS, CH, IM & ME

Sl. No.	Course Code	Course Title	BoS	Credit Allocation				Category	CIE Duration (H)	Max Marks CIE		SEE Duration (Hrs)	Max Marks SEE	
				L	T	P	Total			Theory	Lab		Theory	Lab
1	MA221TB	Vector Calculus and Computational Methods	MA	3	1	0	**4**	Theory	1.5	**100**	***	**3**	**100**	***
2	CM221IC	Chemistry of Engineering materials	CM	3	0	1	**4**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
3	ME122GL	Computer Aided Engineering Graphics	ME	1	0	2	**3**	Lab	1.5	***	**50**	**3**	***	**50**
4	XX123XTX	Engineering Science Course-II	XX	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
5	XX125XIX	Programming Languages Course	CS	2	0	1	**3**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
6	HS121EL	Communicative English-II	HS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
7	HS124TC	Fundamentals of Indian Constitution	HS	1	0	0	**1**	Theory	1	**50**	***	**2**	**50**	***
8	HS125YL	Scientific Foundations of Health-Yoga Practice	HS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
				13	**1**	**6**	**20**							

2025 SCHEME - CREDITS AND COMPONENTS

I SEMESTER: PHYSICS CYCLE (CV STREAM) CV

Sl. No.	Course Code	Course Title	BoS	Credit Allocation				Category	CIE Duration (H)	Max Marks CIE		SEE Duration (Hrs)	Max Marks SEE	
				L	T	P	Total			Theory	Lab		Theory	Lab
1	MA211TD	Applied Mathematics – I	MA	3	1	0	**4**	Theory	1.5	**100**	***	**3**	**100**	***
2	PY211ID	Applied Physics for Engineers	PY	3	0	1	**4**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
3	CV112TA	Engineering Mechanics	CV	2	1	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
4	XX113XTX	Engineering Science Course - I	XX	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
5	CI114TA/CI124TA	AI Foundations for Engineers	CI	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
6	HS111EL	Communicative English-I	HS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
7	HS112KS/HS113KB	Samskrutika Kannada/ Balake Kannada	HS	1	0	0	**1**	Theory	1	**50**	***	**2**	**50**	***
8	ME111DL	IDEA LAB	ME	0	0	1	**1**	Lab	2	***	**50**	**2**	***	**50**
				15	**2**	**3**	**20**							

II SEMESTER: CHEMISTRY CYCLE (CV STREAM) CV

Sl. No.	Course Code	Course Title	BoS	Credit Allocation				Category	CIE Duration (H)	Max Marks CIE		SEE Duration (Hrs)	Max Marks SEE	
				L	T	P	Total			Theory	Lab		Theory	Lab
1	MA221TD	Applied Mathematics – II	MA	3	1	0	**4**	Theory	1.5	**100**	***	**3**	**100**	***
2	CM221ID	Engineering And Environmental Chemistry	CM	3	0	1	**4**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
3	ME122GL	Computer Aided Engineering Graphics	ME	1	0	2	**3**	Lab	1.5	***	**50**	**3**	***	**50**
4	XX123XTX	Engineering Science Course-II	XX	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
5	XX125XIX	Programming Languages Course	CS	2	0	1	**3**	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
6	HS121EL	Communicative English-II	HS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
7	HS124TC	Fundamentals of Indian Constitution	HS	1	0	0	**1**	Theory	1	**50**	***	**2**	**50**	***
8	HS125YL	Scientific Foundations of Health-Yoga Practice	HS	0	0	1	**1**	Lab	1	***	**50**	**2**	***	**50**
				13	**1**	**6**	**20**							

Applied Science Courses

- **FUNDAMENTALS OF LINEAR ALGEBRA, CALCULUS AND NUMERICAL METHODS (MA211TA)**
- **FUNDAMENTALS OF LINEAR ALGEBRA, CALCULUS AND DIFFERENTIAL EQUATIONS (MA211TB)**
- **FUNDAMENTALS OF LINEAR ALGEBRA, CALCULUS AND STATISTICS (MA211TC)**
- **APPLIED MATHEMATICS - I (MA211TD)**
- **VECTOR CALCULUS, LAPLACE TRANSFORM AND NUMERICAL METHODS (MA221TA)**
- **VECTOR CALCULUS AND COMPUTATIONAL METHODS (MA221TB)**
- **NUMBER THEORY, VECTOR CALCULUS AND COMPUTATIONAL METHODS (MA221TC)**
- **APPLIED MATHEMATICS – II (MA221TD)**

- **CONDENSED MATTER PHYSICS FOR ENGINEERS (PY211IA)**
- **CLASSICAL PHYSICS FOR ENGINEERS (PY211IB)**
- **QUANTUM PHYSICS FOR ENGINEERS (PY221IC)**
- **APPLIED PHYSICS FOR ENGINEERS (PY211ID)**
- **PHYSICS OF ELECTRICAL AND ELECTRONIC MATERIALS (PY211IE)**

- **CHEMISTRY OF SMART MATERIALS AND DEVICES (CM211IA)**
- **CHEMISTRY OF FUNCTIONAL MATERIALS (CM221IB)**
- **CHEMISTRY OF ENGINEERING MATERIALS (CM221IC)**
- **ENGINEERING AND ENVIRONMENTAL CHEMISTRY (CM221ID)**

Semester: I						
FUNDAMENTALS OF LINEAR ALGEBRA, CALCULUS AND NUMERICAL METHODS **Category: Applied Science Course** **Stream: Electronics (Common to EC, EE & ET Programs)** **(Theory)**						
Course Code	**:**	MA211TA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L+30T + 45EL		**SEE Duration**	**:**	03 Hours

Unit – I	**09 Hrs**
Elementary Linear Algebra: Rank of matrices-Rank of a matrix by Echelon form, consistency of system of linear equations- homogeneous and non-homogeneous equations, Gauss elimination, Gauss-Jordan and Gauss-Seidel methods. Eigenvalues and Eigenvectors-properties, largest eigenvalue and smallest eigenvalue by Rayleigh's power method.	
Unit – II	**09 Hrs**
Differential Calculus: Basics of polar coordinates, polar curves, angle between the radius vector and the tangent. Curvature, radius of curvature-Cartesian, polar & parametric forms (without proof), centre and circle of curvature (formulae only) and problems. Taylor's and Maclaurin's series for a function of a single variable (statements only) and problems.	
Unit – III	**09 Hrs**
Multivariable Functions and Partial Differentiation: Functions of several variables, Partial derivatives-definition and notations, higher order partial derivatives-problems, total differentials, total derivatives, composite functions and chain rule-problems. Extreme values for a function of two variables-Method of Lagrange multipliers. Jacobians - properties and problems.	
Unit – IV	**09 Hrs**
Multiple Integrals: Double integrals–Introduction and method of evaluation-problems. Change of order of integration and change of variables to polar coordinates-problems. Applications–area, volume and centre of gravity. Triple integrals-introduction and method of evaluation and problems. Applications-volume of a solid and centre of gravity.	
Unit – V	**09 Hrs**
Numerical Methods: Finite differences, concept of forward and backward difference, introduction to interpolation and extrapolation. Newton-Gregory (N-G) forward and backward interpolation formulae, Lagrange interpolation formula and application-oriented problems. Numerical differentiation based on N-G forward and backward interpolation, applications–velocity and acceleration. Numerical integration-Newton-Cotes approach–Simpson's $1/3^{rd}$, $3/8^{th}$ rules and Weddle's rules.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the foundational knowledge of linear algebra, differential calculus, partial differentiation, multiple integrals, and numerical methods to solve engineering problems.
CO2	Analyze complex engineering problems using appropriate mathematical techniques from linear algebra, differential calculus, partial differentiation, multiple integrals, and numerical methods.
CO3	Evaluate engineering problems by identifying suitable mathematical methods from linear algebra, differential calculus, partial differentiation, multiple integrals, and numerical methods.
CO4	Enhance the comprehensive understanding of linear algebra, differential calculus, partial differentiation, multiple integrals and numerical methods gained to demonstrate the problems arising in real world situations.

Reference Books	
1	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-04-70458-36-5.
2	Calculus, Saturinino L. Salas, Einar Hille and Garret J. Etgen, 10th Edition, 2022, Wiley India, ISBN: 978-93-90421-96-1.
3	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 007-1623663, ISBN-13: 978-00-71623-66-7.
4	Numerical Methods for Scientific and Engineering Computation, M.K. Jain, S.R.K. Iyenger and R.K. Jain, 6th Edition, 2012, New Age International Publishers, ISBN: 978-81-22433-23-4, 812-2433235.
5	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-93328-49-1.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2	**TESTS:** Students will be evaluated in tests, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, Evaluating, and Creating). **THREE** tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video-based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I						
FUNDAMENTALS OF LINEAR ALGEBRA, CALCULUS AND DIFFERENTIAL EQUATIONS **Category: Applied Science Course** **Stream: Mechanical (Common to AS, CH, IM & ME Programs)** **(Theory)**						
Course Code	**:**	MA211TB		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L+30T + 45EL		**SEE Duration**	**:**	03 Hours

Unit – I	**09 Hrs**
Elementary Linear Algebra: Rank of matrices-Rank of a matrix by Echelon form, consistency of system of linear equations- homogeneous and non-homogeneous equations, Gauss elimination, Gauss-Jordan and Gauss-Seidel methods. Eigenvalues and Eigenvectors-properties, largest eigenvalue and smallest eigenvalue by Rayleigh's power method.	
Unit – II	**09 Hrs**
Differential Calculus: Basics of polar coordinates, polar curves, angle between the radius vector and tangent. Curvature, radius of curvature-Cartesian, polar & parametric forms (without proof), centre and circle of curvature (formulae only) and problems. Taylor's and Maclaurin's series for a function of a single variable (statements only) and problems.	
Unit – III	**09 Hrs**
Multivariable Functions and Partial Differentiation: Functions of several variables, Partial derivatives-definition and notations, higher order partial derivatives-problems, total differentials, total derivatives, composite functions and chain rule-problems. Extreme values for a function of two variables-method of Lagrange multipliers. Jacobians - properties and problems.	
Unit – IV	**09 Hrs**
Multiple Integrals: Double integrals–Introduction and method of evaluation-problems. Change of order of integration and change of variables to polar coordinates-problems. Applications–area, volume and center of gravity. Triple integrals-introduction and method of evaluation and problems. Applications-volume of a solid and center of gravity.	
Unit – V	**09 Hrs**
Linear Ordinary Differential Equations of Higher Order: Standard form of a higher-order linear differential equation with constant coefficients. Solution of homogeneous equations–complementary functions. Nonhomogeneous equations-concept of inverse differential operator, methods of finding particular integral based on input function (force function), method of variation of parameters. Equations with functional coefficients–Cauchy equation. Applications-simple harmonic motion, LRC circuits.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the foundational knowledge of linear algebra, differential calculus, partial differentiation, multiple integrals and differential equations to solve engineering problems.
CO2	Analyze complex engineering problems using appropriate mathematical techniques from linear algebra, differential calculus, partial differentiation, multiple integrals and differential equations.
CO3	Evaluate engineering problems by identifying suitable mathematical methods from linear algebra, differential calculus, partial differentiation, multiple integrals and differential equations.
CO4	Enhance the comprehensive understanding of linear algebra, differential calculus, partial differentiation, multiple integrals and differential equations gained to demonstrate the problems arising in real-world situations

Reference Books	
1	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-04-70458-36-5.
2	Calculus, Saturinino L. Salas, Einar Hille and Garret J. Etgen, 10th Edition, 2022, Wiley India, ISBN: 978-93-90421-96-1.
3	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 0071623663, ISBN -13: 978-00-71623-66-7.
4	Calculus, James Stewart, 8th Edition, 2016, Cengage Learning, ISBN: 978-12-85740-62-1.
5	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-93328-49-1.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2	**TESTS:** Students will be evaluated in tests, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, Evaluating, and Creating). **THREE** tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video-based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I						
FUNDAMENTALS OF LINEAR ALGEBRA, CALCULUS AND STATISTICS **Category: Applied Science Course** **Stream: Computer Science (Common to BT, CD, CI, CS & CY Programs)** **(Theory)**						
Course Code	**:**	MA211TC		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L+30T + 45EL		**SEE Duration**	**:**	03 Hours

Unit – I	**09 Hrs**
Elementary Linear Algebra: Rank of matrices-Rank of a matrix by Echelon form, consistency of system of linear equations- homogeneous and non-homogeneous equations, Gauss elimination, Gauss-Jordan and Gauss-Seidel methods. Eigenvalues and Eigenvectors-properties, largest eigenvalue and smallest eigenvalue by Rayleigh's power method.	
Unit – II	**09 Hrs**
Differential Calculus: Basics of polar coordinates, polar curves, angle between the radius vector and tangent. Curvature, radius of curvature-Cartesian, polar & parametric forms (without proof), centre and circle of curvature (formulae only) and problems. Taylor's and Maclaurin's series for a function of a single variable (statements only) and problems.	
Unit – III	**09 Hrs**
Multivariable Functions and Partial Differentiation: Functions of several variables, Partial derivatives-definition and notations, higher order partial derivatives-problems, total differentials, total derivatives, composite functions and chain rule-problems. Extreme values for a function of two variables-method of Lagrange multipliers. Jacobians - Properties and problems.	
Unit – IV	**09 Hrs**
Multiple Integrals: Double integrals–introduction and method of evaluation-problems. Change of order of integration and change of variables to polar coordinates-problems. Applications–area, volume and centre of gravity. Triple integrals-introduction and method of evaluation and problems. Applications-volume of a solid and centre of gravity.	
Unit – V	**09 Hrs**
Statistics: Central moments, mean, variance, coefficients of skewness and kurtosis in terms of moments. Curve fitting by method of least squares, fitting of curves–polynomial, exponential and power functions. Karl Pearson's correlation coefficient and linear regression analysis–problems. Applications.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the foundational knowledge of linear algebra, differential calculus, partial differentiation, multiple integrals, and statistics to solve engineering problems.
CO2	Analyze complex engineering problems using appropriate mathematical techniques from linear algebra, differential calculus, partial differentiation, multiple integrals, and statistics.
CO3	Evaluate engineering problems by identifying suitable mathematical methods from linear algebra, differential calculus, partial differentiation, multiple integrals, and statistics.
CO4	Enhance the comprehensive understanding of linear algebra, differential calculus, partial differentiation, multiple integrals and statistics gained to demonstrate the problems arising in real world situations.

Reference Books	
1	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-04-70458-36-5.
2	Calculus, Saturinino L. Salas, Einar Hille and Garret J. Etgen, 10th Edition, 2022, Wiley India, SBN: 978-93-90421-96-1.
3	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 0071623663, ISBN -13: 978-00-71623-66-7.
4	Theory and Problems of Probability and Statistics, Schaum's outline series, Murray Spiegel, John Schiller, R. Srinivasan, 2nd Edition, 2000, McGraw Hill, ISBN: 007-1350047.
5	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-93328-49-1.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2	**TESTS:** Students will be evaluated in tests, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **THREE** tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video-based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I						
APPLIED MATHEMATICS – I **Category: Applied Science Course** **Stream: Civil (Only to CV Program)** **(Theory)**						
Course Code	**:**	MA211TD		**CIE**	**:**	100 Marks
Credits: L: T: P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L+30T + 45EL		**SEE Duration**	**:**	03 Hours

Unit – I	**09 Hrs**
Elementary Linear Algebra: Rank of matrices-Rank of a matrix by Echelon form, consistency of system of linear equations- homogeneous and non-homogeneous equations, Gauss elimination, Gauss-Jordan and Gauss-Seidel methods. Eigenvalues and Eigenvectors-properties, largest eigenvalue and smallest eigenvalue by Rayleigh's power method.	
Unit – II	**09 Hrs**
Multivariable Functions and Partial Differentiation: Functions of several variables, Partial derivatives-definition and notations, higher order partial derivatives-problems, total differentials, total derivatives, composite functions and chain rule-problems. Extreme values for a function of two variables-method of Lagrange multipliers. Jacobians-Properties and problems.	
Unit – III	**09 Hrs**
Multiple Integrals: Double integrals–introduction and method of evaluation-problems. Change of order of integration and change of variables to polar coordinates-problems. Applications–area, volume and centre of gravity. Triple integrals-introduction and method of evaluation and problems. Applications-volume of a solid and centre of gravity.	
Unit – IV	**09 Hrs**
Linear Ordinary Differential Equations of Higher Order: Standard form of a higher-order linear differential equation with constant coefficients. Solution of homogeneous equations – complementary functions. Nonhomogeneous equations- concept of inverse differential operator, methods of finding particular integral based on input function (force function), method of variation of parameters. Equations with functional coefficients–Cauchy equation. Applications-Simple harmonic motion, LRC circuits.	
Unit – V	**09 Hrs**
Statistics: Central moments, mean, variance, coefficients of skewness and kurtosis in terms of moments. Curve fitting by method of least squares, fitting of curves–polynomial, exponential and power functions. Correlation and linear regression analysis–problems. Applications.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the foundational knowledge of linear algebra, partial differentiation, multiple integrals, differential equations and statistics to solve engineering problems.
CO2	Analyze complex engineering problems using appropriate mathematical techniques from linear algebra, partial differentiation, multiple integrals, differential equations and statistics.
CO3	Evaluate engineering problems by identifying suitable mathematical methods from linear algebra, partial differentiation, multiple integrals, differential equations and statistics.
CO4	Enhance the comprehensive understanding of linear algebra, partial differentiation, multiple integrals, differential equations and statistics gained to demonstrate the problems arising in real world situations.

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3	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 0071623663, ISBN -13: 978-00-71623-66-7.
4	Theory and Problems of Probability and Statistics, Schaum's outline series, Murray Spiegel, John Schiller, R. Srinivasan, 2nd Edition, 2000, McGraw Hill, ISBN: 007-1350047.
5	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-93328-49-1.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2	**TESTS:** Students will be evaluated in tests, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **THREE** tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video-based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: II						
VECTOR CALCULUS, LAPLACE TRANSFORM AND NUMERICAL METHODS **Category: Applied Science Course** **Stream: Electronics (Common to EC, EE & ET Programs)** **(Theory)**						
Course Code	**:**	MA221TA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L+30T + 45EL		**SEE Duration**	**:**	03 Hours

Unit – I	**09 Hrs**
Vector Differentiation: Vector-valued functions–2D and 3D scalar and vector fields. Gradient of a scalar field–Normal vector to the surface, directional derivative, scalar potential. Divergence and curl of a vector field, Laplacian of scalar field, Solenoidal and irrotational fields and physical interpretations. Expressions for gradient, divergence, curl and Laplacian in cylindrical, spherical-polar coordinates-problems.	
Unit – II	**09 Hrs**
Vector Integration: Line integral, work done by a force, surface and volume integrals. Green's theorem, Stokes' theorem and Gauss divergence theorem (statements only)-problems, solenoidal fields and irrotational fields.	
Unit – III	**09 Hrs**
Laplace Transform: Existence and uniqueness of Laplace transform (LT), transform of elementary functions, region of convergence. Properties-linearity, scaling, t-shift property, s-domain shift, differentiation in the s-domain, division by t, differentiation and integration in the time domain. LT of special functions-periodic functions (square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside unit step function, unit impulse function.	
Unit – IV	**09 Hrs**
Inverse Laplace Transform: Definition, properties, evaluation using different methods. Convolution theorem (without proof), problems. Application to solve linear ordinary differential equations.	
Unit – V	**09 Hrs**
Numerical Methods: Algebraic and transcendental equations–Roots of equations, intermediate value property, Regula-Falsi, Secant and Newton-Raphson methods. Methods of solving first-order ordinary differential equations -Taylor's series method, 4th order classical explicit Runge-Kutta method and Adams-Bashforth predictor–corrector method.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the foundational knowledge of Laplace transforms, vector calculus and numerical methods to solve engineering problems.
CO2	Analyze complex engineering problems using appropriate mathematical techniques from Laplace transforms, vector calculus and numerical methods.
CO3	Evaluate engineering problems by identifying suitable mathematical methods from Laplace transforms, vector calculus and numerical methods.
CO4	Enhance the comprehensive understanding of Laplace transforms, vector calculus and numerical methods gained to demonstrate the problems arising in real world situations.

Reference Books	
1	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-04-70458-36-5.
2	Calculus, Saturinino L. Salas, Einar Hille and Garret J. Etgen, 10th Edition, 2022, Wiley India, ISBN: 978-93-90421-96-1.
3	Numerical Methods for Scientific and Engineering Computation, M.K. Jain, S.R.K. Iyenger and R.K. Jain, 6th Edition, 2012, New Age International Publishers, ISBN: 978-81-22433-23-4, 8122433235.
4	Advanced Modern Engineering Mathematics, Glyn James and Phil Dyke, 5th Edition, 2018, Pearson Education, ISBN-13 978-12-92174-34-1, ISBN-10 978-02-73719-23-6.
5	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-93328-49-1.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2	**TESTS:** Students will be evaluated in tests, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **THREE** tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video-based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: II						
VECTOR CALCULUS AND COMPUTATIONAL METHODS **Category: Applied Science Course** **Stream: Mechanical (Common to AS, CH, IM & ME Programs)** **(Theory)**						
Course Code	**:**	MA221TB		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L+30T + 45EL		**SEE Duration**	**:**	03 Hours

Unit – I	**09 Hrs**
Vector Differentiation: Vector-valued functions–2D and 3D scalar and vector fields. Derivative of vector function, tangent, velocity and acceleration. Gradient of a scalar field–Normal vector to the surface, directional derivative, scalar potential. Divergence and curl of a vector field, Laplacian of scalar field, Solenoidal and irrotational fields and physical interpretations.	
Unit – II	**09 Hrs**
Vector Integration: Line integrals, work done by a force, surface and volume integrals. Green's theorem, Stokes' theorem and Gauss divergence theorem (statements only)-problems, solenoidal fields and irrotational fields.	
Unit – III	**09 Hrs**
Partial Differential Equations: Formation of partial differential equations by elimination of arbitrary constants/functions, solution of Lagrange's linear equation. Solution of partial differential equations by method of separation of variables. Solution to wave and heat equations in one dimension and Laplace equation in two dimensions by the method of separation of variables, problems.	
Unit – IV	**09 Hrs**
Numerical Methods – I: Algebraic and transcendental equations–roots of equations, intermediate value property, Regula-Falsi, Secant and Newton-Raphson methods. Methods of solving first-order ordinary differential equations -Taylor's series method, 4th order classical explicit Runge-Kutta method and Adams-Bashforth predictor–corrector method.	
Unit – V	**09 Hrs**
Numerical Methods – II: Finite differences, concept of forward and backward difference, introduction to interpolation and extrapolation. Newton-Gregory (N-G) forward and backward interpolation formulae, Lagrange interpolation formula and application-oriented problems. Numerical differentiation based on N-G forward and backward interpolation, applications–velocity and acceleration. Numerical integration-Newton-Cotes approach–Simpson's $1/3^{rd}$, $3/8^{th}$ rules and Weddle's rules.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the foundational knowledge of vector calculus, partial differential equations and numerical methods to solve engineering problems.
CO2	Analyze complex engineering problems using appropriate mathematical techniques from vector calculus, partial differential equations and numerical methods.
CO3	Evaluate engineering problems by identifying suitable mathematical methods from vector calculus, partial differential equations and numerical methods.
CO4	Enhance the comprehensive understanding of vector calculus, partial differential equations and numerical methods gained to demonstrate the problems arising in real-world situations.

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3	Numerical Methods for Scientific and Engineering Computation, M.K. Jain, S.R.K. Iyenger and R.K. Jain, 6^{th} Edition, 2012, New Age International Publishers, ISBN: 978-81-22433-23-4, 8122433235.
4	Advanced Modern Engineering Mathematics, Glyn James and Phil Dyke, 5^{th} Edition, 2018, Pearson

	Education, ISBN-13 978-1292174341, ISBN-10 978-02-73719-23-6.
5	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-93328-49-1.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
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3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video-based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: II						
NUMBER THEORY, VECTOR CALCULUS AND COMPUTATIONAL METHODS **Category: Applied Science Course** **Stream: Computer Science (Common to BT, CD, CI, CS and CY Programs)** **(Theory)**						
Course Code	**:**	MA221TC		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L+30T + 45EL		**SEE Duration**	**:**	03 Hours

Unit – I	**09 Hrs**
Number Theory: Divisibility, greatest common divisor, prime numbers, properties of prime numbers, fundamental theorem of arithmetic, congruence, linear congruence, Chinese remainder theorem, multiplicative inverses, Euler's theorem, Euler's totient function, RSA public key encryption.	
Unit – II	**09 Hrs**
Vector Differentiation: Vector-valued functions–2D and 3D scalar and vector fields. Derivative of vector function, tangent, velocity and acceleration. Gradient of a scalar field–normal vector to the surface, directional derivative, scalar potential. Divergence and curl of a vector field, Laplacian of scalar field, Solenoidal and irrotational fields and physical interpretations.	
Unit – III	**09 Hrs**
Vector Integration: Line integrals, work done by a force, surface and volume integrals. Green's theorem, Stokes' theorem and Gauss divergence theorem (statements only)-problems, solenoidal fields and irrotational fields.	
Unit – IV	**09 Hrs**
Linear Ordinary Differential Equations of Higher Order: Standard form of a higher-order linear differential equation with constant coefficients. Solution of homogeneous equations–complementary functions. Nonhomogeneous equations-concept of inverse differential operator, methods of finding particular integral based on input function (force function), method of variation of parameters. Equations with functional coefficients–Cauchy equation. Applications-Simple harmonic motion, LRC circuits.	
Unit – V	**09 Hrs**
Numerical Methods: Finite differences, concept of forward and backward difference, introduction to interpolation and extrapolation. Newton-Gregory (N-G) forward and backward interpolation formulae, Lagrange interpolation formula and application-oriented problems. Numerical differentiation based on N-G forward and backward interpolation, applications – velocity and acceleration. Numerical integration-Newton-Cotes approach–Simpson's 1/3rd, 3/8th rules and Weddle's rules.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the foundational knowledge of number theory, vector calculus, differential equations and numerical methods to solve engineering problems.
CO2	Analyze complex engineering problems using appropriate mathematical techniques from number theory, vector calculus, differential equations and numerical methods.
CO3	Evaluate engineering problems by identifying suitable mathematical methods from number theory, vector calculus, differential equations and numerical methods.
CO4	Enhance the comprehensive understanding of number theory, vector calculus, differential equations and numerical methods gained to demonstrate the problems arising in real-world situations.

Reference Books	
1	Elementary Number Theory, David M. Burton, McGraw Hill, 7th Edition, ISBN: 978-00-73383-14-9.
2	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 0071623663, ISBN -13: 978-00-71623-66-7.
3	Numerical Methods for Scientific and Engineering Computation, M.K. Jain, S.R.K. Iyenger and R.K. Jain, 6th Edition, 2012, New Age International Publishers, ISBN: 978-81-22433-23-4, 8122433235.
4	Advanced Modern Engineering Mathematics, Glyn James and Phil Dyke, 5th Edition, 2018, Pearson

	Education, ISBN-13 978-1292174341, ISBN-10 978-02-73719-23-6.
5	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-93328-49-1.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2	**TESTS:** Students will be evaluated in tests, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **THREE** tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video-based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: II						
APPLIED MATHEMATICS – II **Category: Applied Science Course** **Stream: Civil (Only to CV Program)** **(Theory)**						
Course Code	**:**	MA221TD		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L+30T + 45EL		**SEE Duration**	**:**	03 Hours

Unit – I	**09 Hrs**
Vector Differentiation: Vector-valued functions–2D and 3D scalar and vector fields. Derivative of vector function, tangent, velocity and acceleration. Gradient of a scalar field–Normal vector to the surface, directional derivative, scalar potential. Divergence and curl of a vector field, Laplacian of scalar field, Solenoidal and irrotational fields and physical interpretations.	
Unit – II	**09 Hrs**
Vector Integration: Line integrals, work done by a force, surface and volume integrals. Green's theorem, Stokes' theorem and Gauss divergence theorem (statements only)-problems, solenoidal fields and irrotational fields.	
Unit – III	**09 Hrs**
Laplace Transform: Existence and uniqueness of Laplace transform, transform of elementary functions, region of convergence. Properties - linearity, scaling, s-domain shift, differentiation in the s-domain, division by t, differentiation and integration in the time domain. Inverse Laplace Transform - definition, properties, evaluation using different methods. Convolution theorem (without proof), problems. Application to solve linear ordinary differential equations.	
Unit – IV	**09 Hrs**
Numerical Methods - I: Algebraic and Transcendental equations–Roots of equations, intermediate value property, Regula-Falsi, Secant and Newton-Raphson methods. Taylor's and Maclaurin's series for a function of a single variable and problems. Methods of solving first-order ordinary differential equations–Taylor's series method, 4th order classical explicit Runge-Kutta method and Adams-Bashforth predictor–corrector method.	
Unit – V	**09 Hrs**
Numerical Methods - II: Finite differences, concept of forward and backward difference, introduction to interpolation and extrapolation. Newton-Gregory (N-G) forward and backward interpolation formulae, Lagrange interpolation formula and application-oriented problems. Numerical differentiation based on N-G forward and backward interpolation, applications – velocity and acceleration. Numerical integration- Newton-Cotes approach – Simpson's $1/3^{rd}$, $3/8^{th}$ rules and Weddle's rules.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the foundational knowledge of vector calculus, Laplace transforms and numerical methods to solve engineering problems.
CO2	Analyze complex engineering problems using appropriate mathematical techniques from vector calculus, Laplace transforms and numerical methods.
CO3	Evaluate engineering problems by identifying suitable mathematical methods from vector calculus, Laplace transforms and numerical methods.
CO4	Enhance the comprehensive understanding of vector calculus, Laplace transforms and numerical methods gained to demonstrate the problems arising in real-world situations.

Reference Books	
1	Advanced Engineering Mathematics, E. Kreyszig, 10^{th} Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-04-70458-36-5.
2	Calculus, Saturnino L. Salas, Einar Hille and Garret J. Etgen, 10^{th} Edition, 2022, Wiley India, ISBN: 978-93-90421-96-1.
3	Numerical Methods for Scientific and Engineering Computation, M. K. Jain, S. R. K. Iyenger and R. K.

	Jain, 6th Edition, 2012, New Age International Publishers, ISBN: 978-81-22433-23-4, 8122433235.
4	Calculus, James Stewart, 8th Edition, 2016, Cengage Learning, ISBN: 978-12-85740-62-1.
5	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-93328-49-1.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **THREE** tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video-based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I

Condensed Matter Physics for Engineers

Category: Applied Science Course

Stream: Electronics (Common to EC & ET Programs)

(Theory and Practice)

Course Code	**:**	PY211IA		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	45 L + 45 EL + 30 P		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**

Basics of Solid-State Physics:

Electrical Conductivity in Metals:

Free electron theory, Band theory of solids, Fermi energy and Fermi level, density of states, carrier concentration in metals at 0K.

Electrical Conductivity in Semiconductors:

Fermi level in intrinsic semiconductors, Expression for concentration of electrons in conduction band (derivation), Law of mass action, Electrical conductivity of a semiconductor (derivation), Extrinsic semiconductors, Variation of Fermi level with temperature and doping in extrinsic semiconductor. Hall effect and Hall coefficient (derivation), Numerical.

Unit – II	**09 Hrs**

Semiconductor Diodes and Sensors:

Diodes: Direct and indirect band gap, Band gap engineering, P-N junction diode-forward and reverse bias, diode equation, V-I characteristic, Application: bridge rectifier, breakdown mechanism in diodes: Avalanche & Zener breakdown, Application: Zener diode as voltage regulator.

Sensors: Introduction to sensors, Sensor characteristics, Temperature sensor: Thermistor, Gas sensor: Metal oxide semiconductor (MOS) sensor, Pressure sensor: Piezoresistive sensor, Numerical.

Unit –III	**09 Hrs**

Quantum Mechanics:

de Broglie Hypothesis and Matter Waves, Heisenberg's Uncertainty Principle and its application.

Wave Mechanics: Wave function, Operators, Eigen function and Eigen values of a free particle, Expectation value and its significance, Derivation of 1- dimensional (1D) time-independent Schrodinger equation (TISE) from classical wave equation, 1D TISE for infinite well, Mapping to free particle, Solution for 3-dimensional (3D) well, Concept of degeneracy, Displaced well, Quantum Tunneling and Finite well, Numerical.

Unit –IV	**09 Hrs**

Lasers and Optical Fibers:

Lasers: Characteristics of LASER, Interaction of radiation with matter, Requisites of a Laser system, Construction and working of semiconductor laser, Use of attenuators for single photon sources.

Optical Fibers: Propagation mechanism, Numerical aperture derivation, Modes of propagation, Attenuation in fiber, Application: Point-to-Point communication, Advantages of optical fiber over conventional cables. Numerical.

Unit –V	09 Hrs

Superconductivity

Zero resistance state, Meissner effect, Critical temperature, Critical current – Derivation for a cylindrical wire, Critical field, Formation of Cooper pairs - Mediation of phonons, Two-fluid model, BCS Theory - Phase coherent state, Limitations – examples of systems with low and high electron-phonon coupling, Type-I and type-II superconductors, Vortex state, Explanation for upper critical field, High Temperature super conductors, Cooper pair Tunneling (Andreev reflection), Josephson junction, Flux quantization, DC and AC SQUID, Numerical.

Course Outcomes	
CO1	Apply the principles of quantum mechanics and material science to comprehend the behaviour and properties of materials for optoelectronic and semiconductor device applications.
CO2	Analyze the working mechanisms of engineering devices associated with LASER, optical fibers, superconductors and semiconductors.
CO3	Evaluate engineering problems related to the performance of semiconductor and optoelectronic devices.
CO4	Design and propose experiments and sustainable solutions for challenges in real-time applications.

Reference Books

1.	Engineering Physics, R. K. Gaur and S.L. Gupta. Dhanpat Rai Publications, 8th Edition, 2011. ISBN: 978-81-89928-22-3
2.	A Textbook of Engineering Physics, M. N. Avadhanulu and P G Kshirsagar. S. Chand publications, 2019, ISBN : 978-93-528-3399-3.
3.	Solid state electronic devices, Ben G Streetman and Sanjay Kumar Banerjee, PHI learning, 6th edition, 2009, ISBN: 978-81-203-30207.
4.	Physics for Degree students, C.L. Arora and Dr. P. S. Hemne, S Chand, revised 2010, ISBN: 978-81-219-33506.
5.	Grob's Basic Electronics, Mitchel E Schultz, Mc Graw-Hill, 10th edition, 2007, ISBN 978-0-07-3373874
6.	Introduction to Quantum Mechanics, D J Griffiths, Pearson Education, Inc. 2nd Edition, ISBN: 0-13-191175-9
7.	Modern Quantum Mechanics, J. J. Sakurai and J. Nepolitano, Cambridge University Press, 3rd Edition, ISBN: 978-1-108-64592-8
8.	Optics, Ajoy Ghatak, McGraw-Hill Publishers, 1st Edition, ISBN: 978–0–07–338048–3
9.	Introduction to Superconductivity, A. C. Rose-Innes and E. H. Rhoderick, Pergamon Press Plc. 2nd Edition, ISBN: 0-08-021651-X
10.	Introduction to Solid State Physics, Charles Kittel, John Wiley & Sons, Inc, 8th edition, 2012. ISBN: 978-8126535187

11.	Solid State Physics, S O Pillai, New Age International Publishers, 10th edition, 2023, ISBN: 978-93-6074-814-2
12.	Handbook of Modern Sensors: Physics, Design and Applications, Jacob Fraden, Springer, 4th Edition, 2010. ISBN: 978-1-4419-6465-6

Web links and Video Lectures (e-Resources)	
1.	Sensors and Actuators – NPTEL (IISc Bangalore, Prof. Hardik J. Pandya) Lecture 1 – Introduction to Sensors, Transducers & Actuators, incl. Hall, RTDs, Thermistors https://digimat.in/nptel/courses/video/108108147/L01.html
2.	Smart Sensors – NPTEL Lecture 34 – Covers various sensors including gas, pressure, MOS sensors, photodetectors like SNSPD https://www.youtube.com/watch?v=oRydUfgMdgA
3.	Concepts in Magnetism and Superconductivity – NOC (IIT Kharagpur)Series start (Lecture 1): https://digimat.in/nptel/courses/video/115105131/L01.html
4.	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
5.	A Brief Course on Superconductivity – NPTEL IIT Guwahati (Prof. Saurabh Basu)
6.	Solid State Physics – NPTEL (IIT Madras) https://nptel.ac.in/courses/115106127
7.	Lecture 32 – Superconducting Qubits (includes Charge Qubit / Cooper-Pair Box) https://www.youtube.com/watch?v=iYo8ALJ-Mls
8.	NPTEL – Quantum Mechanics I (IIT Madras): https://nptel.ac.in/courses/115106066

Laboratory Experiments (EE stream)
1. Determination of wavelength of LASER using Diffraction Grating.
2. Determination of acceptance angle and numerical aperture of the given Optical Fiber.
3. Determination of Fermi energy of Copper.
4. Determination of Band Gap Energy of the given Semiconductor.
5. Determination of Hall coefficient of a Semiconductor
6. Identification of circuit elements in a Black Box and determination of values of the components
7. Determination of resistivity of a semiconductor by Four Probe Method
8. Determination of dielectric constant of the material of capacitor by Charging and Discharging method.
9. ExpEyes experiment: Study the *I-V* Characteristics of the Given Bipolar Junction Transistor.
10. ExpEyes experiment: Determination of Wavelength of LED
11. ExpEyes experiment: Study the frequency response of Series & Parallel LCR circuits.
12. ExpEyes experiment: Study of *I-V* characteristics of Zener diode.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
Sl.No.	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS**.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I						
Classical Physics for Engineers **Category: Applied Science Course** **Stream: Mechanical (Common to AS, CH, IM & ME Programs)** **(Theory + Practice)**						
Course Code	**:**	PY211IB		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	45 L + 45 EL + 30 P		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**
Oscillations: Simple Harmonic motion (SHM), differential equation for SHM and solution, Spring mass and its applications. Theory of damped oscillation, Types of damping. Engineering applications of damped oscillations, Theory of forced oscillations, resonance and sharpness of resonance. Numerical problems	
Unit – II	**09 Hrs**
Elasticity: Introduction, Relation among Elastic constants, Bending of beams, expression for bending moment of a beam: Single cantilever (with theory), uniform bending, Numerical problems. Torsion of a Shaft: Expression for couple per unit twist of a solid shaft, torsion pendulum: expression for time period and rigidity modulus, Numerical problems.	
Unit –III	**09 Hrs**
Thermoelectric materials: Thermo-emf and thermo-electric current, Seeback effect, Peltier effect, Thermo-couples, thermopile, Construction and Working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), Numerical Problems. **Cryogenics:** Production of low temperature - Joule Thomson effect, Porous plug experiment, Lindey's air liquefier, Liquefaction of Helium. Adiabatic demagnetisation, Applications of Cryogenics, in Aerospace, Tribology and Food processing (qualitative), Numerical Problems.	
Unit –IV	**09 Hrs**
Quantum and Nanoscale Physics of materials: Derivation of 1- dimensional (1D) time-independent Schrodinger equation (TISE) from classical wave equation, physical interpretation of wave function, Quantum confinement effects - particle in a box, energy levels, Quantum tunnelling, Optical properties due to quantum confinement - blue shift, absorption, fluorescence. Numerical Problems. Nanomaterials and its classification, Synthesis - Bottom-up approach - Solgel, hydrothermal. Top-down approach - Ball milling, lithography, laser ablation. Nano scale semiconductors—quantum dots, size-dependent optical and electrical characteristics. Applications in electronics, biomedicine, and solar cell technologies. Numerical Problems.	
Unit –V	**09 Hrs**
Non-Destructive Testing: Introduction, Classification of Testing methods, Visual inspection, liquid penetration inspection, Radiography, Ultrasonic inspection, Thermography , basic principle, procedure to identify the defects. Numerical Problems. **Instrumentation techniques:** Basics of crystal structure, Isotropic and Anisotropic, Bragg's law, construction and working of X-ray Diffractometer, crystallite size determination by Scherrer equation, Principle, construction,	

working and applications of Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM). Numerical Problems.

Course Outcomes	
CO1	Apply the principles of Physics to study the fundamental concepts of oscillations, elasticity, thermoelectric materials, cryogenics, nanomaterials, non-destructive testing & instrumentation techniques to engineering applications.
CO2	Analyse the behaviour of different types of oscillations, elastic deformation, thermoelectric materials, cryogenics, and structural morphology of materials by applying analytical techniques to solve mechanical engineering problems.
CO3	Evaluate the engineering problems associated with mechanical, elastic and thermoelectric materials.
CO4	Design & develop simulating models and validate with real time experimentation.

Reference Books	
1.	Engineering Physics, Gaur and Gupta, 2012, Dhanpat Rai Publications (P) LTD. ISBN-13: 978-8189928223.
2.	Principles of Engineering Physics-2, Md.N.Khan . S.Panigrahi Cambridge University Press 2016 ISBN 978-1-316-63565-0
3.	Elements of Properties of matter, D S Mathur, 2010, S Chand and Company PVT, LTD , ISBN-13:978-8121908153.
4.	A Textbook of Engineering Physics, M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, 2019, S Chand and Company Limited, New Delhi, ISBN: 978-93-528-3399-3, Revised Edition.
5.	A Textbook of Heat and Thermodynamics, J. B Rajam, C. L. Arora

Web links and Video Lectures (e-Resources):	
1	Simple Harmonic Motion (SHM) – NPTEL Lecture: ttps://www.youtube.com/watch?v=gnD8Se92hfk
2	Waves and Oscillations Playlist (SHM, damping, resonance, etc.)– NPTEL https://www.youtube.com/playlist?list=PLyqSpQzTE6M9X7oRXliYM8t0aaR_N0Csd
3	Simple Harmonic motion: https://www.youtube.com/watch?v=k2FvSzWeVxQ
4	Stress- strain curves :https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
5	Stress curves: https://www.youtube.com/watch?v=f08Y39UiC-o
6	Cryogenic Engineering by Prof. M.D. Atrey , Department of Mechanical Engineering, IIT Bombay.: https://www.youtube.com/watch?v=4gGMBNEzeuc
7	Liquefaction of gases: https://www.youtube.com/watch?v=aMelwOsGpIs
8	Non-destructive testing: https://youtu.be/JGQnbwxPiFA

9	Non-destructive testing: https://youtu.be/uzogGRDSmMA
10	Materials Characterisation : https://youtu.be/SXIYzrFGmkU

Laboratory Experiments (ME stream):	
1	Springs in series and parallel.
2	Moment of Inertia of irregular body and rigidity modulus by Torsion pendulum.
3	Young's modulus by Single cantilever.
4	Young's modulus by Uniform bending.
5	Ultrasonic Interferometer.
6	Volume resonator.
7	Exp Eyes experiment: Resonance of LCR circuit
8	Exp Eyes experiment: Wavelength of LED
9	Bandgap of Thermistor
10	Laser diffraction
11	Numerical aperture of Optical Fiber
12	Characteristics of Strain gauge Sensor
13	Measurement of Thermo-emf and measurement of constants a and b

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
Sl No.	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to **20 MARKS.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	**Objective-type questions covering the entire syllabus**	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: II

Quantum Physics for Engineers

Category: Applied Science Course

Stream: Computer Science (Common BT, CI, CD, CS & CY Programs)

(Theory + Practice)

Course Code	**:**	PY221IC		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	45 L + 45 EL + 30 P		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**

Quantum Mechanics: de Broglie Hypothesis and Matter waves, Heisenberg's uncertainty principle and its application in broadening of spectral lines.

Wave Mechanics: Wave function and its properties, Operators, Eigen functions and Eigen values of an operator, Example of a free particle, Expectation value and its significance, Derivation of 1- dimensional (1D) time-independent Schrodinger equation (TISE) from classical wave equation, Solving the 1D TISE for infinite well, Recovery of free particle solution for infinite well width, Solution for 2 and 3-dimensional (3D) well by analogy with 1D, Degeneracy in higher dimensions, Finite well (concept of symmetry) and Quantum Tunnelling, Numerical problems.

Unit – II	**09 Hrs**

Electrical Conductivity of solid materials

Postulates of classical free electron theory (CFET), Concept of phonons, Matthiessen's rule, Quantum free electron theory (QFET), Density of states in three dimension (qualitative), Fermi factor and Fermi energy, Variation of Fermi factor with temperature.

Band Theory of solids (qualitative approach), Electron concentration in metals at 0K, Intrinsic semiconductor – electronic concentration in conduction band and hole concentration in valence band, Fermi level in intrinsic semiconductor, Extrinsic semiconductor – variation of carrier concentration and Fermi energy with temperature and doping, Hall effect for metals and semiconductors, Numerical problems.

Unit –III	**09 Hrs**

Superconductivity

Zero resistance state, Meissner effect, Critical temperature, Critical current – Derivation for a cylindrical wire, Critical field, Formation of Cooper pairs - Mediation of phonons, Two-fluid model, BCS Theory - Phase coherent state, Limitations – examples of systems with low and high electron-phonon coupling, Type-I and type-II superconductors, Vortex state and Vortex Lattice, Explanation for upper critical field, High Temperature super conductors, Cooper pair Transport across junctions through Andreev reflection, Josephson junction, I-V characteristics of Josephson Junction, DC and AC Josephson effect, Flux quantization, DC and AC SQUID, Numerical Problems

Unit –IV	09 Hrs

Photonics

LASER: Interaction of radiation with matter, Characteristics of LASER, Einstein's coefficients, Prerequisites for lasing actions, Types of LASER – Semiconductor diode LASER.

Use of attenuators as single photon sources and its limitations, Optical modulators and its types, Electro-optical modulators (Pockel's effect, Kerr effect). Beam Splitter, Photodetectors – Single Photon Avalanche Diode, Superconducting Nanowire Single Photon Detector, Mach-Zehnder interferometer.

Optical fiber: Derivation of Numerical aperture, V number, No. of modes, losses in optical fiber, Numerical problems.

Unit –V	09 Hrs

Principles of Quantum Computation

Classical versus Quantum Computation, bit, Superposition, Qubit and its properties, Dirac notation, Brief discussion on types of qubits. Neutral atom and ion qubit, Charge Qubit, The LC oscillator and its quantum analogue Quantum Harmonic oscillator, Equi-spaced energy levels, Need for anharmonicity.

Quantum Gates – Pauli Gates, Phase gate (S, T), Hadamard Gate, Two qubit gates – CNOT gate, Concept of Entanglement. Quantum Circuits, Numerical Problems.

Course Outcomes: After completing the course, the student will be able to

CO1	Apply the principles of Quantum Physics in the behavioural study of materials for the design of opto-electronic and superconducting devices.
CO2	Analyse the working mechanisms of quantum devices associated with LASER, Optical detectors, Quantum information and computation for utilization in engineering fields.
CO3	Analyse and solve quantitative problems related to quantum phenomena to strengthen analytical thinking and application skills.
CO4	Design and develop models and validate with real time experimentations.

Reference Books

1	"Introduction to Quantum Mechanics" by D J Griffiths, Pearson Education, Inc. 2nd Edition, ISBN: 0-13-191175-9
2	"Principles of Quantum Mechanics" by R Shankar, Kluwer Academic/Plenum Publishers, 2nd Edition, ISBN: 0-306-44790-8
3	"Introduction to Superconductivity" by A. C. Rose-Innes and E. H. Rhoderick, Pergamon Press Plc. 2nd Edition, ISBN: 0-08-021651-X
4	A Textbook of Engineering Physics, M. N. Avadhanulu and P G Kshirsagar. S. Chand publications, 9th Edition, ISBN : 978-93-528-3399-3.
5	"Introduction to non-linear optics" by Geoffrey New, Cambridge University Press, ISBN: 978-0-521-87701-5
6	"Quantum Computation and Quantum Information" by M. A. Neilsen and I. L. Chuang,

	Cambridge University Press, ISBN: 0-521-63235-8
7	"Modern Quantum Mechanics" by J. J. Sakurai and J. Nepolitano, Cambridge University Press, 3rd Edition, ISBN: 978-1-108-64592-8
8	"Optics" by Ajoy Ghatak, McGraw-Hill Publishers, 1st Edition, ISBN: 978–0–07–338048–3

	Web links and Video Lectures (e-Resources):
1	Quantum Mechanics I (IIT Madras): https://nptel.ac.in/courses/115106066
2	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	Introduction to Photonics – NPTEL (IIT Madras, Prof. Balaji Srinivasan), Lecture 03 to Lecture 12: https://nptel.ac.in/courses/108106135/03
6	Semiconductor Optoelectronics (Prof. M. R. Shenoy): https://nptel.ac.in/courses/108108174/05
7	Quantum Computing Basics: https://www.youtube.com/watch?v=-fttE1SzpD8
8	Quantum Gates and Circuits Part 1: https://www.youtube.com/watch?v=nGPr1QM_XrY

Laboratory Experiments (CS Stream)	
1	Determination of wavelength of LASER using Diffraction Grating.
2	Determination of acceptance angle and numerical aperture of the given Optical Fiber.
3	Determination of Fermi Energy of Copper.
4	Determination of Energy gap of the given Semiconductor.
5	Determination of Hall coefficient of a Semiconductor
6	Identification of circuit elements in a Black Box and determination of values of the components.
7	Determination of resistivity of a semiconductor by Four Probe Method
8	Determination of dielectric constant of the material of capacitor by Charging and Discharging method.
9	ExpEyes experiment: Study the *I-V* Characteristics of the Given Bipolar Junction Transistor.
10	ExpEyes experiment: Determination of Wavelength of LED
11	ExpEyes experiment: Study the frequency response of Series & Parallel LCR circuits.
12	ExpEyes experiment: Study of *I-V* characteristics of Zener diode.
13	Implementation of Pauli's X-Gate (NOT Gate) with the help of IBM Qiskit
14	Implementation of Hadamard (Superposition) Gate with the help of IBM Qiskit
15	Use of polarizers to obtain projection operator

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS**.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	**Objective-type questions covering the entire syllabus**	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I						
Applied Physics for Engineers **Category: Applied Science Course** **Stream: Civil (Only for CV Program)** **(Theory + Practice)**						
Course Code	**:**	PY211ID		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	45 L + 45 EL + 30 P		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**

Oscillations:

Simple Harmonic Motion (SHM), differential equation for SHM (No derivation), Sprig mass system and its applications. Theory of damped oscillations (Derivation), Types of damping (Graphical Approach). Engineering applications of damped oscillations, Forced, Damped Harmonic oscillator, Resonance, sharpness of resonance. Numerical problems.

Unit – II	**09 Hrs**

Elastic properties of materials:

Stress-Strain Curve, Stress hardening and softening. Elastic Moduli, Poisson's ratio and its limiting values.

Relation among elastic constants (qualitative), Bending of beams: neutral surface and neutral axis, expression for bending moment of a beam, Single cantilever (derivation).

Torsion of a cylinder: Expression for couple per unit twist of a solid cylinder, torsion pendulum: expression for time period and rigidity modulus. Numerical problems.

Unit –III	**09 Hrs**

Multifunctional Materials: Different types of smart materials, their properties and applications.

Piezo-Electric materials-Quartz, Shape memory alloys: Principle of phase transformation in shape memory alloys, its properties, applications.

Sensor systems and overview of sensor technologies, Classification of sensors, Sensor's characteristics.

Temperature sensors: Vibration sensor, Optical fiber sensor for structural health monitoring, Strain gauge sensor RTD, Thermistor, Thermocouple. Numerical problems. .

Unit –IV	**09 Hrs**

Acoustics for civil structures: Basics of acoustics, Sound wave generation and its propagation, sound interference and Doppler effect; Principles of sound absorbers, Noise generation and its impact, reverberation, Sabine's formula and its significance, Applications of acoustic materials in civil engineering: Sound insulation standards, Highway noise barriers, noise attenuations in buildings, Sound insulation materials for civil structures: Acoustic wood panels and wood composites, Numerical problems.

Unit –V	09 Hrs
Non-Destructive Testing: Introduction, Classification of Testing methods, liquid penetration inspection, Radiography, Ultrasonic inspection, (quantitative), Pulse echo method, Thermography (quantitative), basic principle, procedure to identify the defects. Numerical Problems. Instrumentation techniques: Basics of crystal structure, Isotropic and Anisotropic, Bragg's law, construction and working of X-ray Diffractometer, (Powder Diffraction spectrum) crystallite size determination by Scherrer equation, Principle, construction and working of Differential Scanning Calorimetry, Thermo-Gravimetric Analysis, Scanning Electron Microscopy (SEM).	

Course Outcomes:	
CO1	Apply the principles of physics to comprehend the concepts of oscillations, elasticity, acoustics, and material behaviour relevant to civil engineering systems.
CO2	Analyse and interpret the mechanical and dynamic responses of materials and structures using experimental methods and sensor-based measurement techniques.
CO3	Evaluate material properties and structural integrity through advanced characterization techniques and non-destructive testing (NDT) methods.
CO4	Design and develop sustainable, efficient, and intelligent civil engineering structures using smart materials, sensor technologies, and acoustic control strategies.

Reference Books:	
1.	A Textbook of Engineering Physics, M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, 2019, S Chand and Company Limited, New Delhi, ISBN: 978-93-528-3399-3, Revised Edition
2.	Jacob Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications, 5th Edition 2016, PHI Publication, ISBN: 978-1-4419-6465-6.
3.	Elements of Properties of matter, D S Mathur, 2010, S Chand and Company PVT, LTD, ISBN-13:978-8121908153.
4.	Engineering Physics, Gaur and Gupta, 2012, Dhanpat Rai Publications (P) LTD. ISBN-13: 978-8189928223.
5.	Physics for Degree students, C L Arora and P S Hemne, 2016, S Chand and Company PVT. LTD, ISBN: 978-81-219-4059-7.
6.	Non-Destructive Testing Techniques by Ravi Prakash ISBN 13: 978 8122425888 New Age International

Web links and Video Lectures (e-Resources):	
1	Simple Harmonic Motion (SHM) – NPTEL Lecture: ttps://www.youtube.com/watch?v=gnD8Se92hfk
2	Waves and Oscillations Playlist (SHM, damping, resonance, etc.)– NPTEL https://www.youtube.com/playlist?list=PLyqSpQzTE6M9X7oRXliYM8t0aaR_N0Csd
3	Simple Harmonic motion: https://www.youtube.com/watch?v=k2FvSzWeVxQ

4	Stress- strain curves :https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
5	Stress curves: https://www.youtube.com/watch?v=f08Y39UiC-o
6	Acoustics: https://www.youtube.com/watch?v=fHBPvMDFyO8
7	INTRO – Fundamentals of Acoustics" (Lecture 1, NPTEL-NOC, IIT Madras) https://www.youtube.com/watch?pp=0gcJCfwAo7VqN5tD&v=rT9B44Q4Rko
8	Fundamentals of Acoustics playlist (multiple lectures on acoustic wave behavior, sound propagation, etc.) ttps://www.youtube.com/playlist?list=PLgMDNELGJ1CYWnDbcbVET5zCbN4 aLEbZQ
9	Structural Health Monitoring of Composites (IIT Kanpur) – Full NPTEL Course: https://nptel.ac.in/courses/112104160
10	Course Introduction – Structural Health Monitoring (IITM – NPTEL): https://www.youtube.com/watch?v=It4aogUfQis
11	Smart Structures (IIT Kharagpur) – Covers smart materials, actuators, SHM: https://onlinecourses.nptel.ac.in/noc23_ae19/preview

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS.	20
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3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS.	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. THE FINAL MARKS WILL BE 50 MARKS	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q No.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I						
Physics of Electrical and Electronic Materials **Category: Applied Science Course** **Stream: Electrical and Electronics Engineering** **(Theory and Practice)**						
Course Code	**:**	PY211IE		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	45 L + 45 EL + 30 P		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**

Dielectric and Magnetic Materials:

Dielectrics:

Introduction, Electrical Polarization Mechanisms, Internal fields in solids (qualitative), Clausius-Mossotti relation (Derivation) and its implications, Properties and Frequency dependence of Dielectric constant, Dielectric loss, Solid, Liquid and Gaseous dielectrics. Application of dielectrics in Capacitors, Transformers (Oils), SF6 in High Voltage application, Numerical Problems.

Magnetic material:

Classification of magnetic materials, Weiss Molecular field theory of ferromagnetism(Qualitative), Importance of Curie Temperature, Ferromagnetic Hysteresis and Explanation using Domain theory, Energy loss, Hard and soft ferromagnetic materials and Applications, Transformer Cores, Armature, Inductors and chokes, Permanent Magnets, Numerical Problems.

Unit – II	**09 Hrs**

Quantum Mechanics:

de Broglie Hypothesis and Matter Waves, Heisenberg's Uncertainty Principle and its application.

Wave Mechanics: Wave function,Operators, Eigen function and Eigen values of a free particle, Expectation value and its significance, Derivation of 1- dimensional (1D) time-independent Schrodinger equation (TISE) from classical wave equation, 1D TISE for infinite well, Mapping to free particle, Solution for 3-dimensional (3D) well, Concept of degeneracy, Displaced well, Quantum Tunneling and Finite well, Numerical problems.

Unit –III	**09 Hrs**

Electrical Properties of Metals and Semiconductors:

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

Unit –IV	**09 Hrs**

Superconductivity

Zero resistance state, Persistent current, Meissner effect, Critical temperature, Critical current (Silsbee Effect) – Derivation for a cylindrical wire using ampere's law, Critical field, Formation of Cooper pairs - Mediation of phonons, Two-fluid model, BCS Theory - Phase coherent state, Limitations of BCS theory, Type-I and Type-II superconductors, High Tc superconductors, Formation of Vortices, Explanation for upper critical field, Josephson

junction, Flux quantization, DC Squid,, Superconducting Magenet, MAGLEV, Numerical Problems.	
Unit –V	**09 Hrs**
Thermoelectric materials and devices: 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 T1 and T2, Thermo couples, thermopile, Construction and Working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), low, mid and high temperature thermoelectric materials, Applications: Exhaust of Automobiles, Refrigerator, Space Program (RadioisotopeThermoelectricGenerator), Numerical Problems	

Course Outcomes	
CO1	Apply the principles of quantum mechanics and material science to comprehend the behaviour and properties of materials for dielectric, magnetic, superconducting and thermoelectric applications.
CO2	Analyze the working mechanisms of engineering devices associated withelectrical, dielectric, thermoelectric and superconducting systems.
CO3	Evaluate engineering problems related to the performance of electrical, dielectric,thermoelectricand superconducting devices.
CO4	Design and propose experiments and sustainable solutions for challenges in real-time applications.

Reference Books	
1.	Engineering Physics, R. K. Gaur and S.L. Gupta. Dhanpat Rai Publications, 8th Edition, 2011. ISBN: 978-81-89928-22-3
2.	A Textbook of Engineering Physics, M. N. Avadhanulu and P G Kshirsagar. S. Chand publications, 2019, ISBN : 978-93-528-3399-3.
3.	Solid state electronic devices, Ben G Streetman and Sanjay Kumar Banerjee, PHI learning, 6th edition, 2009, ISBN: 978-81-203-30207.
4.	Physics for Degree students, C.L. Arora and Dr. P. S. Hemne,S Chand, revised 2010, ISBN: 978-81-219-33506.
5.	Introduction to Quantum Mechanics, D J Griffiths, Pearson Education, Inc. 2ndEdition, ISBN: 0-13-191175-9
6.	Introduction to Superconductivity, A. C. Rose-Innes and E. H. Rhoderick, Pergamon Press Plc. 2ndEdition, ISBN: 0-08-021651-X
7.	Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBS Publishers and Distributers Pvt. Ltd., 2018
8.	Solid State Physics, S O Pillai, New Age International Publishers, 10th edition, 2023, ISBN: 978-93-6074-814-2
9.	Heat, Thermodynamics & Statistical Physics, Singhal, Agarwal and Satya Prakash, Pragati Prakashan,2011, ISBN-13 : 978-9350063668.
10.	Heat and Thermodynamics, Mathur D S, S Chand & Company Ltd, 2004,ISBN : 81-8054-259-9

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 – Quantum Mechanics I (IIT Madras): https://nptel.ac.in/courses/115106066
5.	Mod-01 Lec-27: Superconductivity – Perfect Conductivity & Diamagnetism – Prof. G. Rangarajan, IIT Madras https://www.youtube.com/watch?v=GglT1RoBPzg
6.	Lecture 32 – Superconducting Qubits (includes Charge Qubit / Cooper-Pair Box) https://www.youtube.com/watch?v=iYo8ALJ-Mls
7.	NPTEL course: Solid State Physics – Prof. A.K. Raychaudhuri, IIT Kharagpur Course link: https://archive.nptel.ac.in/courses/115/105/115105099
8.	Electrical Measurement course Prof Avishek Chatterjee IIT Kharagpur : https://www.youtube.com/playlist?list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio

Laboratory Experiments (EE stream)	
1.	Determination of wavelength of LASER using Diffraction Grating.
2.	Determination of acceptance angle and numerical aperture of the given Optical Fiber.
3.	Determination of Fermi energy of copper.
4.	Determination of Band Gap Energy of the given Semiconductor.
5.	Determination of Hall coefficient of a Semiconductor
6.	Identification of circuit elements in a Black Box and determination of values of the components
7.	Determination of resistivity of a semiconductor by Four Probe Method
8.	Determination of dielectric constant of the material of capacitor by Charging and Discharging method.
9.	ExpEyes experiment: Study the I-V Characteristics of the Given Bipolar Junction Transistor.
10.	ExpEyes experiment: Determination of Wavelength of LED
11.	ExpEyes experiment: Study the frequency response of Series & Parallel LCR circuits.
12.	ExpEyes experiment: Study of I-V characteristicsof Zener diode.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
Sl.No.	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS**.**	20
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3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I/II						
CHEMISTRY OF SMART MATERIALS AND DEVICES **Category: Applied Science Course** **Stream: Computer Science (Common to BT, CD, CI, CS & CY Programs)** **(Theory and Practice)**						
Course Code	**:**	CM211IA		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	45L + 45 EL + 30 P		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**
Sustainability in biomaterials and e-waste management: Bio materials: Introduction, bio-degradable and bio-compatible polymers, synthesis and applications. E-waste: Introduction, hazards and toxicity, segregation and recycling (hydrometallurgy, and pyrometallurgy). Extraction of valuable metals from e-waste. Battery waste management and recycling (recycling of lithium from spent LIBs). Microplastics and recycling of e-waste. Life cycle assessment: Case studies.	
Unit – II	**09 Hrs**
Advanced materials for data storage and display devices: Introduction to types of materials, materials for electronic memory. Types of memory devices: capacitor, transistor and memristors. Classification materials used in memory devices: organic, polymeric and hybrid materials. Green computing. Materials for display technology (liquid crystals, light emitting diodes, organic light emitting diodes and photo electrochemical cells).	
Unit –III	**09 Hrs**
Materials for advanced energy conversion and storage: Battery technology: Lithium-ion battery (NMC and LFP) and Lithium-air batteries. Battery technology for e-mobility: Battery management system. Supercapacitors: Storage principle, types (EDLC, pseudo and hybrid supercapacitors) with examples. Super batteries. Photovoltaics: Inorganic solar cells, quantum dot sensitized (QDSSC's). Hydrogen as a green fuel: Electrochemical and photocatalytic water splitting.	
Unit –IV	**09 Hrs**
Quantum materials and smart sensing: Quantum materials: Synthesis, properties and applications of graphene oxide, carbon nanotubes (CNTs). Super conducting materials: Introduction, Meissner effect, properties and applications of Yttrium Barium Copper Oxide (YBCO). Conducting polymers for sensing: synthesis, properties and applications of polyaniline. Introduction to sensors, piezoelectric and electrochemical sensors (strain sensors, biomolecule sensor and volatile organic compounds.). Introduction to analytical techniques-colorimetry, potentiometry, conductometry, Flame photometry.	
Unit –V	**09 Hrs**
Computational chemistry: Introduction to molecular modelling: Scope, cost and efficiency of computational modelling, molecular interactions. Molecular topology, topological matrix representation (vertex adjacency, edge adjacency and distance), topological indices (Zagreb, Wiener, Platt number). Prediction of molecular properties through QSPC/QSAR.	

CO	Course Outcomes
CO1	Apply the fundamental principles of sustainable materials chemistry and green technologies for addressing environmental and technological challenges (PO1, PO11)
CO2	Integrate materials selection, design, and modelling strategies for the development of smart, functional, and energy-efficient systems. (PO1, PO6)
CO3	Critically evaluate the role of advanced materials and computational approaches in emerging

	technologies across electronics, sensing, and energy domains (PO1, PO6, PO7, PO8, PO10, PO11)
CO4	Propose innovative and sustainable solutions for real-world problems using a multidisciplinary understanding of materials, devices, and waste management systems. (PO1, PO6)

#	**Laboratory Experiments**
1	Fundamental laboratory practices and the foundations of experimental chemistry.
2	Quantitative determination of acid electrolytes using conductometry.
3	Estimation of amount of alkali metals in electronic waste using flame photometry
4	Potentiometric determination of iron using electrochemical sensing technique.
5	Determination of copper content in e-waste leachate by colorimetry.
6	Electrochemical sensing of ascorbic acid using ion selective electrodes.
7	Determination of viscosity coefficient of electrolyte solvents using ostwald's viscometer.
8	Electrochemical deposition of copper for the fabrication of current collectors via electroplating technique.
9	Monitoring the oxidative polymerization of aniline to polyaniline using conductivity and colorimetric measurements.
10	Synthesis of metal oxide nano materials by solution combustion technique and determination of Bandgap of the same using UV-Vis spectroscopy.
11	Fabrication of thin-film gas sensors using spin coating and electro-spinning technique.
12	Determination of the ionic conductivity of electrolytes for supercapacitors.
13	Determination of dye concentration in organic semiconductor solutions.
14	Photocatalytic degradation of organic dye using nanomaterials under UV Light.

Reference Books	
1.	E-waste recycling and management T. S. Jayanthi. 2024, Lambert Academic Publishing. ISBN: 978-6207476862.
2.	Essentials of computational chemistry: theories and models, Christopher J Cramer, reprint in 2023, John Wiley & Sons. ISBN: 978-0-470-09182-1.
3.	Energy storage and conversion devices: Supercapacitors, batteries and hydroelectric cells, Anurag Gaur A. L. Sharma, Anil Arya. 2021, CRC press, 1st edition, ISBN: 978-1-003-14176-1.
4.	Fundamentals of analytical chemistry: An introduction, Douglas A. Skooget etal., Reprint in 2023 Thomson Asia pte Ltd., 8th, ISBN: 978-0-495-55828-6
5	Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press, ISBN: 978-036-727-510-5.
Online links	
1	https://www.vlab.co.in/broad-area-chemical-sciences (VLAB)
2	Lecture 19 - Introduction to Battery Parameters - Part 1 (NPTEL: battery parameters)
3	Electrochemical Energy Storage - Course (Electrochemical Energy Storage)

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
#	**COMPONENTS**	**MARKS**
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	FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.	
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I/II						
CHEMISTRY OF FUNCTIONAL MATERIALS **Category: Applied Science Course** **Stream: Electronics (Common to EC, EE & ET)** **(Theory + Practice)**						
Course Code	**:**	CM221IB		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	45L + 45 EL + 30 P		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**
Materials for electronic and quantum technologies Si Semiconductors: Types-intrinsic and extrinsic, inorganic semiconductors: InP, GaAs-properties, applications. Organic semiconductors: Pentacene, tetracyanoquinodimethane (TCNQ)-synthesis, properties, applications. Quantum dots & low-dimensional materials: Quantum dots-0D - quantum dots of carbon, CdSe, 1D – carbon nanotubes, 2D – Graphene, preparation, properties & applications.	
Unit – II	**09 Hrs**
Semiconductor materials and Thin-film techniques Silicon extraction & purification: SiO_2 to metallurgical-grade Si (carbothermic reduction), electronic-grade Si-zone refining (Float Zone), Czochralski method. Silicon wafer processing: Wafer slicing, Si oxidation (dry/wet), dopant diffusion ion implantation and testing & packaging. Thin film fabrication techniques: Plasma enhanced chemical vapor deposition (PECVD) for SiN_x-Si and metal-organic CVD for GaAs/GaN thin films. Thin film deposition techniques: Sol-gel chemistry for TiO_2 thin films	
Unit –III	**09 Hrs**
Energy storage and conversion devices Battery technology: Li-ion batteries ($LiCoO_2$ and $LiFePO_4$), Sodium ion battery, construction, materials, mechanism & applications. Supercapacitors: Electrical double layer capacitors (EDLC), Pseudo-supercapacitors, and hybrid supercapacitors-construction, materials, mechanism & applications. Fuel cells: Construction, mechanism & applications-direct methanol fuel cells, Solid oxide fuel cells (SOFC). Solar cells: Amorphous Si and quantum dot-sensitized solar cells -materials, fabrication, mechanism, applications.	
Unit –IV	**09 Hrs**
Smart and sustainable materials for flexible electronics Smart materials: Chromic Materials (Thermo-, photo-, electrochromic), and electromechanical materials (Magnetostrictive, electrostrictive): Phenomena, mechanisms, and applications. Functional materials for Flexible electronics - Phase change materials (PCMs), shape memory polymers (SMPs). Conducting polymers (Polyaniline and its composites) preparation, properties, applications in stretchable & printable circuits.	
Unit –V	**09 Hrs**
Sensors, and analytical techniques Sensors: Introduction, types (electrochemical, optoelectronic), chemistry of sensing mechanisms, Electrochemical: Glucose, vitamin C, gas sensor, optoelectronic: Pulse oximetry. Instrumentation & Analytical chemistry: Flame photometry, potentiometry, conductometry, colorimetry, UV-Vis spectrophotometry-Principle, Instrumentation, working, estimation procedure, applications	

CO	Course Outcomes
CO1	Apply material properties to understand the synthesis and use of semiconductors, nanomaterials, energy devices, smart materials, and sensors.
CO2	Analyze and interpret structural, chemical, electrochemical, and optical data for characterizing materials used in electronic, energy, and sensing devices.
CO3	Propose chemical and physical methods for the development of semiconductors, thin films, energy materials, smart polymers, and sensing components.

CO4	Critically evaluate and correlate experimental results with theory to optimize the synthesis and performance of advanced electronic, energy, smart, and sensing materials.

#	**Laboratory Experiments**
1	Essential Laboratory Techniques and Foundations of Experimental Chemistry
2	Conductometric estimation of electrolyte (KOH) concentration for energy devices (supercapacitor)
3	Colorimetric determination of copper in the given Lithium ion battery anode and e –waste.
4	Electrochemical estimation iron using potentiometric sensor.
5	Determination of ascorbic acid using pH-based electrochemical sensor.
6	Determination of pKa of Weak Acid (e.g., Acetic Acid)
7	Comparative study of viscosity of electrolyte solvents used in energy devices using ostwald viscometer.
8	Determination of Sodium Ion Concentration in Na Battery Electrolyte Samples Using Flame Photometry
9	Electrochemical deposition of copper using electroless or electroplating technique.
10	Fabrication and Testing of WO_3 based thin Film for smart devices.
11	Demonstration of Electrochromic Behavior of Prussian Blue Thin Film via Voltage-Induced Color Change
12	Monitoring the oxidative polymerization of aniline to polyaniline using conductivity and colorimetric measurements.
13	Recording and analysing the UV Vis spectra of CNT and Graphene derivatives.
14	Investigation of Optical Properties of CNTs and Graphene Derivatives via UV-Vis Spectroscopy
15	Synthesis of inorganic quantum dots and determination of Bandgap using UV-Vis spectroscopy.
16	UV-Visible Spectroscopic Analysis of Pentacene for Organic Semiconductor Applications

Reference books	
1	Loutfy H. Madkour, Nanoelectronic Materials: Fundamentals and Applications, Springer, 2019, Volume: 116, ISBN 3030216217, 9783030216214
2	Sankapal, Babasaheb R., et al. “Simple Chemical Methods for Thin Film Deposition.” In: Sankapal, B.R., Gupta, R.B., Ennaoui, A., Lokhande, C.D. (Eds.), *Simple Chemical Methods for Thin Film Deposition*, Springer, 2023. ISBN 978-981-99-0963-6.
3	Morosanu, Constantin E. *Thin Films by Chemical Vapour Deposition*. Vol. 7, Elsevier, 2016.
4	Kulkarni, Madhusudan B., and N. H. Ayachit. “Energy Conversion and Storage Devices.” In: *Green Nanomaterials in Energy Conversion and Storage Applications*, Apple Academic Press, 2024, pp. 75–93. ISBN 978-1-77491-388-8.
5	Wong, William S., and Alberto Salleo (eds.). *Flexible Electronics: Materials and Applications*. Vol. 11, Springer, 2009. ISBN 978-1-4419-4494-8.
Online links	
1	https://www.vlab.co.in/broad-area-chemical-sciences (VLAB)
2	Lecture 19 - Introduction to Battery Parameters - Part 1 (NPTEL: battery parameters)
3	Electrochemical Energy Storage - Course (Electrochemical Energy Storage)

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS**.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case studybased teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I/II						
CHEMISTRY OF ENGINEERING MATERIALS **Category: Applied Science Course** **Stream: Mechanical (Common to AS, CH, IM & ME Programs)** **(Theory + Practice)**						
Course Code	**:**	CM221IC		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	45L + 45 EL + 30 P		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**
Energy storage and conversion devices: Battery: Introduction, classification of batteries. Construction and working of Li-CoO_2 battery, metal hydride battery (Ni-MH battery). Super capacitors: (EDLC, Pseudo, Hybrid) –Working, principle, fabrication and applications. Super battery. Fuel cells: methanol - oxygen fuel cell, solid oxide fuel cell and their applications. Renewable energy: Solar cell – principle, construction and working of amorphous Si and quantum dot sensitized solar cells. Battery management system in EV and hybrid electric vehicles.	
Unit – II	**09 Hrs**
Corrosion Science and Control: Corrosion: Electrochemical theory of corrosion. Types: differential aeration (pitting and water line), differential metal, stress corrosion, caustic embrittlement and crevice corrosion. Factor affecting rate of corrosion. Case studies on corrosion failure. Corrosion control:surface conversion coating - anodizing and phosphating. Corrosion testing by weight loss method. Corrosion penetration rate (CPR)-numerical problems, Metal finishing: Electroplating and electroless plating.	
Unit –III	**09 Hrs**
Fuels: Fuel characteristics, calorific value of fuels- GCV & NCV, numericals, Flash point & fire point. Fuel rating and quality: Knocking in internal combustion engines, reasons for knocking, octane and cetane number, antiknocking agents. Bio-Fuels: Biodiesel- synthesis by trans esterification, advantages and disadvantages. Power alcohol– preparation, advantages and disadvantages. Green fuel-hydrogen production and storage. Rockets Fuels: Properties, characteristics and types.	
Unit –IV	**09 Hrs**
Chemistry of nanomaterials and analytical techniques Introduction, properties (surface area, electrical, optical, and catalytic properties), Synthesis: Solution combustion and sol-gel methods. Carbon Nanotubes & graphene: Synthesis, properties and applications. Nano lubricants: Types of nanoparticles as lubricant additives and their application. Analytical techniques: Colorimetry, flame photometry, conductometry, potentiometry, pH-sensor (glass electrode), Determination of viscosity.	
Unit –V	**09 Hrs**
Polymers: Glass transition temperature (Tg)- Significance and factors affecting Tg. Thermosets-Epoxy. Thermoplastics- polycarbonate and polyether sulfones, ABS- preparation and specific applications in industries. Biodegradable polymer: Introduction, synthesis, properties and application of poly lactic acid (PLA). Polymer composites and nanocomposites. Matrix types & reinforcements- Glass, carbon and natural fibre - synthesis, properties and applications. Testing: ASTM standards of material testing-tensile strength, flexural strength, ILSS and impact strength.	

CO#	Course Outcomes
CO1	Apply principles of chemistry for material synthesis and characterization techniques to enhance performance in engineering applications.
CO2	Evaluate the performance and sustainability of polymer composites and biodegradable materials for industrial applications and real-world challenges.
CO3	Analyze fuel properties and material characteristics to understand their roles in sustainable and green technologies.
CO4	Critically examine energy storage, conversion, and corrosion systems, and propose innovative and

	efficient solutions for their improvement

#	Laboratory Component
1	Fundamental laboratory practices and the foundations of experimental chemistry
2	Quantitative estimation of Fe^{2+} in iron ore samples using standard $K_2Cr_2O_7$ solution
3	Experimental determination of pKa for weak acids used in metal etching and cleaning processes
4	Analysis of iron content in rust using potentiometric techniques for corrosion assessment
5	Experimental estimation of copper content using colorimetry
6	Quantitative determination of acid electrolytes using conductometry.
7	Determination of viscosity coefficient of a given liquid using ostwald's viscometer.
8	Flame photometric estimation of sodium in the given saline solution.
9	Estimation of Fe in rust by colorimetry
10	Anodizing of aluminium and measurement of its thickness
11	Preparation of polymer composites by hand layup technique
12	Synthesis of metal oxide nanomaterials using solution combustion synthesis
13	Dye degradation study using UV-Visible spectroscopy.
14	Determination of dye concentration in organic semiconductor solutions
15	Estimation of sodium and potassium in electronic waste leachate
15	Measurement of ionic conductivity of electrolytes for supercapacitors

Reference Books	
1	Battery Technology: From fundamentals to thermal behavior and management, Marc A. Rosen & Aida Farsi- 1st Edition, 2023, Academic Press**,** ISBN**:** 9780443188626.
2	Energy storage and conversion devices, Anurag Gaur, A. L. Sharma, Anil Arya, 1st Edition, 2021, CRC Press, Taylor and Francis Group, ISBN: 9781003141761.
3	Textbook of Polymer Science and Technology, Vibha Chaturvedi, 2025 Edition, AITBS Publishers, India, ISBN:9789374734605.
4	Engineering Chemistry P. C. Jain & Trishla Jain, 2025**,**17th Edition, Dhanpat Rai & Co. (P) Ltd, New Delhi. ISBN-13: 978-9352165728, ISBN-10: 935216572.
5	Chemistry Lab Manual for Engineers, Dr. Hari Krishna S, Dr. Suvodip Mukherjee & Suneetha Rani N; Book Rivers, April 2023; ISBN: 978-93-5515-894-9.
Online links	
1	https://www.vlab.co.in/broad-area-chemical-sciences (VLAB)
2	https://onlinecourses.nptel.ac.in/noc24_me34/preview (NPTEL: Fuels)
3	https://onlinecourses.nptel.ac.in/noc20_cy21/preview (NPTEL: Polymers)
4	Lecture 19 - Introduction to battery parameters - Part 1- (NPTEL: battery parameters) https://www.youtube.com/watch?v=iihYXx79QiE
5	Electrochemical energy storage systems https://www.youtube.com/watch?v=xuoqIY_9lsM

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS**.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test).	40

	Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I/II						
Engineering and Environmental Chemistry **Category: Applied Science Course** **Stream: Civil Engineering** **(Theory + Practice)**						
Course Code	**:**	CM221ID		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	45L + 45 EL + 30 P		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**
Chemistry of nanomaterials and analytical techniques Properties (surface area, electrical, optical, and catalytic properties), synthesis of nanomaterials: sol-gel, solution combustion and Hydrothermal methods. Civil engineering applications of carbon nanotubes and nano materials. Analytical techniques: Optical Methods-Colorimetry, flame photometry, Electrical methods: conductometry, potentiometry, pH-sensor (glass electrode), Determination of viscosity.	
Unit – II	**09 Hrs**
Chemistry of construction materials Cement: Chemical composition of cement, manufacturing process of portland cement, process of setting and hardening, types (Mortar, concrete, RCC and CSH Gel) and their applications. Piezoelectric cement composites, Polymer concrete. Geopolymer Concrete: Introduction, Advantages over Ordinary Portland Cement (OPC) Concrete. Ceramic materials: Properties, types, and applications. Refractory materials: Properties, types, and applications	
Unit –III	**09 Hrs**
Green and water chemistry Introduction, principles of green chemistry, case studies, examples of green synthesis. Water Chemistry: Water quality parameters as per BIS, Emerging pollutants, determination of fluoride, DO, BOD and COD, numericals, desalination of water by electrodialysis method. Sewage treatment process (primary, secondary and tertiary)	
Unit –IV	**09 Hrs**
Concepts in Corrosion Science and Control Corrosion: Electrochemical theory, types: differential aeration (waterline and pitting), differential metal and stress corrosion (caustic embrittlement), crevice corrosion. Factors affecting rate of corrosion. Corrosion control: Surface conversion coating - anodizing and phosphating, cathodic protection. Corrosion testing by weight loss method, corrosion penetration rate (CPR), numerical problems. Metal finishing: Electroplating of chromium and electroless plating of copper.	
Unit –V	**09 Hrs**
Polymers and polymer composites Smart polymers: Thermo chromic, electrochromic, and self-healing polymers. Synthesis, properties, and applications of PMMA, PVC, polystyrene. Polymer composites: Carbon fiber composites, CNT, and graphene-based composites. Adhesives: Synthesis and application of epoxy resins. Polymer coatings, Polymer binders. Biodegradable polymers: Polylactic acid and its application.	

CO	Course Outcomes
CO1	Apply the principles of chemistry in synthesis and selection of materials associated with green chemistry, civil engineering, and corrosion science.
CO2	Evaluate the properties materials for their application in environmental monitoring and civil engineering applications.
CO3	Integrate material quality assessment with environmental monitoring and civil engineering practices to support the development of resilient and eco-efficient infrastructure systems
CO4	Propose and interpret solutions for the challenges connected to engineering applications.

#	Laboratory Component
1.	Fundamental laboratory practices and the foundations of experimental chemistry.
2.	Estimation of Chemical oxygen demand in waste water.
3.	Estimation of CaO in cement solution.
4.	Determination of pKa of a weak acid using pH meter.
5.	Analysis of iron content in rust using potentiometric techniques for corrosion assessment
6.	Experimental estimation of copper content using colorimetry
7.	Conductometric estimation of acid
8.	Determination of viscosity coefficient of a given liquid using Ostwald's viscometer
9.	Flame photometric estimation of sodium
10.	Estimation of Fe in rust by colorimetry
11.	Photocatalytic degradation of pollutants.
12.	Synthesis of $CoFe_2O_4$ by solution combustion method
13.	Determination of relative and kinematic viscosities of given lubricating oil at different temperatures using Redwood viscometer
14.	To find of Tg of polymer using DSC
15.	Study of surface morphology of materials using SEM.

Reference Books	
1.	Engineering Chemistry P. C. Jain & Trishla Jain, 2025**,**17th Edition, Dhanpat Rai & Co. (P) Ltd, New Delhi. ISBN-13: 978-9352165728, ISBN-10: 935216572.
2.	Engineering chemistry, Shubha Ramesh et.al., Wiley India, 1st Edition, 2013, ISBN: 9788126519880.
3.	Advances in corrosion science and technology, M.G. Fontana, R.W. Staettle, Springer publications, 2013, ISBN: 9781461590620.
4.	Fundamentals of analytical chemistry, Douglas A. Skoog et.al., 10th edition, 2022, Thomson Asia pte Ltd. ISBN: 9812435131.
5	Polymer Science: V. R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, 4th edition, 2021, New Age International, ISBN: 978-8122418607.
Online books	
1	https://www.vlab.co.in/broad-area-chemical-sciences (VLAB)
2	https://onlinecourses.nptel.ac.in/noc21_ce10/preview (Construction materials)
3	https://onlinecourses.nptel.ac.in/noc22_mm17/preview (Corrosion science)
4	https://nptel.ac.in/courses/104103020 (Green chemistry and water chemistry)
5	https://onlinecourses.nptel.ac.in/noc21_mm38/preview (Nano materials)

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS**.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Professional Core Courses

- **BASIC ELECTRONICS (EC112TA)**
- **ELEMENTS OF ELECTRICAL ENGINEERING (EE112TA)**
- **ELEMENTS OF MECHANICAL ENGINEERING (ME112TA)**
- **PRINCIPLES OF PROGRAMMING USING C (CS221IA)**
- **ENGINEERING MECHANICS (CV112TA)**

Semester: I						
Basic Electronics **Category: Professional Core Course** **Stream: Electronics (Common to EC, ET Programs)** **(Theory)**						
Course Code	**:**	EC112TA		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	30L +30T + 30EL		**SEE Duration**	**:**	**3 Hours**

Unit-I	**06 Hrs**
DIGITAL ELECTRONICS FUNDAMENTALS Difference between Analog and digital signals, Boolean Algebra and Simplification of Switching functions using Boolean theorems/postulates and K-maps (up to 4 variables). **DIGITAL ELECTRONICS CIRCUITS** Basic Gates and Universal Gates, Half adder, Full adder, Multiplexer, Encoder, Decoder	
Unit – II	**06 Hrs**
DIODES & BJT: Semiconductor Diodes - overview, LED, Photodiode, Bipolar Junction Transistors-Transistor Construction, Operation and characteristics, Load-Line Analysis, Operating (Q) Point, Voltage Divider Bias Configurations, Bias Stabilization, Transistor as a Switch, Types, Single-Stage BJT Amplifier Configurations: Common Base, Common Emitter, and Common Collector; the Emitter followe. Numerical Examples.	
Unit –III	**06 Hrs**
SINGLE STAGE AMPLIFIERS: Amplification in the AC Domain, the re-Model for CE Configuration, RC Coupled Amplifier, Gain, Input Resistance and Frequency Response, Cascaded Systems, Numerical Examples. Feedback in amplifiers and advantages of negative feedback. **MOSFET:** Differences between BJT & FET, Enhancement Type N-MOSFET Operation. Output Characteristics, Regions of Operation, Current Equation and Transfer Characteristics, Small Signal Equivalent, Calculation of Trans-Conductance and Voltage Gain, r_{ds}, The Source follower, Numerical Examples, Operation of CMOS Inverter, CMOS NAND and CMOS NOR, Numerical Examples.	
Unit –IV	**06 Hrs**
OPERATIONAL AMPLIFIERS AND APPLICATIONS Block Diagram of Op-Amp, Characteristics of an Ideal Op-Amp: Gain, Bandwidth, Input & Output Impedances, CMRR, PSRR, Slew Rate, Input Offset Voltage. Pin configuration and Typical Parameters of Op-Amp μA-741. Differential Amplifier, Op-Amp Applications: Inverting Amplifier, Non-Inverting, Amplifier, Voltage Follower, Summer, Difference Amplifier, Integrator, Differentiator, Comparator, Schmitt Trigger, Numerical Examples.	
Unit –V	**06 Hrs**
INTRODUCTION TO COMMUNICATION & EMBEDDED SYSTEMS: Block diagram of a general communication system, Need for modulation, types of modulation: AM, FM, PM. AM detector and Envelope detector, Problems, Difference between AM and FM, Numerical Examples. Concepts of Digital Communication and Block diagram, Super heterodyne receiver. **Introduction to Embedded Systems**: Block diagram, Characteristics & Metrics, CPU Architectures-MPUs and MCUs, Interfacing basics.	

Course Outcomes	
CO1	Describe the fundamental concepts of electronic systems including digital logic, semiconductor devices, amplifiers, operational amplifiers, and communication systems.
CO2	Apply the principles of digital electronics, Analog devices, and communication techniques to solve basic engineering problems across different domains of electronics.

CO3	Analyse the functionality and behaviour of digital circuits, amplifier stages, op-amp configurations, and modulation schemes in communication systems.
CO4	Evaluate electronic circuits and systems based on performance parameters such as gain, power efficiency, and modulation effectiveness using appropriate tools and techniques.

Reference Books	
1.	Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, M. Morris Mano and Michael D. Ciletti, 6E, 2018, Pearson Education India, ISBN: 978-93-530-6201-9
2.	Electronic Devices and Circuit Theory, Robert L Boylestad, Louis Nashelsky, 11E, 2015, Pearson Education India, ISBN: 978-93-325-4260-0.
3.	Basic Electronics, Ravish Aradhya H V, McGraw Hill Higher Ed, 1E, 2013, ISBN: 978-0071333108.
4.	Electronic Devices and Circuits, David A. Bell, 5E, 2018, Oxford University Press, ISBN: 9780195693409.
5.	Fundamentals of Microelectronics, Behzad Razavi, John Wiley & Sons Singapore Pte. Limited, 3E, 2014, ISBN: 9781118165065

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I/II						
ELEMENTS OF ELECTRICAL ENGINEERING **Category: Professional Core Course** **Stream: Electronics** **(Theory)**						
Course Code	**:**	EE112TA		**CIE**	**:**	**100 Marks**
Credits: L: T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	30L + 30T + 30EL		**SEE Duration**	**:**	**3 Hours**

Unit-I	**06 Hrs**
DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits, mesh analysis, Power and energy. **Electromagnetism:** Faraday's Laws of Electromagnetic Induction, Lenz's Law, Flemings rules, statically and dynamically induced EMF; concepts of self and mutual inductance. Coefficient of Coupling. Energy stored in magnetic field.	
Unit – II	**06 Hrs**
Single-phase AC circuits: Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form factor and peak factor of sinusoidal voltage and currents. Phasor representation of alternating quantities. Analysis of R, L, C, R-L, R-C and R-L-C circuits with phasor diagrams, Real power, reactive power, apparent power, and Power factor. Series, Parallel and Series-Parallel circuits. **Three-phase circuits:** Generation of three phase voltage, phase sequence, relation between phase and line values of voltage and current in balanced star -delta connected systems. Measurement of power by two wattmeter method (Balanced load).	
Unit –III	**06 Hrs**
Domestic Wiring: Requirements, Types of wiring: casing, capping. Two way and three-way control of load. **Electricity bill:** Calculation of electricity bill for domestic consumers. **Equipment Safety measures:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. **Personal safety measures:** Electric Shock, Earthing and its types, Safety Precautions to avoid shock.	
Unit –IV	**06 Hrs**
Semiconductor devices: Construction, principle of working and characteristics- Diodes, BJT. **Transistors biasing:** voltage divider bias, RC coupled amplifier, emitter follower. **Instrumentation:** Basics of Instrumentation, Commonly Used Sensors: Temperature sensors, Pressure and level sensors, Light and motion sensors	
Unit –V	**06 Hrs**
Electric Vehicle: Basics of Electric Vehicles, Components of Electric Vehicle, General Layout of EV, EV classification, advantages & Disadvantages of EV, National Policy for adoption of EVs **Renewable Energy sources:** Power generation using renewable energy sources (Block diagram approach (Solar and Wind energy)	

Course Outcomes	
CO1	Understand single phase and three phase AC circuits using basic laws and fundamental concepts of electromagnetism, renewable energy sources, electric vehicle, safety devices in electrical systems.
CO2	Apply the concepts and evaluate the electrical quantities of DC circuits and AC circuits, performance parameters of semiconductor devices.
CO3	Explain & evaluate the electricity billing, circuit protective devices, safety measures.
CO4	Apply the basic concepts of electronics to evaluate the transistor circuits.

Reference Books	
1.	D. C. Kulshreshtha, Basic Electrical Engineering, McGraw-Hill Education, 1st Edition, 2019, ISBN- 13:978-0071328968.
2.	V. K. Mehta, Basic Electrical Engineering, S.Chandand Company Ltd., New Delhi, 2006,
3.	Mehrdad Ehsani, Yimin Gao, and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 3rd Edition, 2018, ISBN: 978-1-4822-8498-7.
4.	Electrical and Electronics Technology, E. Hughes, 10th Edition, 2010, Pearson, ISBN- 978-8131733660.
5	Solar photo voltaic Technology and systems, Chetan Singh Solanki, third edition (2013), 2 PHI, Learning Private limited New Delhi ISBN: 978-81-203-4711-3.
6.	Electronic Instrumentation, H. S. Kalsi, 4th Edition 25 March2019, TMH, ISBN-9780074621868.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2	**TESTS:** Students will be evaluated in tests, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, Evaluating, and Creating). **THREE** tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video-based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I/II						
ELEMENTS OF MECHANICAL ENGINEERING **Category: Professional Core Course** **Stream: ME (ME, IM, CH, AS)** **(Theory)**						
Course Code	**:**	ME112TA		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	30L + 30T + 30EL		**SEE**	**:**	**3 Hours**

Unit-I	**06 Hrs**
Engineering Materials: Introduction and Classification of Engineering materials, Thermoset and Thermoplastics polymers, Ceramics, Classification of Fiber Reinforced Polymers (FRP) and their applications. **Properties of materials:** Mechanical, Thermal, Chemical, Physical, Magnetic, Optical, Electrical and Electronics, Stress-Strain Diagram for mild steel & Cast Iron. materials and its desirable properties for Aerospace, Automotive, Electronic and Biomedical applications.	
Unit – II	**06 Hrs**
Manufacturing Systems: Overview of manufacturing systems such as casting, forming & machining. **Metal Joining Processes:** Introduction to metal joining processes, Welding & Soldering and its differences, Principle of Arc Welding, Gas Welding and soldering. Materials for Welding and soldering. Safety devices. Emphasis on **modern** and emerging technologies: CNC machining. **Introduction to smart manufacturing**: automation & its types and features, IIoT. **Applications:** electronics, aerospace, biomedical, and sustainable manufacturing.	
Unit – III	**06 Hrs**
Steam and its properties: property charts, Enthalpy, Numerical on steam. **Steam turbines:** hydraulic turbines & its types- Pelton, Francis and Kaplan turbines (working principles). **Refrigeration:** Refrigeration effect, working principle of Vapour Compression refrigeration systems, ton of refrigeration, COP, refrigerants and their properties.	
Unit – IV	**06 Hrs**
IC Engines: Classification of IC Engines, Working of 4-Stroke petrol and diesel Engines and Comparison. Efficiency of Engines, FHP, BHP and IHP and numerical on IC Engines. **Elements of Power transmission system:** Basics of power transmission- gear: types: spur, helical, bevel, Worm gear & rack and pinion, classifications, gear trains- simple & compound & simple Numericals.	
Unit – V	**06 Hrs**
Hybrid Drives: Classification of hybrid electric vehicles – series, parallel & series-parallel, regenerative braking concepts. Introduction to hybrid vehicles, Configurations, EV/ICEV comparison, components, Traction Motor, mechanical & electrical characteristics, batteries & battery management systems, control module etc. **Mechatronics & Robotics:** phases of mechatronics**,** basics of sensors, actuators, control system, applications- ABS, EMS. **Robotic system:** basics of robotics, elements & Anatomy of robot, and configuration, and industrial applications of robots.	

Course Outcomes	
CO1	Understand the fundamental principles of engineering materials, manufacturing methods, energy systems, mechanical drives, and smart technologies such as mechatronics, robotics, and artificial intelligence..
CO2	Explain the working principles and applications of conventional and modern manufacturing systems, thermal and mechanical systems, and intelligent automation in various engineering fields.
CO3	Apply basic engineering knowledge to interpret the behaviour of materials, select manufacturing processes, assess energy performance, and understand drive systems and intelligent control devices.
CO4	Identify and describe the role of integrated systems involving materials, energy, mechanical elements, production technologies, and smart automation for solving elementary engineering problems.

Reference Books	
1.	Elements of Mechanical Engineering, K. R. Gopalakrishna, Subhas Publications, 35th Edition August-2015
2.	Material Science & Engineering- William D Callister, 2 / 10th Edition, 2020, ISBN 978-1—119-4553918.
3.	Welding Technology (PB), Khanna O P, Dhanpat Rai publication, 22nd Edition, 2024.
4.	Electric and Hybrid Vehicles, Design Fundamentals – Iqbal Husain, CRC Press, 10th Edition, 2020. ISBN – 13:978-1-119-4553918
5.	Modern Electric, Hybrid Electric; Fuel Cell Vehicles, Fundamentals, Theory and Design - Mehrdad Ehsani, CRC Press, 3rd Edition, 2021. ISBN – 13:978-0367693930.
6.	Mechatronics – Electronic control systems in Mechanical and Electrical Engineering, William Bolton, Pearson, 6th Edition, ISBN: 978-1-292-07668-3, 2018.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
	MAXIMUM MARKS FOR THE CIE (THEORY)	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I/II						
Principles of Programming using C **Category: Professional Core Course** **Stream: CSE** **(Theory and Practice)**						
Course Code	**:**	**CS222IA**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**30L + 30EL + 30P**		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**06 Hrs**
Logical Reasoning and Algorithmic Problem Solving: Skill development – Examples related to Arithmetical Reasoning and Analytical Reasoning. **Introduction to Programming:** Design and Implementation of efficient programs. Program Design Tools: Algorithms, Flowcharts and Pseudo codes. Types of Errors. **Introduction to C:** Introduction, structure of a C program, writing the first program, Files used in a C program. Compiling and executing C Programs using comments, C Tokens, Character set in C, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, I/O statements in C. Operators in C, Type conversion and type casting, scope of variables. **Simple AI Context:** "Can machines think?" (Discussion)	
Unit – II	**06 Hrs**
Decision Control and Looping Statements: Introduction to decision control, conditional branching statements, iterative statements, Nested loops, Break and continue statements, goto statements. AI Concept Link: Using decision trees and recursion to simulate decision-making. **Arrays:** Introduction, Declaration of Arrays, accessing elements of an array, Storing values in arrays, Operations on Arrays. Two dimensional arrays- Operations on two dimensional arrays. **AI Concept Link:** Using decision trees and recursion to simulate decision-making.	
Unit –III	**06 Hrs**
Strings: Introduction, Operations on strings- finding length of a string, converting characters of a string into uppercase and lowercase, Concatenating two strings, appending a string to another string, comparing two string, reversing a string, String and character Built in functions. AI Mini Task: Simple text-based chatbot using strings and if-else logic **Functions:** Introduction, using functions, Function declaration/function prototype, Function definition, Function call, Return statement, passing parameters to a function, Built-in functions. Passing arrays to functions. **Recursive functions**- Greatest Common Divisor (GCD), Fibonacci Series. **AI Mini Task:** Simple text-based chatbot using strings and if-else logic	
Unit –IV	**06 Hrs**
Structures: Introduction: Structure Declaration, Typedef declaration, initialization of structures, accessing members of a structures, copying and comparing structures, array of structures, Structures and functions. Mini AI project: Basic Dataset Reader in C. **Pointers:** Introduction to pointers, declaring pointer variables, pointer expressions and pointer arithmetic, null pointers, passing arguments to functions using pointers, pointers and arrays. **Mini AI project:** Basic Dataset Reader in C	
Unit –V	**06 Hrs**
Dynamic memory allocation- Memory allocation process, allocating a block of memory, releasing the used space. **Linked List and Files:** Introduction, Linked lists vs Arrays, Memory allocation and deallocation for a linked list, types of linked lists, singly linked lists. Introduction to files, using files in C, Reading data from files, writing data to files, Detecting End-Of-File, Functions for selecting a record randomly, Remove().	

Course Outcomes	
CO1	Apply logical reasoning and problem-solving skills using C programming constructs to address AI-related tasks in areas such as engineering, mathematics, and data processing.
CO2	Design and implement sustainable AI-enabled solutions using C programming, addressing societal and environmental concerns while embracing lifelong learning for emerging technologies .
CO3	Evaluate and select appropriate methods or data structures in C programming to develop AI-oriented solutions by thoroughly analyzing the problem.
CO4	Demonstrate programming skills to solve interdisciplinary AI-driven problems using modern tools effectively, while showcasing teamwork through oral presentations and written reports.

Reference Books	
1.	Programming in C, Reema Thareja, 2018, Oxford University Press. ISBN: 9780199492282.
2.	Algorithmic Problem Solving , Roland Backhouse, 2011, Wiley, ISBN: 978-0-470-68453-5
3.	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, 2015, 2nd Edition, Prentice Hall, ISBN (13): 9780131103627.
4.	Turbo C: The Complete Reference, H. Schildt, 2000, 4th Edition, Mcgraw Hill Education, ISBN-13: 9780070411838.
5.	C Programming- A modern approach, Kim N. King, 2008, W.W. Norton, ISBN: 9780393979503.
6.	NPTEL Course Link: https://onlinecourses.nptel.ac.in/noc25_cs119/preview
7.	Virtual Lab for C programming: https://cse02-iiith.vlabs.ac.in/

Laboratory Component

PART A

Implement the following programs using cc/gcc compiler

Programming Assignments:

1. Sorting and searching algorithms
2. Matrix operations (used in AI)
3. Mini-rule engine using if-else
4. Creating a training dataset
5. File-based data logging

PART B

Design and develop mini-project: Use C to simulate a basic AI application such as:

- Line following robot logic
- Voice command parser (simulated input)
- Smart thermostat logic

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
#	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS**.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &	40

	Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	
4.	Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I/II						
Engineering Mechanics **Category: Professional Core Course** **Stream: Civil Engineering** **(Theory)**						
Course Code	**:**	CV112TA		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	30L + 30T + 30EL		**SEE Duration**	**:**	**3 Hours**

Unit-I	**06 Hrs**
Centroid of plane areas: Introduction, centroid of composite areas and simple built-up sections - Numerical examples. **Moment of inertia of plane areas:** Introduction, polar moment of inertia, radius of gyration, moment of inertia of simple and built-up sections - Numerical examples.	
Unit – II	**06 Hrs**
Support Reactions: Resolution of forces, Classification of beams, loads and supports, statically determinate beams with varying loads – Numerical examples.	
Unit –III	**06 Hrs**
Analysis of Trusses: Introduction, Classification of trusses, analysis of plane perfect trusses by the method of joints and method of sections - Numerical examples.	
Unit –IV	**06 Hrs**
Simple stress & strain: Characteristics of stress and strain, elastic modulus, analysis of bars of uniform and varying section, composite section, elastic constants – Numerical examples.	
Unit –V	**06 Hrs**
Shear Force & Bending Moment: Concept, sign convention and SFD, BMD for statically determinate beams subjected to different forms of loading – Numerical examples.	

Course Outcomes	
CO1	Describe the basic concepts of mechanics related to centroid, force, free-body diagram, equilibrium, support reactions, stress & strain.
CO2	Apply the concepts of mechanics for analysis of simple beams, truss & interpret the result in the analytical manner for practical understanding.
CO3	Comprehend the behaviour of civil engineering elements in relation to its stability and engineering properties subjected to different forms of loading.
CO4	Exhibit the application of fundamental concepts in solving engineering problems based on the scenario specific requirement.

Reference Books	
1.	R.C. Hibbeler, “Engineering Mechanics”, Pearson Education. ISBN-10: 9789332584747, ISBN-13: 978-9332584747.
2.	J. L. Meriam, L. G. Kraige and J. N. Bolton “Engineering Mechanics: Statics, SI Version”, Wiley. ISBN-10: 8126564032, ISBN-13: 978-8126564033.
3.	R. S. Khurmi, N. Khurmi “A Textbook of Engineering Mechanics”, S Chand Publishing. ISBN-10: 9352833961, ISBN-13 : 978-9352833962.
4.	S. Timoshenko, D.H. Young, J.V. Rao and Sukumar Pati, “Engineering Mechanics (in SI units)”, McGraw Hill Education, ISBN-13: 978-1259062667, ISBN-10: 9781259062667
5.	M.N. Shesha Prakash & Ganesh B. Mogaveer, “Elements of Civil Engineering and Engineering Mechanics”, PHI Learning. ISBN-10 : 8120344391, ISBN-13: 978-8120344396.
6.	R. V. Raikar, “Elements of Civil Engineering and Engineering Mechanics”, PHI Learning. ISBN-10: 8120353064, ISBN-13: 978-8120353060
7.	R.K. Bansal, “Engineering Mechanics”, Laxmi Publications. ISBN-10: 8131800784, ISBN-13: 978-8131800782.

Relevant (MOOC) Courses	
1.	Engineering Mechanics - Prof K Ramesh, IIT Madras, Online Course - NPTEL (Swayam Platform) link: https://onlinecourses.nptel.ac.in/noc21_me70/preview
2.	Introduction to Engineering Mechanics - Dr. Wayne Whiteman, PE, Georgia Institute of Technology, Online Course - COURSERA link: https://www.coursera.org/learn/engineering-mechanics-statics

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
	MAXIMUM MARKS FOR THE CIE (THEORY)	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Courses Common to All Programs

- **IDEA LAB (IDEA DEVELOPMENT, EVALUATION & APPLICATION) (ME111DL / ME121DL)**
- **COMPUTER AIDED ENGINEERING GRAPHICS (ME112GL / ME122GL)**
- **AI FOUNDATION FOR ENGINEERS (CI114TA/CI124TA)**

RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

Semester: I/II						
IDEA LAB **(Idea Development, Evaluation & Application)** **Category: Professional Core Course** **(Common to all Programmes)** **(Practice)**						
Course Code	**:**	ME111DL/ME121DL		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	0:0:1		**SEE**	**:**	**50 Marks**
Total Hours	**:**	30P		**SEE Duration**	**:**	**03 Hours**

Microcontroller Interfacing and Programming	
PART-A	
1.	Microcontroller-Based Single LED ON/OFF Control System
2.	GPIO-Based Multi-LED ON/OFF Control Using Microcontroller
3.	LED Control Using Physical Switch Interface with Microcontroller
4.	Proximity Alert System Using Ultrasonic Sensor with LED and Buzzer Notification
5.	Environmental Monitoring System Using Temperature and Humidity Sensor with LCD Display
6.	Flame Detection and Safety Alert System with Optional Emergency Response Control
7.	Liquid Level Monitoring and Alert System Using Float Sensor
Experiential Learning (PART-A)	
1.	Smart Fire Detection and Alert System with Water Spray Activation
2.	Contactless Smart Water Level Controller for Overhead Tanks
3.	IoT-Based Room Environment Monitor with Alert System
4.	Touch-Free Smart Obstacle Detection and Warning System for Visually Impaired
PART-B	
1.	Touch Sensor-Based LED Activation System
2.	Magnetic Door Sensor-Based Intrusion Alert System
3.	Ambient Light-Controlled Lighting System Using LDR and Relay Interface
4.	Smoke Detection and Alert System Using Sensor-Based LED and Buzzer Activation
5.	Automated Irrigation Control System Using Soil Moisture Sensor and DC Pump
Experiential Learning (PART-B)	
1.	Smart Door Security System with Touch Access and Intrusion Alert
2.	Automatic Street Lighting System with Theft Protection
3.	IoT-Enabled Smart Irrigation System with Soil Moisture and Light Sensing
4.	Home Fire and Smoke Detection with Emergency Response Mechanism
PART-C (USED CASES)	
1.	IoT-Based Weather Monitoring Station Using Blynk for Real-Time Environmental Data Visualization
2.	IoT-Enabled Home Security and Monitoring System Using Thing Speak for Motion, Entry, and Gas Detection
3.	Python-Driven Web Dashboard for Greenhouse Monitoring Using Flask/Django and Charts.js
4.	Predictive Maintenance for Small Motors Using Vibration and Temperature Data with Machine Learning Algorithms
5.	Multi-Sensor Data Analytics and Logging using ESP32 with Firebase Real-time Database Integration

Course Outcomes	
CO1	Apply basic circuit interfacing using microcontrollers to control LEDs, buzzers, and other simple devices.
CO2	Analyse multiple sensors and actuators in embedded systems for real-time monitoring and control applications.
CO3	Evaluate IoT-based prototypes that utilize sensor data for decision-making and cloud communication.
CO4	Create interactive dashboards or AI/ML-enabled prototypes to visualize, analyze, and interpret sensor data.

Reference Books	
1.	Saini, Sandeep & Kaur, Manpreet. Arduino Solutions Handbook: Design Interesting DIY Projects Using

	Arduino Uno, C and C++. BPB Publications, January 25, 2023. ISBN-10: 9355513240
2.	Natheem S & Arsath, Arduino Book for Beginners: Getting Started with Arduino and Basic Programming with Projects, Zoom Books Co., 2022 edition.
3.	Ryan Turner, Arduino Programming: 3 Books in 1 – The Ultimate Beginners, Intermediate and Expert Guide to Master Arduino Programming, Publishing Factory LLC, 2020, ISBN-13: 978-1647710774.
4.	Barrett, Steven F. Arduino V: Machine Learning. Synthesis Lectures on Digital Circuits & Systems, Springer International Publishing, December 27, 2022 (1st ed. 2023). ISBN-10: 3031218760.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (LAB)		
#	**COMPONENTS**	**MARKS**
1.	Conduction of laboratory exercises, lab report, observation, and analysis **(20 marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation **(20 Marks)** adding upto **50 Marks**.	**50**
	MAXIMUM MARKS FOR THE CIE (THEORY)	**50**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

2025 Scheme					
Semester: I /II					
COMPUTER AIDED ENGINEERING GRAPHICS					
Course Code	:	ME112GL/ME122GL	CIE	:	50 Marks
Credits: L:T:P	:	2: 0: 1	SEE	:	50 Marks
Total Hours	:	30L+30P	SEE Duration	:	3.00 Hrs

Unit-I (For CIE Only)	**06 Hrs**
Geometrical Construction: - Develop foundational understanding of geometric entities and relationships. Bisecting a line, dividing a line, bisecting a circle, drawing regular polygons, 2D drawing practice using CAD tool.	
Unit – II (For CIE Only)	**12 Hrs**
Projection of Points: - Definition and significance of orthographic projection, four quadrants, Reference planes: Horizontal Plane (HP), Vertical Plane (VP), Profile Plane (PP). Projection of Straight Lines (located in First quadrant/first angle only): Lines inclined to both the HP and VP. Determining true length & angle and apparent length & angle. (No application problems). Projections of Plane Surfaces (First Angle Projection Only): Introduction, Projections of regular planes, plane inclined to both the planes in different positions by change of position method only (No problems on punched plates and composite plates).	
UNIT III	**16 Hrs**
Projection of Solids (Resting on HP only): Classifications of Solids, Introduction to Prisms and Pyramids. Projection of solids on auxiliary planes. (No problems on octahedrons and combination solid). Development of Lateral Surfaces: Introduction to section planes, methods of development - parallel line method and radial line method – prism and cylinder (truncated), pyramid and cone (frustum and truncated)	
Unit –IV	**16 Hrs**
Transformation of Projections: Introduction to the 2D & 3D Views of Engineering Objects. Convert isometric view of a solid into orthographic projections and Conversion of orthographic views to isometric views.	
Unit –V (For CIE Only)	**10 Hrs**
Multidisciplinary Applications & Practice **– Simple 2D Sketch (For CIE Only):** Drawing Simple Mechanisms: Gear trains, Ratchets, Chain and belt drives, etc. Electric Wiring and lighting diagrams: Automatic fire alarm, Call bell system, UPS system. Basic Building Drawing: Basic foundation drawing, steel structures- Frames, bridges, trusses. Electronics Engineering Drawings: Simple Electronics Circuit Drawings.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand and interpret fundamental geometric entities and relationships for engineering applications.
CO2:	Apply orthographic projection principles to represent points, lines and planes using quadrant systems and reference planes.
CO3:	Develop lateral surfaces and apply auxiliary plane projection techniques to visualize solids.
CO4:	Transform of engineering objects between isometric and orthographic views and create 2D sketches for various engineering domains.

Textbooks	
1	Engineering Drawing, N. D. Bhatt, 55th Edition 2025, Charotar Publishing house Pvt. Ltd., ISBN-13: 978-9385039805
2	A textbook of Engineering Drawing, R K Dhawan, S Chand and Company Limited, Third Revised Edition, 2019; ISBN 978-93-5283-737-3.
3	Engineering Graphics & Design, by Pradeep Jain, Khanna Book Publishing, First Edition,

	2022, ISBN13: 978-9391505066,

Scheme of CIE

Units	Solutions on Sketch book	CAD printout	Marks	Minimum TWO tests to be conducted for Max. of 50 Marks each. (ONE for Manual and Laboratory)	Reduction of marks
I	10 Marks	10 Marks	20		Unit I to IV - 80 reduced to **20 Marks** EL – 20 reduced to **10 Marks** Manual and Lab. Test 100 reduced to **20 Marks**
II	10 Marks	10 Marks	20		
III	10 Marks	10 Marks	20		
IV	10 Marks	10 Marks	20		
V	**EL – 20**		20		
				CIE Total	**50**

CIE SAP Marks	Lab Record	Lab Test	Lab EL	Total
	20	**20**	**10**	**50**

Scheme of SEE	
1	UNIT I, II and V is only for practice and Internal Assessment and not for SEE.
2	Question paper for each batch of students will be sent through CoE Office before the commencement of Examination of each batch. The answer sheets will have to be jointly evaluated by the Internal & External examiners.
3	A maximum of Four questions will be set as per the following pattern (No mixing of questions from different units)

Q, No	**UNIT**	**Marks Allotted**	**Remarks**	**Max Marks**
Q 1	**Unit – III** 1 Question from Development of lateral surfaces	20	**Students to answer One question from Q1 and Q2**	**20 (CAD)**
Q 2	1 Question from Projection of Solids	20		
Q3	**Unit – IV** 1 Question from Conversion of isometric view into orthographic projections	30	**Students to answer One question from Q3 and Q4**	**30 (CAD)**
Q4	1 Question from Conversion of orthographic projections into isometric view.	30		
			Total Marks	**50**

Semester: I/II						
AI Foundations for Engineers **Category: Emerging Technology Course** **Stream: Common to ALL Programs** **(Theory)**						
Course Code	**:**	**CI114TA/CI124TA**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L + 45 EL**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**07 Hrs**
Introduction: What is AI? Acting humanly: The Turing test approach, thinking humanly: The cognitive modelling approach, Thinking rationally: The "laws of thought" approach, Acting rationally: The rational agent approach; The foundations of AI: Mathematics, Economics, Neuroscience, Psychology, Computer Engineering; The State of the Art; Risks and Benefits of AI **General Introduction to Responsible AI:** What is Responsible AI? Why it is important **Intelligent Agents:** Agents and Environments, The concept of Rationality, The Nature of Environments	
Unit – II	**10 Hrs**
Solving Problems by Searching: Problem-solving agents: Search problems and solutions, Formulating problems, Example Problems: Grid world problems (Vacuum world, Sokoban Puzzle), Real-world problems (Route-finding problems) **Search Algorithms:** Uninformed Search Strategies(BFS, DFS); Informed (Heuristic) Search Strategies(A* Search)	
Unit –III	**10 Hrs**
Introduction to Machine learning: Well-posed learning problems, designing a learning System: Choosing the training experience, Choosing the target function, choosing representation for the target function, Choosing a function approximation algorithm, the final design; Prospects and Issues in ML **Decision Tree Learning:** Decision Tree Representation, Appropriate Problems for DT learning, The basic DT algorithm, and Applications **Bayesian Learning:** Bayes' Theorem, Bayes' Theorem and Concept Learning,and Applications **Instance-Based Learning:** K-Nearest Neighbor learning, and Applications	
Unit –IV	**10 Hrs**
Artificial Neural Networks: Biological Motivation, Neural Network Representations, Appropriate Problems for Neural Network Learning, Perceptrons, Multilayer Networks and the Backpropagation Algorithm **General Introduction to Deep Learning Models:** Recurrent Neural Networks (RNN), Convolutional Neural Networks (CNN), Reinforcement Learning, and Applications	
Unit –V	**08 Hrs**
Responsible AI: Understanding Human-centered Design, Responsible AI Lifecycle, Envisioning and Impact Assessment, Data Collection and Processing, Prototyping, Testing, Building for Production, Deployment, Monitoring, Tools for Responsible AI, Case studies	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Explain fundamental concepts of Artificial Intelligence, including approaches to building intelligent systems, foundations, state of the art, and assess the potential risks and benefits of AI.
CO2	Apply problem-solving techniques and search algorithms to model and solve real-world problems using uninformed and informed search strategies.
CO3	Demonstrate an understanding of key machine learning techniques, including decision trees, Bayesian learning, instance-based learning, and neural networks incorporating backpropagation, and analyze their applications within AI systems.
CO4	Apply the principles of Responsible AI and human-centered design to assess the impacts of AI systems, ensure ethical development throughout the AI lifecycle for building trustworthy AI solutions.

Reference Books	
1.	Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, 4th Edition, Publisher: Pearson, 2020, ISBN-13: 978 0134610993 (Unit1 & Unit2)
2.	Machine Learning, Tom M. Mitchell, McGraw-Hill, 1997. (Unit3 & Unit4)
3.	Responsible AI Architect's Guide-Responsible AI Best Practices, NASSCOM(White Paper) (Unit5)
4.	Artificial Intelligence: A Guide for Thinking Humans, Melanie Mitchell, Publisher: Farrar, Straus and Giroux, 2019, ISBN-13: 978 0374257835

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
	MAXIMUM MARKS FOR THE CIE (THEORY)	**100**

Engineering Science Courses

- **FUNDAMENTALS OF PROGRAMMING USING C (CS113ATA/CS123ATA)**
- **ELEMENTS OF CIVIL ENGINEERING (CV113ATB/CV123ATB)**
- **PRINCIPLES OF ELECTRONICS ENGINEERING (EC113ATC/EC123ATC)**
- **BASICS OF ELECTRICAL ENGINEERING (EE113ATD/EE123ATD)**
- **FUNDAMENTALS OF MECHANICAL ENGINEERING (ME113ATE/ME123ATE)**

Semester: I/II						
Fundamentals of Programming Using C **Category: Engineering Science Courses** **(Common to all Programmes)** **(Theory & Practice)**						
Course Code	**:**	**CS113ATA/CS123ATA**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L + 45 EL**		**SEE Duration**	**:**	**3 Hours**

Unit-I — **09 Hrs**

Introduction to Programming

Definition of a computer. Components of computer system, Programming Languages.

Design and implementation of efficient programs. Program Design Tools: Algorithms, Flowcharts and Pseudocodes. Types of Errors.

Unit – II — **09 Hrs**

Introduction to C

Introduction, structure of a C program, Writing the first program, Files used in a C program. Compiling and executing C Programs using comments, C Tokens, Character set in C, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, I/O statements in C.

Operators in C, Type conversion and type casting, scope of variables.

Simple AI Context: "Can machines think?" (Discussion)

Unit –III — **09 Hrs**

Decision Control and Looping Statements

Introduction to decision control, conditional branching statements, iterative statements, Nested loops, Break and continue statements, goto statements. AI Concept Link: Using decision trees and recursion to simulate decision-making.

Arrays

Introduction, Declaration of Arrays, Accessing elements of an array, Storing values in arrays, Operations on Arrays- Traversing, Inserting and Deletion of element in an array. Two dimensional arrays- Operations on two dimensional arrays.

AI Concept Link: Using decision trees and recursion to simulate decision-making

Unit –IV — **09 Hrs**

Strings

Introduction, Operations on strings- finding length of a string, converting characters of a string into uppercase and lowercase, Concatenating two strings, appending a string to another string, comparing two string, reversing a string. String and character Built in functions. AI Mini Task: Simple text-based chatbot using strings and if-else logic

Functions

Introduction, Using functions, Function declaration/function prototype, Function definition, Function call, Return statement.

AI Mini Task: Simple text-based chatbot using strings and if-else logic

Unit –V — **09 Hrs**

Functions

Passing parameters to a function, Built-in functions. Passing arrays to functions. Recursive functions- Greatest Common Divisor (GCD), Fibonacci Series.

Structures and Pointers

Introduction: Structure Declaration, Typedef declaration, initialization of structures, accessing members of a structures, Introduction to pointers, declaring pointer variables.

Mini AI project: Basic Dataset Reader in C

Course Outcomes	
CO1	Apply logical reasoning and problem-solving skills using C programming constructs to address AI-related tasks in areas such as engineering, mathematics, and data processing.
CO2	Design and implement sustainable AI-enabled solutions using C programming, addressing societal and environmental concerns while embracing lifelong learning for emerging technologies .

CO3	Evaluate and select appropriate methods or data structures in C programming to develop AI-oriented solutions by thoroughly analyzing the problem.
CO4	Demonstrate programming skills to solve interdisciplinary AI-driven problems using modern tools effectively, while showcasing teamwork through oral presentations and written reports.

Reference Books	
1.	Programming in C, Reema Thareja, 2018, Oxford University Press. ISBN: 9780199492282.
2.	Algorithmic Problem Solving , Roland Backhouse, 2011, Wiley, ISBN: 978-0-470-68453-5
3.	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, 2015, 2nd Edition, Prentice Hall, ISBN (13): 9780131103627.
4.	Turbo C: The Complete Reference, H. Schildt, 2000, 4th Edition, Mcgraw Hill Education, ISBN-13: 9780070411838.
5.	C Programming- A modern approach, Kim N. King, 2008, W.W. Norton, ISBN: 9780393979503.
6.	NPTEL Course Link: https://onlinecourses.nptel.ac.in/noc25_cs119/preview
7.	Virtual Lab for C programming: https://cse02-iiith.vlabs.ac.in/

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
	MAXIMUM MARKS FOR THE CIE (THEORY)	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

Semester: I/II						
Elements of Civil Engineering **Category: Engineering Science Courses** **Stream: CV** **(Theory)**						
Course Code	:	CV113ATB/ 123ATB		**CIE**	:	100 Marks
Credits: L:T:P	:	3:0:0		**SEE**	:	100 Marks
Total Hours	:	45L + 45 EL		**SEE Duration**	:	3 Hours

Unit-I – Introduction	**09 Hrs**
Overview and importance of Civil Engineering in nation building. Branches of Civil Engineering and their roles-Surveying, Structural Engineering, Geotechnical Engineering, Hydraulics & Water Resources, Transportation Engineering, Environmental Engineering, Construction planning & Project management, RS and GIS. Smart and sustainable cities, Civil Engineering and Sustainable Development Goals (SDGs)	
Unit – II - Construction Materials and Building Components	**09 Hrs**
Construction Materials – Conventional and alternates: ● Conventional Materials: Bricks, cement, concrete, steel, asphalt, paints and solvents – basic properties and applications. ● Alternate materials – types, basic properties and applications, nanomaterials Building Planning: Plinth area, carpet area, setback – concept only Building elements: Beams, columns Slabs, Foundation, walls, staircase - classification and functional importance. Introduction to Green Buildings- concept and rating systems	
Unit –III – Environmental and Water Resource Engineering	**09 Hrs**
Water supply – Potable and Palatable – concept, basic requirements and supply layouts. Solid waste – sources and disposal techniques. Water and waste water treatment technologies (Concepts only). Air quality index (AQI) Introduction to Water resources and Hydraulic structures- Dams, Canals, Aqueducts; Rainwater harvesting and water conservation techniques	
Unit – IV – Transportation Engineering, Remote Sensing and GIS	**09 Hrs**
Classification of transportation systems - roads, railways, harbour, tunnel, bridges, and airports Public transport systems and intermodal connectivity, Transportation planning, Road safety awareness. Applications of RS and GIS	
Unit –V – Geotechnical Engineering and Emerging Technologies	**09 Hrs**
Introduction to soil and foundations – Classification and application. Emerging Technologies in Civil Engineering – drones, sensors, 3D printing (basic exposure). Civil Engineering aspects in disaster management and mitigation – floods, earthquakes.AI in Civil Engineering	

Course Outcomes: After completing the course students will be able to	
CO1	Apply the knowledge of Civil Engineering in the infrastructural development of society.
CO2	Comprehend the importance of construction materials for Civil Engineering applications.
CO3	Illustrate the latest technologies in Civil Engineering for sustainable practices.
CO4	Exhibit the knowledge of Civil Engineering in interpreting engineering problems.

Reference Books	
1.	Basic Civil Engineering, B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications; 1st Edition, 2003, ISBN-13 : 978-8170084037.
2.	Basic Civil Engineering, G.K. Hiraskar, Dhanpat Rai Publications, 1st Edition, ISBN-13 :9383182022-978 .
3.	Water and Wastewater Engineering, Design Principles and Practice, Mackenzie L. Davis, The McGraw-Hill publication, ISBN: 978-0-07-171385-6
4.	Principles of Transportation Engineering, Partha Chakroborty, Animesh Das, PHI Learning Pvt. Ltd., 2nd Edition, 2003, ISBN: 9788120320840.
5	Introduction to Civil Engineering Profession, Prof. Ravindra Gettu, Prof. Subhadeep Banerjee,IIT Madras online NPTEL Course, Link: https://onlinecourses.nptel.ac.in/noc22_ce42/preview

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
	MAXIMUM MARKS FOR THE CIE (THEORY)	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I/II						
Principles of Electronics Engineering **Category: Engineering Science Course** **(Theory)**						
Course Code	**:**	EC113ATC/123ATC		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	45L+ 45SL		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
SEMICONDUCTOR DIODES Review, Regulated Power Supply, Bridge Rectifier with filter, Zener diode as Voltage Regulator, Photo diode, LED, CE Amplifier, Multistage amplifier, BJT as a switch	
Unit – II	**09 Hrs**
FEEDBACK AND SIGNAL GENERATORS Feedback Concepts, Advantages of Voltage series Negative feedback, Oscillator Operation, Barkhausen Criterion, RC Phase Shift Oscillator, Wein-Bridge Oscillator, Crystal Oscillator, Op-Amp basics, Practical Op-amp circuits, Inverting Amplifier, Non Inverting Amplifier, Voltage Follower, Summer, Integrator, Differentiator.	
Unit –III	**09 Hrs**
DIGITAL ELECTRONICS FUNDAMENTALS Binary numbers, Number base conversion, Hexadecimal Numbers, Complements, Basic definitions, Basic theorems and properties of Boolean Algebra, Boolean functions, Canonical and Standard forms, Digital Logic gates, Demorgan's Laws, K-Map (Upto 4 variable). Basic and Universal Gates,Ex-OR realization using NAND and NOR, Half adder, Full adder.	
Unit –IV	**09 Hrs**
INTRODUCTION TO COMMUNICATION SYSTEMS: Block diagram of a general communication system, Need for modulation, types of modulation: AM and FM. Difference between AM and FM, Problems. Super heterodyne receiver, Digital Communication block diagram. **INTRODUCTION TO MICROPROCESSOR AND MICROCONTROLLER:** Fundamentals and architectural Block diagrams. Case Studies: i. Development board based on Microprocessor (Raspberry Pi) ii. Development board based on Microcontroller (Arduino)	
Unit –V	**09 Hrs**
EMBEDDED COMPUTING SYSTEMS: Characteristics and classification of embedded systems, Design metrics and constraints (Power, Size, Cost, Performance), Basics of Embedded Linux, Edge Computing concepts: need, architecture, examples, Edge AI/ML: Introductory concepts, Building an IoT system with ESP32, Cloud platforms for IoT (ThingSpeak, Blynk) Case Studies: Edge-based Predictive Maintenance, Wearable Health Monitors	

Course Outcomes	
CO1	**Comprehend** the operation and characteristics of electronic devices, digital circuits, communication blocks, and embedded systems used in modern electronic applications.
CO2	**Analyze** various analog and digital electronic circuits including amplifiers, oscillators, logic gates, and microcontroller-based systems for functional understanding and system design.
CO3	**Identify** the essential building blocks of electronic systems and their relevance in multidisciplinary engineering applications.
CO4	**Apply** the basic concepts of embedded systems, communication techniques, and edge computing to appreciate their role in solving real-world engineering problems using modern tools and platforms.

Reference Books	
1.	Electronic Devices and Circuits, David A. Bell, 5E, 2018, Oxford University Press, ISBN: 9780195693409
2.	Electronic Devices and Circuit Theory, Robert L Boylestad, Louis Nashelsky, 11E, 2015, Pearson Education India, ISBN: 978-93-325-4260-0.
3.	Basic Electronics, Ravish Aradhya H V, McGraw Hill Higher Ed, 1E, 2013, ISBN: 978-0071333108.
4.	Digital Logic and Computer Design, Morris Mano, 54th Edition, 2007, Prentice Hall India publication, ISBN: 978-81-317-1450-8
5.	Internet of Things: Principles and Paradigms, Rajkumar Buyya, Amir Vahid Dastjerdi, 2013, 1st Edition, Morgan Kaufmann Elsevier, ISBN: 9780128053959

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

Semester: I/II						
BASICS OF ELECTRICAL ENGINEERING **Category: Engineering Science Courses** **Stream: Electronics** **(Theory)**						
Course Code	:	EE113ATD/113ATD		**CIE**	:	**100 Marks**
Credits: L:T:P	:	3:0:0		**SEE**	:	**100 Marks**
Total Hours	:	45L + 45 EL		**SEE Duration**	:	**3 Hours**

Unit-I	**09 Hrs**
Introduction: Conventional and non-conventional energy resources; General structure of electrical power systems using single line diagram approach. **Power Generation:** Hydel, Nuclear, Solar & wind power generation (Block Diagram approach). **DC Circuits:** Ohm's Law and its limitations. KCL & KVL, applications to series, parallel and series-parallel circuits.	
Unit – II	**09 Hrs**
A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. (Only definitions) Voltage and current relationship with phasor diagrams in R, L, and C circuits. Concept of Impedance. Analysis of R-L, R-C, R-L-C Series circuits. Active power, reactive power and apparent power, Power Factor and Its Importance, Causes of Low Power Factor and Simple Methods for Power Factor Improvement (e.g., Capacitor Banks). **Three Phase Circuits:** Generation of Three phase AC quantity, advantages and limitations; star and delta connection, relationship between line and phase quantities (excluding proof)	
Unit –III	**09 Hrs**
Magnetic Circuits: Analogy between electric and magnetic circuits, self-inductance and mutual inductance, coefficient of coupling. **DC Machines:** **DC Generator:** Construction and principle of operation, induced emf expression, classification of generators with relation between induced emf and terminal voltage. **DC Motor:** back emf and its significance, Torque equation, classification, characteristics and applications. **EV Motors:** Introduction to BLDC, PMSM – Construction and principle of operation.	
Unit –IV	**09 Hrs**
Transformers (single phase): principle of operation, Types and construction, EMF equation, losses, efficiency and regulation expressions. **Three-phase induction Motors:** Concept of rotating magnetic field, Principle, constructional features of squirrel cage and wound rotor, slip and torque characteristics. **Alternators:** Types, principle of operation	
Unit –V	**09 Hrs**
Domestic Wiring: Requirements, Types of wiring: casing, capping. Two way and three-way control of load. **Electricity bill:** Calculation of electricity bill for domestic consumers. **Equipment Safety measures:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. **Personal safety measures:** Electric Shock, Earthing and its types, Safety Precautions to avoid shock.	

Course Outcomes	
CO1	Understand the concepts of various energy sources, power transmission and distribution.
CO2	Apply the basic laws and concepts to solve the ac and dc circuits.
CO3	Analyse the construction, operation and characteristics of ac and dc machines.
CO4	Explain & evaluate the electricity billing, circuit protective devices, safety measures.

Reference Books	
2.	D. C. Kulshreshtha, Basic Electrical Engineering, McGraw-Hill Education, 1st Edition, 2019, ISBN- 13:978-0071328968.
2.	V. K. Mehta, Basic Electrical Engineering, S.Chandand Company Ltd., New Delhi, 2006,
3.	D.P. Kothari and Nagrath Theory and Problems in electrical Engineering, PHI Edition 2016, ISBN-978-81-203-5279-7.
4.	V. N. Mittal, Basic Electrical Engineering, TMH Publication, New Delhi, 2006, ISBN: 9780070593572.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2	**TESTS:** Students will be evaluated in tests, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, Evaluating, and Creating). **THREE** tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video-based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	40
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I/II (2025 Scheme)					
FUNDAMENTALS OF MECHANICAL ENGINEERING **Category: Engineering Science Course** **(Common to all Programs Except ME Cluster Programs)** **(Theory)**					
Course Code	**:**	ME113ATE / ME123ATE	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0	**SEE**	**:**	**100 Marks**
Total Hours	**:**	45L + 45 EL	**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Engineering Materials: Introduction and Classification of Engineering materials, Thermoset and Thermoplastics polymers, Ceramics, Classification of Fiber Reinforced Polymers (FRP) and their applications. **Properties of materials:** Mechanical, Thermal, Chemical, Physical, Magnetic, Optical, Electrical and Electronics, Stress-Strain Diagram for mild steel & Cast Iron. materials and its desirable properties for Aerospace, Automotive, Electronic and Biomedical applications.	
Unit – II	**09 Hrs**
Metal Joining Processes: Introduction to metal joining processes, Welding & Soldering and its differences, Principle of Arc Welding, Gas Welding and soldering. Materials for Welding and soldering. Safety devices. Advances in welding Technology: TIG and MiG welding, Principle and applications.	
Unit –III	**09 Hrs**
Lathe and Drilling Machines: Lathe: Introduction, Principle of Lathe, Lathe specifications, Major parts of Lathe and their functions, Lathe operations-Turning, Taper turning, thread cutting, Boring, Facing, Reaming & Knurling. **Drilling Machine:** Introduction to Drilling, Principle of Radial Drilling Machine, Drilling Machine Operations: Boring, Counterboring, countersinking, Tapping.	
Unit –IV	**10 Hrs**
Mechanical Drives: Classification of IC Engines, Working of 4-Stroke petrol and diesel Engines and Comparison. Efficiency of Engines, FHP, BHP and IHP and numerical on IC Engines. **Electrical Drives:** History of Electric vehicles, Configurations, EV/ICEV comparison, Performance, Traction Motor Characteristics, Concept of Hybrid Electric Drive Trains, Classification of hybrid electric vehicles.	
Unit –V	**08Hrs**
Mechatronics: Introduction, Evolution of Mechatronics system, Open and Closed loop control system, basic elements of control system, Applications- Electronic Fuel Injection(EFI), Traction Control System (TCS), Adaptive cruise Control(ACC). Industrial Robots, Aerial Robots, Anti-lock Braking System (ABS). **Automation in Manufacturing**: Introduction to Automation, Its advantages and disadvantages, Types of Automation, Historical Development. **Robotics in Manufacturin**g: Robots- Basic Structure of Robots, Robot Anatomy, Classification of Robots, Fundamentals about Robot Technology, Basic Robot Configurations and their Relative Merits and Demerits.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand core mechanical concepts, material science and energy systems.
CO2	Classify and select material for various engineering applications, Principal of IC engines, Series parallel hybrid Electric vehicles, Energy, Robotics configurations.
CO3	Identify and classify engineering. materials in manufacturing processes, exposure to traditional and modern manufacturing methods. Awareness of metal joining processes for various applications.
CO4	Understanding of Hybrid Electric Vehicles

Reference Books	
1.	Elements of Mechanical Engineering, K. R. Gopalakrishna, Subhas Publications, 35th Edition August-2015
2.	Material Science & amp; Engineering- William D Callister, 2 / 10th Edition, ISBN 978-1-119-45520-2.
3.	Electric and Hybrid Vehicles Design Fundamentals, By Iqbal Husain, ISBN 9781032312989, 498 Pages 343 B/W Illustrations Published February 22, 2021 by CRC Press.
4.	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Mehrdad Ehsani, Yimin Gao, ISBN 9780367137465,572 Pages, Published March 28, 2018 by CRC Press .
5.	Mechatronics: Electronic Control Systems In Mechanical And Electrical Engineering 7th Edition, Kindle Edition, by W. Bolton (Author) Format: Kindle Edition , Pearson; 7th edition (5 December 2018).

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	20
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
MAXIMUM MARKS FOR THE CIE (THEORY)		**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective-type questions covering the entire syllabus	10
	PART B **(Maximum of THREE Sub-divisions only)**	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Programming Language Lab Courses

- **INTRODUCTION TO PYTHON PROGRAMMING (CI115AIA/CI125AIA)**
- **INTRODUCTION TO WEB PROGRAMMING (CS115AIB/CS125AIB)**
- **BASICS OF JAVA PROGRAMMING (CS115BIC/CS125BIC)**
- **INTRODUCTION TO C++ PROGRAMMING (CS115AID/CS125AID)**

Semester: I/ II						
Introduction to Python Programming **Category: Programming Language Course** **Stream: ALL** **(Common to all Programmes)** **(Theory & Practice)**						
Course Code	**:**	**CI115IA/CI125AIA**		**CIE**	**:**	**100+50 Marks**
Credits: L: T: P	**:**	**2:0:1**		**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	**30L + 30EL + 30P**		**SEE Duration**	**:**	**03+03 Hours**

Unit I — **06 Hrs.**

Introduction to Python

Getting Started

Setting Up Your Programming Environment, Python on Different Operating Systems, Running a Hello World program, Running a Python Program from a Terminal.

Variables and Simple Data Types

What Really Happens When You Run hello_world.py, Variables, Strings, Numbers, Comments.

If Statements

A Simple Example, Conditional Tests, if Statements, Using the else Clause, Styling Your if Statements, Compound Conditions, **User input and while loop,** How the input () Function Works, introducing while Loops, Using a while Loop with Lists and Dictionaries

Unit II — **06 Hrs.**

For Loops, Strings, and Tuples: Using for Loops, counting with the For Loops, Using Sequence Operators and Functions with Strings, Indexing Strings, Slicing the Strings, Creating the Tuple, Using Tuple

Introducing List

What Is a List? Changing, Adding, and Removing Elements, organizing a List, Avoiding Index Errors When Working with Lists. **Working with Lists:** Looping Through an Entire List, Avoiding Indentation Errors, Making Numerical Lists, Working with Part of a List, Styling Your Code.

Unit III — **06 Hrs.**

Dictionaries

A Simple Dictionary, Working with Dictionaries, Looping Through a Dictionary, Nesting, Sets, Working with Sets, and Operations with Sets

Functions

Defining a Function, Passing Arguments, Return Values, Passing a List, Passing an Arbitrary Number of Arguments, Storing Your Functions in Modules, and Styling Functions.

Unit IV — **06 Hrs.**

Classes

Creating and Using a Class, Working with Classes and Instances, Inheritance, Importing Classes, Understanding Object Encapsulation. Extending a Class through Inheritance, Understanding Polymorphism

Files and Exceptions

Reading from a File, writing to a File, Exceptions, Storing Data

Unit V — **06 Hrs.**

Numpy: Creating Numpy Arrays (zeros, ones, arrange, linspace), Numpy arrays VS. Python Lists, array Indexing and Slicing, Aggregation Functions

Pandas: Introduction to Data Frames, Reading Writing Data (CSV, Excel, JSON), Data inspection (head, info, describe), Indexing, Handling Missing Data

Matplotlib: Introduction to plotting, Basic plots (Line, Scatter, Bar, Pie chart), Customising the plots (Labels, Legends, Grids), Subplots and Layouts, Introduction to seaborn for advance visualization.

Course Outcomes	
CO1	Apply fundamental Python programming concepts to address basic computational tasks relevant to diverse engineering domains. (PO1)
CO2	Identify and solve engineering domain-specific problems using appropriate Python data structures. (PO2)
CO3	Design modular and object-oriented Python programs using modern computing tools to perform data analysis, contributing to engineering solutions. (PO3)
CO4	Collaborate effectively in teams and communicate clearly to develop and present real-world engineering solutions using Python programming skills. (PO8, PO9)

PART A	
LABORATORY EXERCISES	
1	Introductory Lab: Lab-Installation and Working with the Sample Programs
2	Write a program to determine if a given number is a perfect number.
3	Write a program to calculate the Body Mass Index (BMI Calculator) and categorize BMI results into different health categories (underweight, normal weight, overweight, obesity).
4	Simulate a robotic arm transformation using matrix multiplication. Multiply a matrix of joint positions (coordinates) with a transformation matrix and print the new coordinates.
5	Read a paragraph from the user and count the number of words, the frequency of words appearing, and search for a specific word.
6	Take a sequence of numbers that has some missing entries. Write a Python program to fill in those missing values, remove certain numbers from the sequence, and add additional values to enhance the existing sequence.
7	Create a Simple Banking System using dictionaries and perform deposit, withdrawal, and checking balance operations.
8	Write a program using sets to find the common words present in a list of sentences.
9	Given a list of students' records as tuples, sort the list by marks, and find the topper.
10	Create a text file called my_file.txt with some content, capitalize the first letter of every word, and print the content of the file in reverse order.
PART B	
Students perform any one of the following: 1. Design and develop a Python GUI application connected to the Sustainable Development Goals (SDGs) of interest, 2. Real-time simulation projects, 3. Data analysis and Visualization Projects, 4. Problem-solving & Algorithms, and 5. Any interdisciplinary projects.	

Reference Books	
1.	Eric Matthes, Python Crash Course: A Hands-on, Project-Based Introduction to Programming, 2nd Edition, No Starch Press, Inc., ISBN-10: 1-59327-928-0, 2019.
2.	John V. Guttag. Introduction to Computation and Programming using Python, The MIT Press, Cambridge, Massachusetts, London, ISBN: 978-0-262-51963-2, 2013.
3.	Wes McKinney, Python for Data Analysis, 3rd Edition, O'Reilly Media, ISBN-13: 978-1098104030, 2022.
4.	VanderPlas, J, Python Data Science Handbook: Essential Tools for Working with Data. O'Reilly Media, ISBN-13: 978-1491912058, 2016.
5.	Mark Summerfield, Programming in Python 3: A Complete Introduction to the Python Language, 2nd Edition, ISBN-13: 978-0-321-68056-3, ISBN-10: 0-321-68056-1.
6.	Bradley N. Miller, David L. Ranum, *Problem Solving with Algorithms and Data Structures Using Python*, 2nd Edition, Franklin, Beedle & Associates Inc., ISBN-13: 978-1-59028-257-1, 2011.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY & LAB)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted, & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding upto 20 marks.	20
2.	TESTS: Students will be evaluated through tests and descriptive questions with varying complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, totaling adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/ presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/ Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	TOTAL MARKS FOR THE COURSE (Theory + Practice)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	**Objective-type questions covering the entire syllabus**	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I : (Compulsory)	18
3	Unit – II : (Compulsory)	18
4 & 5	Unit – III : Question 4 or 5	18
6 & 7	Unit – IV : Question 6 or 7	18
8 & 9	Unit – V : Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I/II						
Introduction to Web Programming **Category: Programming Language Course** **(Common to all Programmes)** **(Theory & Practice)**						
Course Code	**:**	**CS115AIB/CS125AIB**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**2:0:1**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**30L + 30EL + 30P**		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**06 Hrs**
Introduction to Web Concepts: Fundamentals of Web -Introduction to Internet, World Wide Web, Web Browsers and Web Servers, Uniform Resource Locators, MIME (Multipurpose Internet Mail Extensions), Hypertext Transfer Protocol -HTTP Request Phase, HTTP Response Phase.	
Unit – II	**06 Hrs**
XHTML: Basic syntax, Standard XHTML document structure, Basic text markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic differences between HTML and XHTML.	
Unit –III	**06 Hrs**
CSS (Cascading Style Sheets): Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution.	
Unit –IV	**06 Hrs**
The Basics of JavaScript: Overview of JavaScript; Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements, Object creation and modification; Arrays; Functions; Constructor	
Unit –V	**06 Hrs**
Database access through Web: Introduction to Database Systems, Relational databases, Introduction to SQL- Simple SQL Queries. USE CASES: Explore AI tools for Web Development, design & UI (Github Copilot, Uizard).	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Explain the fundamental concepts of web and syntax & semantics of different web programming tools such as HTML, CSS and JavaScript.
CO2:	Apply the concepts of different web frameworks to build static and dynamic web pages.
CO3:	Design and Develop client side of the application using an appropriate web programming tool
CO4:	Demonstrate real world web-based applications for different domains.

LABORATORY COMPONENT	
Part - A and Part – B details here	
1	Familiarization with IDE -Compilation, Debugging and execution considering simple programs.
2	Implementation and execution of simple HTML/XHTML programs to understand working of • Tables . Lists • Frames • Forms

3	Web page styling with CSS • Font Properties • List Properties • Color Properties • Box Model • Background Image • Conflict Resolution
4	Web Page validation using JavaScript • Data Types, Operators and Expressions • Object creation, modification and Constructors • Screen output and keyboard input • Pattern matching using regular expressions
5	Web application using JavaScript with MySQL

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS**.**	20
2.	TESTS: Students will be evaluated through tests and descriptive questions with varying complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, totaling adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	**Objective-type questions covering the entire syllabus**	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I/II						
Basics of Java Programming **Category: Programming Language Course** **(Common to all Programmes)** **(Theory & Practice)**						
Course Code	**:**	**CS115BIC/CS125BIC**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**2:0:1**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**30L + 30EL + 30P**		**SEE Duration**	**:**	**3 + 3 Hours**

Unit I	**06 Hrs**

Basics of Java and Programming Constructs

History and evolution of Java, The Java Buzzwords; Overview of Java platform and architecture (JVM, JDK, JRE); Basic syntax and structure of a Java program; Data types, variables, keywords, Type Conversion and casting, arrays (Single-dimensional & Multidimensional) and Strings; Operators and expressions, Operator Precedence; Control flow statements: if, if-else, switch, loops (for, while, do-while); Writing simple Java programs with console input/output.

Case-Study:

a) Control Flow & Arrays – Rule-based Classification

Determine the health risk category of a patient based on temperature and symptoms.

Concepts: if-else, arrays, switch, data types

b) Strings & Arrays – Sentiment Classification (Basic NLP)

Accept a sentence and classify it as positive, negative, or neutral

Concepts: String, arrays, string functions, basic feature extraction

Unit II	**06 Hrs**

Classes, Objects and Methods

Paradigms of Programming**,** Object-Oriented Programming, The Three OOP Principles; Class Fundamentals, Declaring Objects, Assigning Object Reference, Variables, Introducing Methods, Constructors, this keyword, Method overloading, Access Control, using static, Using final keyword.

Case Study: Classes & Objects – Student Performance Evaluator

Create a Student class to store marks, calculate average, and classify as Distinction/Pass/Fail

Concepts: OOP, constructor, encapsulation, method overloading

Unit III	**06 Hrs**

Inheritance:

Inheritance Basics, Using Super, Method Overriding, Abstract Classes, Using final with Inheritance.

Case Study: Inheritance & Polymorphism – Chatbot Skeleton

Design a simple chatbot with base class Bot and derived class HealthBot, EduBot, etc.

Concepts: Inheritance, method overriding, runtime polymorphism.

Unit IV	**06 Hrs**

Packages and Interfaces:

Packages: Defining a Package, Packages and Member Access, Importing Packages.

Interfaces: Defining an Interface, Default Interface Methods.

Case Study: Interfaces & Packages – Feature Extractor Interface

Define an interface FeatureExtractor with method extractFeatures(), and implement for TextData and NumericData classes.

Concepts: Interface, package, abstraction

Exception Handling: Exception-Handling Fundamentals- try ,catch, finally blocks; Exception Types; Throw, throws keywords and custom exceptions**,** Java's Built-in Exceptions.

Case Study: Exception Handling – Data Validation Simulator

Simulate input form and throw custom exceptions for invalid input (e.g., age < 0, marks > 100).

Concepts: try, catch, custom exception class.

Unit V	06 Hrs
Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization basics. **Case Study: Multithreading – Parallel Data Loading** Load training data and test data in parallel using threads. Concepts: Thread, Runnable, join(), sleep()	

Course Outcomes	
CO1	Explore the fundamentals of Object -oriented concepts and apply features of object-oriented programming of Java to solve real world problems.
CO2	Design Classes and establish relationship among Classes for various applications from problem definition.
CO3	Analyze and implement reliable object-oriented applications using Java features such as Exception Handling, Multithreaded Programming
CO4	Design and develop real world applications using Object Oriented concepts and Java programming.

Laboratory Experiments	
1	Familiarization with IDE - compilation, debugging and execution considering simple Java programs. Implement programs on Fundamentals of Java Programming: Data Types, Variables and Arrays , Operators , Control Statements.
2	**Open-Ended / Project Based Learning:** Students must demonstrate **AI application** on the problem statements chosen from Health Care, Agriculture, Manufacturing, Automobiles and Process Control/Automation, Education Domains mapped to the Sustainable Development Goals (SDGs). **Design and develop an AI application- Classification/Prediction/Generation** to demonstrate suitable Object-Oriented concepts and Core Java programming features listed below: **1. Classes, Objects and Methods** ● user defined classes and objects. ● class members and their properties. ● Methods, constructors, method / constructor overloading. **2. Inheritance and Polymorphism** ● user defined classes and objects illustrating concept of Inheritance ● class members to demonstrate Polymorphism **3. Package and Interfaces** ● Creation of package/s. ● Accessing a package/s using different Access Specifiers ● Implementing interfaces **4. Exception handling** ● Predefined exceptions. ● Custom Exceptions **5. Multithreading** Illustrate multithreaded concept: a) Using Thread class. b) Using Runnable interface

Reference Books	
1.	Java - The Complete Reference , Herbert Schildt, 13th Edition, 2024, McGraw Hill Education Publications, ISBN-10: 9355326475, ISBN-13: 978-9355326478.
2.	Introduction to Java Programming, Y Daniel Liang, Comprehensive Version, 10th Edition , January 2018, Pearson education, ISBN 10: 935306578X ISBN 13: 978-9353065782.
3.	Core Java – Vol 1, Cay S.Horstmann, 12th Edition, 2023, Pearson Education, ISBN-10: 8119847334, ISBN-13: 978-8119847334.
4.	Head First Java: A Brain-Friendly Guide, by Kathy Sierra, Bert Bates, Trisha Gee, Third Edition, June 2022, Orielly publication, ISBN-10 : 9355420900, ISBN-13 : 978-9355420909
5.	Object-Oriented Analysis and Design With applications, Grady Booch, Robert A Maksimchuk, Michael W Eagle, Bobbi J Young, 3rd Edition, 2015, Pearson education, ISBN : 8131722872, ISBN-13 : 978-8131722879
6.	https://onlinecourses.nptel.ac.in/noc25_cs110/preview - Programming In Java, NPTEL course**,** By Prof. Debasis Samanta, IIT Kharagpur
7.	https://java-iitd.vlabs.ac.in/ - Core Java Programming Virtual Lab, Indian Institute of Technology Delhi

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
#	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS**.**	20
2.	TESTS: Students will be evaluated through tests and descriptive questions with varying complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, totaling adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (20 Marks),lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (20Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	**Objective-type questions covering the entire syllabus**	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Semester: I/II						
Introduction to C++ Programming **Category: Programming Language Course** **(Common to all Programmes)** **(Theory & Practice)**						
Course Code	**:**	**CS115AID/ CS125AID**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**2:0:1**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**30L + 30EL + 30P**		**SEE Duration**	**:**	**3 + 3 Hours**

Unit I	**06 Hrs**
The Foundation of C++: The C Subset An Overview of C, Expressions, Statements, Arrays and Null-Terminated Strings, Pointers, Functions, C-Style Console I/O, The Preprocessor and Comments	
Unit II	**06 Hrs**
C++ Foundations (contd.): Structures, Unions, Enumerations, and User-Defined Types **C++:** An Overview of C++, Classes and Objects, Arrays, Pointers, References, and the Dynamic Allocation Operators, Function Overloading, Copy Constructors, and Default Arguments, Operator Overloading	
Unit III	**06 Hrs**
C++ (contd.): Inheritance, Virtual Functions and Polymorphism, Templates, Exception Handling, The C++ I/O System Basics, C++ File I/O, Run-Time Type ID and the Casting Operators	
Unit IV	**06 Hrs**
The Standard Function Library: The C-Based I/O Functions, The String and Character Functions. The Mathematical Functions, Time, Date, and Localization Functions, The Dynamic Allocation Functions, Utility Functions, The Wide-Character Functions	
Unit V	**06 Hrs**
The Standard C++ Class Library: The Standard C++ I/O Classes, The STL Container Classes, The STL Algorithms, STL Iterators, Allocators, and Function Objects, The String Class, The Numeric Classes, Exception Handling and Miscellaneous Classes	

Course Outcomes	
CO1	Exhibit program design and implementation competence through the choice of appropriate object oriented concept and explain the benefits of the same.
CO2	Design and analyse the classes and objects using object-oriented programming paradigm, for real world case studies.
CO3	Implement the solutions for real-time problems using Object Oriented concepts.
CO4	Apply and analyze the advanced features of C++ specifically templates and operator overloading which influences the performance of programs.

Laboratory Experiments **(Implement the following in gcc compiler)**	
1	Implement the following requirement: An electricity board charges the following rates to domestic users to discourage large conceptions of energy. 0 - 100 units : Rs 1.50 per unit 101 - 200 units : Rs 1.80 per unit Beyond 200 units: Rs 2.50 per unit All users are charged a minimum of Rs 50. If the total amount is more than Rs 300 then an additional surcharge of 15% is added. The C++ program must read the names of users, number of units consumed and display the calculated charges.
2	Design and implement a class STUDENT with attributes like: roll number, name, 3 tests marks. Implement member functions

	a. to read student data like name and test marks, b. to compute average marks (considering best two out of three test marks) and c. to display the student information. Declare an array of STUDENT objects in the main function, use static data member to generate unique student roll number.
3	Design and implement a C++ program using class to process Shopping list for a departmental store. The list include details such as the Code No., Name, Price of each item and operations like adding, deleting items to the list and printing the total value of an order.
4	Design and implement a C++ class POLYNOMIAL. The internal representation of a POLYNOMIAL is an array of terms. Each term contains a coefficient and an exponent, e.g., the term $2x^4$ has the coefficient 2 and the exponent 4. Implement a class containing constructors and the following capabilities: a. Overload the addition operator (+) to add two polynomials b. Overload the assignment operator to assign one polynomial to another c. Overload the multiplication operator (*) to multiple two polynomials d. Overload the >> operator to enable input through in. e. Overload the << operator to enable output throughout. Member function to compute value of the polynomial, given the value of x.
5	Design and implement a C++ program to create an abstract class - SHAPE to represent any shape in general. The class should have two pure virtual functions to read dimensions and to compute the area. Create three derived classes - CIRCLE, RECTANGLE, and SQUARE by inheriting the features of class SHAPE. Implement the functions to read and compute the area. Add constructors, method to display the results as required. (Assume appropriate attributes).
6	Implement the following functionalities on strings (use *string* class) i. Find a substring in the given (read by user) string ii. Append new string to the existing string iii. Insert a new string at a position read from the user iv. Remove 'N' characters from the string, starting from the position indicated by the user Replace 'N' characters within a given string
7	Write a template function to search for a given key element from an array. Illustrate how you perform search in integer, character as well as double arrays using the same template function.
8	Write a C++ program using generic class to implement queue of integers, floating point numbers and strings. Support the queue operations like insert, delete and display in the queue class.

Reference Books	
1.	The Complete Reference C++, Herbert Schildt, 5th Edition, 2020, McGrawHill, ISBN: 9780070532465.
2.	C++ How to Program, Paul Deitel and Harvey Deitel, 8th Edition,2018,Prentice Hall,ISBN-9780132990448.
3.	Big C++, Cay S. Horstmann, Timothy Budd, 1st Edition, 2020, Wiley India (P.) Ltd ISBN: 9788126509201.
4.	Thinking in C++-Introduction to standard C++, Bruce Eckel, http://iacs-courses seas.harvard.edu/courses/cs207/resources/TIC2Vone.pdf Vol 1, 2nd Edition, 2002 , Pearson, ISBN:10: 8131706613
Online/NPTEL course links	
1.	https://onlinecourses.nptel.ac.in/noc21_cs02/preview
2.	https://nptel.ac.in/courses/106105234
3.	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
Virtual Lab link	
1.	https://cse02-iiith.vlabs.ac.in/ - Computer Programming (MoE, Govt. of India initiative)

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY + PRACTICE)		
#	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS**.**	20
2.	TESTS: Students will be evaluated through tests and descriptive questions with varying complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted (Two regular tests and one optional improvement test). Each test will be evaluated for 50 Marks, totaling adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). **ADDING UPTO 40 MARKS.**	40
4.	LAB: Conduction of laboratory exercises, lab report, observation, and analysis (40 Marks) and lab test (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	50
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	**Objective-type questions covering the entire syllabus**	10
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit – I: (Compulsory)	18
3	Unit – II: (Compulsory)	18
4 & 5	Unit – III: Question 4 or 5	18
6 & 7	Unit – IV: Question 6 or 7	18
8 & 9	Unit – V: Question 8 or 9	18
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LABORATORY)
Evaluation will be conducted as problem / project based learning, which is program / laboratory specific

Humanities and Social Science Courses

- **COMMUNICATIVE ENGLISH - I (HS111EL)**
- **COMMUNICATIVE ENGLISH - II (HS121EL)**
- **SAMSKRUTIKA KANNADA(HS112KS/HS122KS)**
- **BALAKE KANNADA (HS113KB/HS123KB)**
- **FUNDAMENTALS OF INDIAN CONSTITUTION (HS114TC/HS124TC)**
- **SCIENTIFIC FOUNDATIONS OF HEALTH: YOGA (HS115YL/HS125YL)**

Semester: I

COMMUNICATIVE ENGLISH-I

Category: Humanities & Social Sciences

Common to all Programmes

Practice

Course Code	**:**	**HS111EL**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**30P**		**SEE Duration**	**:**	**02 Hours**

Online English Course: Standardized Test Of English Proficiency – From The Hindu Group

About the Course: STEP (Standardized Test of English Proficiency) train is 20 hours of adaptive course. designed to improve every aspect of English language learning – Listening, Speaking, Reading and Writing skills. The STEP train course assesses learner's current language level as well learning intent against global standards.

The online course includes the following:

1. 45-minute Diagnostic test (baseline) to ascertain the current level of English proficiency.
2. Personalized course content (50-Hours) based on baseline levels including Detailed instructions, practice sessions, interactions, feedback, and assessments.

The course begins with a baseline test which determines the learner's current language levels. Based on their language levels, the course will provide the learner with webisodes suitable to their language levels. The course is also interspersed with exercises and mid-line tests. Based on the learner's performance in these tests, and their strengths and challenges/gaps, the course will adaptively provide webisodes matching their performance profile.

Unit I — **10 Hrs**

Core Communication & Foundational Skills

- **Theme: Everyday Interactions & Basic Fluency**
  - Listening (Conversational/Inquiry): Discussions about places, radio interviews, enquiring about routines.
  - Speaking (Conversational/Transactional): Reacting to news, making plans/arrangements, asking for clarification, reading timetables and safety regulations aloud.
  - Reading (Comprehension/Informative): General articles.
  - Writing (Grammar Application/Structural): Question words, Parts of Speech (1 & 2).
  - Grammar (Descriptive/Expressive): Appearance and Personality, Feelings and Emotions.
  - Vocabulary (Directional): Giving directions.
  - Communication Skill Focus: Informative, Descriptive, Transactional, Conversational, Foundational Grammar.
- **Theme: Deeper Engagement & Expressive Language**
  - Listening (Informative/Analytical): Talks on mental health, reclaiming female prerogatives, team meetings.
  - Speaking (Explanatory/Discursive): Giving reasons and explanations, expressing opinions, negotiating skilfully.
  - Reading (Instructive/Descriptive): Instructions on procedures, articles on art.
  - Writing (Persuasive/Narrative): Persuasive writing, narrative writing, using appropriate tone for different audiences.
  - Grammar (Enhancement): Intensifiers, Adjective Collocation.
  - Vocabulary (Legal/Political): Words from the Indian Constitution (1 & 2).
  - Communication Skill Focus: Explanatory, Expressive, Persuasive, Narrative, Negotiation, Audience Adaptation.
- **Theme: Reporting, Feedback & Pronunciation Basics**
  - Listening (Informative/Analytical): Talks on healthcare challenges, panel discussions, movie discussions.
  - Speaking (Evaluative/Reportive): Giving feedback, reporting incidents, using stress and intonation.
  - Reading (Informative/Analytical): Articles about bills, India's achievements in space.
  - Writing (Argumentative/Structural): Supporting a point of view, writing introductions and conclusions.
  - Grammar (Structural): Ellipsis and tags, Idioms and Phrases (1 & 2).
  - Vocabulary (Legal/Political): Political and legal jargon.
  - Communication Skill Focus: Evaluative, Reportive, Argumentative, Structural Writing, Pronunciation Foundation.

Unit II — **10 Hrs**

Professional Readiness & Advanced Dialogue

- **Theme: Finance, Job Search & Application Skills**

- Listening (Informative/Technical): Talks on finance (Section 80C, Income tax slabs, Standard Deductions, Twin balance sheet problem).
- Speaking (Pronunciation/Narrative): Commonly mispronounced words, pronunciation of fricatives, describing personal experiences.
- Reading (Analytical/Argumentative): Articles with opinions.
- Writing (Expository/Structural): Writing expositions.
- Strategies (Placement/Job Search): Campus placement processes, off-campus placement, decoding job postings, researching employers and industry.
- Communication Skill Focus: Informative, Technical Comprehension, Expository Writing, Job Search Strategy.

- **Theme: Group Discussions & Email Correspondence**
  - Speaking (Collaborative/Discursive): Group Discussion (2).
  - Strategies (Business Communication/Email): Emails (introduction, applying, accepting, rejecting).
  - Strategies (Interview Basics): Interview introduction, being a team player.
  - Speaking (Informative/Explanatory): Talking about work and study, giving reasons.
  - Writing (Structural/Summarization): Paraphrasing, Summarizing.
  - Grammar (Structural): Modals (Could for past possibility), Discourse Markers (Summarising), Compound Adjectives, Idioms and Phrases (3).
  - Vocabulary (Descriptive/Contextual): Words to talk about people, words for giving reasons, words for expressing preferences.
  - Communication Skill Focus: Collaborative, Discursive, Business Correspondence, Interview Preparation, Structural Writing.
- **Theme: Advanced Debates & Core Interview Skills**
  - Listening (Informative/Analytical): Talks on finance (Fiscal deficit), debates on unemployment.
  - Speaking (Collaborative/Discursive): Group Discussion (3 & 4).
  - Reading (Analytical/Argumentative): Analyzing advantages and disadvantages in writing.
  - Writing (Structural/Academic): Tenses (Present Perfect Simple), Precis Writing, Expository Essay.
  - Grammar (Refinement): Confusing Adverbs, Idioms and Phrases (4).
  - Vocabulary (Professional): Workplace Jargon (1).
  - Strategies (Interview Deep Dive): Interview skills (learning, achievement, problem-solving, productivity).
  - Communication Skill Focus: Analytical, Argumentative, Academic Writing, Advanced Interviewing, Discursive.

Unit III	**10 Hrs**

Strategic Communication & Mastery

- **Theme: Advanced GDs, Interview Mastery & Writing Refinement**
  - Listening (Informative/Analytical): Lectures on mysteries of space.
  - Speaking (Collaborative/Discursive): Group Discussion (5 & 6).
  - Writing (Structural/Cohesion): Linking Words, Learning New Phrases.
  - Grammar (Idiomatic): Idioms and Phrases (5, 6, 7).
  - Vocabulary (Professional): Workplace Jargon (2 & 3).
  - Strategies (Advanced Interviewing): Interview skills (fit, communication, body language, phone interviews), Upskilling.
  - Communication Skill Focus: Collaborative, Interview Mastery, Cohesive Writing.
- **Theme: Persuasion, Presentation & Sentence Structure**
  - Listening (Informative/Analytical): Talk about social media.
  - Writing (Persuasive/Descriptive/Structural): Argumentative essay, descriptive essay, structuring paragraphs (Part 1 & 2), structuring sentences (Part 1 & 2).
  - Strategies (Persuasive Communication): Persuasive Communication (1, 2, 3, 4, 5, 6).
  - Strategies (Presentation Skills): Presentation (pre-plan, plan, involve audience, good start, texts, visuals, eye contact, posture).
  - Grammar (Advanced Tenses/Phrases): Tenses (Past Perfect Continuous with Relative Clauses), Using phrasal verbs, Idioms and Phrases (8, 9, Q22020_GR_IdiomsPhrases9_B2).
  - Vocabulary (Legal/Political): Words from the Indian Constitution (5 & 6).
  - Communication Skill Focus: Persuasive, Argumentative, Presentation, Structural Writing, Academic Essay

Writing.

- **Theme: Nuance in Communication & Business Etiquette**
  - Listening (Conversational/Analytical): Colloquialisms, short discussions, presentations.
  - Speaking (Discursive/Transactional/Pronunciation): Agreeing and disagreeing, asking for information, pronunciation (Intonation, Stress, Diphthongs, Plosives, Accent Neutralisation).
  - Writing (Evaluative/Formal): Giving feedback, accepting responsibility for a mistake.
  - Strategies (Business Professionalism): Business Etiquette (1 & 2).
  - Vocabulary (Professional): Workplace Jargon (4, 5, 6, 7).
  - Communication Skill Focus: Discursive, Transactional, Professionalism, Evaluative, Expressive, Pronunciation Refinement.

Course Outcomes	
CO1	Comprehend spoken English in academic and social contexts and respond appropriately to a variety of audio inputs such as discussions, instructions, and conversations.
CO2	Articulate ideas clearly and confidently in formal and informal settings through structured presentations, group interactions, and extempore activities.
CO3	Interpret and analyze a range of texts by identifying key ideas, making inferences, and evaluating content across genres and disciplines.
CO4	Produce grammatically accurate, coherent, and well-structured written content suited to academic, professional, and everyday communication needs.

Reference Books	
1.	Standardized Test of English Proficiency-from The Hindu Group: e-books.
2.	Lambert, V., & Murray, E. (2003). Everyday Technical English: English for Work**.** Pearson Education Limited.
3.	Bonamy, D. (2011). Technical English Level 3: Course Book. Pearson Education Limited.
4.	Lambert, V., & Murray, E. (2003). Everyday Technical English: English for Work. Longman.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
	COMPONENTS	**MARKS**
1.	**Module Completion:** Students must complete **10 modules** on the STEP online portal, each carrying 1 mark, totalling **10 marks**. These modules focus on enhancing LSRW skills through guided practice.	10
2.	**Tests:** Two tests will be conducted during the semester to assess **listening, speaking, reading, and writing**. Each test will be for **50 marks**, and the combined total of **100 marks** will be scaled down to **20 marks**.	20
3.	Experiential Learning: Students will engage in **experiential learning activities**, targeting all of the LSRW skills. These activities carry a total of **50 marks** and will be scaled down to **20 marks**.	20
	MAXIMUM MARKS FOR THE CIE THEORY	**50**

Semester: I						
COMMUNICATIVE ENGLISH-II **Category: Humanities & Social Sciences** Common to all Programmes Practice						
Course Code	**:**	**HS121EL**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**30P**		**SEE Duration**	**:**	**02 Hours**

Online English Course: Standardized Test Of English Proficiency – From The Hindu Group

About the Course: STEP (Standardized Test of English Proficiency) train is a 20 hours of adaptive course. Designed to improve every aspect of English language learning – Listening, Speaking, Reading and Writing skills.The STEP train course assesses learner's current language level as well learning intent against global standards.

The online course includes the following:

1. 45-minute Diagnostic test (baseline) to ascertain the current level of English proficiency.
2. Personalized course content (50-Hours) based on baseline levels including detailed instructions, practice sessions, interactions, feedback and assessments.

The course begins with a baseline test which determines the learner's current language levels. Based on their language levels, the course will provide the learner with webisodes suitable to their language levels. The course is also interspersed with exercises and mid-line tests. Based on the learner's performance in these tests, and their strengths and challenges/gaps, the course will adaptively provide webisodes matching their performance profile.

Unit I — **10 Hrs**

Foundational Communication & Daily Life

- **Theme: Personal & Social Interactions**
  - Listening (Informative/Conversational): Understanding basic conversations (hospital calls, shopping, job discussions, self-descriptions, introductions, location descriptions).
  - Speaking (Descriptive/Informative): Discussing personal details (what you do, where you live, family, education, likes/dislikes), exchanging news.
  - Reading (Transactional/Informative): Comprehending basic documents (enquiry emails, articles describing places, letters to friends, prospectuses).
  - Writing (Descriptive/Expressive): Expressing personal preferences, writing about family and pets, describing rooms, hobbies, and general interests.
  - Communication Skill Focus: Informative, Descriptive, Expressive, Basic Transactional.
- **Theme: Foundational Grammar & Vocabulary**
  - Grammar: Determiners (very, adjectives), Nouns (singular, plural, 's' and 'es'), Verbs, Adjectives (basic, comparative Part 1 & 2), Modifying Adjectives, Position Adjectives.
  - Vocabulary: Parts of the body, head, leg, hand, types of pets, types of wild animals (Part 1).

Unit II — **10 Hrs**

Expanding Descriptive & Transactional Skills

- **Theme: Planning, Comparisons & Instructions**
  - Listening (Informative/Transactional): Understanding announcements (figures, prices, travel), and careful instructions.
  - Speaking (Transactional/Instructive): Making requests, asking permission, giving thanks and apologies, talking about quantities, reading recipes, asking questions.
  - Speaking (Comparative/Discursive): Comparing people and things, making suggestions, agreeing and disagreeing.
  - Speaking (Planning/Narrative): Discussing weekend plans, pastimes, making plans.
  - Reading (Informative/Narrative): Reading about weather, stories, guidebooks, directions, signs, and notices.
  - Writing (Narrative/Descriptive): Describing objects, past events, and work/school experiences.
  - Communication Skill Focus: Instructive, Comparative, Discursive, Planning, Narrative, Transactional.

- **Theme: Intermediate Grammar & Vocabulary Expansion**
  - Grammar: Adverbs (General, Time, Frequency), Predicative Adjectives, Superlative Adjectives (basic rules, more about superlatives), Types of wild animals (Part 2), Types of farm animals, Types of sea animals, Types

of birds.
- Vocabulary: Travel announcements, colours, cost.

Unit III	10 Hrs

Professional & Advanced Communication (10 Hrs)

- **Theme: Workplace & Advanced Social Interactions**
  - Listening (Conversational/Business): Understanding office news, meetings, project reports, discussions about office parties/sports events, interviews on hobbies, conversations about time, travel tips, talking about colleges.
  - Speaking (Business Communication/Interview): Talking about yourself in an interview, describing experiences, describing people.
  - Speaking (Transactional/Inquiry): Asking for prices, simple questions, explanations, asking people for things.
  - Speaking (Social/Invitational): Inviting people, reading social media posts, reading medicine labels, reading brochures/menus for events.
  - Writing (Business Communication/Formal): Writing formal emails, simple emails, thank you letters, apology letters, writing to exchange information, writing to give personal information.
  - Writing (Narrative/Reflective): Writing diary entries, writing about things that happened during a holiday.
  - Communication Skill Focus: Business Communication, Interviewing, Social Interaction, Inquiry, Explanatory, Formal Correspondence.
- **Theme: Advanced Grammar, Writing Structure & Persuasion**
  - Grammar: Adverbs of Degree (with adjectives, with verbs), Conjunctions, Position Prepositions, Modals (Yes/No Questions), Proper Noun Capitalisation, Present Continuous Tense, Question Types (Quantifiers), Mixed Conditionals, Negative Adverbials, Subject-Verb Agreement (Parts 1-6), Forms of Adjectives, Intensity of Adjectives, Active Voice, Passive Voice, Reported Speech (Rules and Form).
  - Vocabulary: Types of fruits (Part 1 & 2), Types of vegetables (Part 1 & 2), Types of sweets, Words about food, Things we see in a city, Things that we use in school, Things in a park, Things we can find in a restaurant, Weekend plans, Insects, Words for colours.
  - Writing (Analytical/Argumentative): Making a counter-argument.
  - Writing (Structural/Analytical): Parajumbles (1-6), Sentence Structure (1-6), Paraphrasing, Precis Writing, Expository Essay.
  - Writing (Persuasive/Argumentative): Persuasive Communication (1-6).
  - Communication Skill Focus: Persuasive, Argumentative, Report Writing, Narrative, Descriptive, Structural Writing

Course Outcomes	
CO1	Comprehend spoken English in academic and social contexts and respond appropriately to a variety of audio inputs such as discussions, instructions, and conversations.
CO2	Articulate ideas clearly and confidently in formal and informal settings through structured presentations, group interactions, and extempore activities.
CO3	Interpret and analyze a range of texts by identifying key ideas, making inferences, and evaluating content across genres and disciplines.
CO4	Produce grammatically accurate, coherent, and well-structured written content suited to academic, professional, and everyday communication needs.

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RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
	COMPONENTS	**MARKS**
1.	**Module Completion:** Students must complete **10 modules** on the STEP online portal, each carrying 1 mark, totalling **10 marks**. These modules focus on enhancing LSRW skills through guided practice.	10
2.	**Tests:** Two tests will be conducted during the semester to assess **listening, speaking, reading, and writing**. Each test will be for **50 marks**, and the combined total of **100 marks** will be scaled down to **20 marks**.	20
3.	Experiential Learning: Students will engage in **experiential learning activities**, targeting all of the LSRW skills. These activities carry a total of **50 marks** and will be scaled down to **20 marks**.	20
	MAXIMUM MARKS FOR THE CIE THEORY	**50**

Semester: I						
ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ **Category: Humanities and Social Sciences** **Common to all Programmes** **Theory**						
Course Code	**:**	**HS112KS/HS122KS**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**1:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**15L**		**SEE Duration**	**:**	**01 Hours**

ಅಧ್ಯಾಯ (Unit) - ೧	**05 Hrs**
೧. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ: ಹಂಪನಾಗರಾಜಯ್ಯ ೨. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ- ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ ೩. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ- ವಿ ತಾ ವಿ ಯ ಆಡಳಿತ ಕನ್ನಡ ಪುಸಕ್ತದಿಂದ ಆಯ್ದಲೇಖನ ೪. ವಚನಗಳು: ಬಸವಣ್ಣ ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯಕ್ಕಿಮಾರಯ್ಯ ಜೇಡರ ದಾಸಿಮಯ್ಯ ಆಯಕ್ಕಿ ಲಕ್ಕಮ್ಮ	

ಅಧ್ಯಾಯ (Unit) - ೨	**05 Hrs**
೧. ಕೀರ್ತನೆಗಳು: * ಅದರಿಂದೇನು ಫಲ-ಇದರಿಂದೇನು ಫಲ- <u>ಪುರಂದರದಾಸರು</u>,, * ತಲಣ್ಣಿಸದಿರು ಕಂಡ್ಯತಾಳು ಮನವೆ – <u>ಕನಕದಾಸರು</u> ೨. ಮಂಕುತಿಮ್ಮ ಕಗ್ಗ: ಡಿ.ವಿ.ಜಿ, ೩. ಡಾ. ಸರ್ ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ- ವ್ಯಕ್ತಿ ಮತ್ತು ಖ್ಯಾತಿಹ್ಯ:ಎ.ಎನ್.ಮೂರ್ತಿರಾವ್ ೪. ಹೊಸಬಾಳಿನ ಗೀತೆ: ಕುವೆಂಪು	

ಅಧ್ಯಾಯ (Unit) - ೩	**05 Hrs**
೧. ಕುರುಡು ಕಾಂಚಾಣಾ: ದ.ರಾ.ಬೇಂದ್ರೆ ೨. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ ೩. ತತ್ಸಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು– ಶಿಶುನಾಳ ಷರೀಫ, ಶಿವಯೋಗಿ – ಬಾಲಲೀಲಾ ಮಹಾಂತ ಶಿವಯೋಗಿ ೪. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿeÁÕನ: ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ 5. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ. ಚಿ. ಮೋರಲಿಂಗಯ್ಯ	

ಕಲಿಕಾ ಫಲಿತಾಂಶಗಳು / Course Outcomes:

CO1	ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯಮತ್ತು ಸಂಸ್ಕೃತಿ, ಹಿರಿಮೆಯ ಪರಿಚಯವಾಗುತದ್ದೆ
CO2	ಕನ್ನಡ ಸಾಹಿತ್ಯ ಆಧುನಿಕ ಪೂರ್ವ, ತಾಂತಿಕ್ಷ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ
CO3	ಕನ್ನಡದ ಕಾವ್ಯಪರಿಚಯ. · ಭಾಷಾಭ್ಯಾಸ ಹಾಗೂ ವಾಕ್ಯರಣದ ಬಗ್ಗೆತಿಳಿಯುವರು
CO4	ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿಸರಳ ವಾಕ್ಯಗಳೊಂದಿಗೆ ಮಾತನಾಡಲು ಪ್ರಯತಿಸುತಾರ್ತೆ.

Reference Books

೧.	"ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ" ಪಠ್ಯಪುಸಕ್ತ, ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ,ಎಲ್. ತಿಮ್ಮೇಶ್ ಮತ್ತು ವಿ. ಕೇಶವಮೂರ್ತಿ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತಿಕ್ಷ ವಿದ್ಯಾಲಯ
೨.	"ಆಡಳಿತ ಕನ್ನಡ" ಪಠ್ಯಪುಸಕ್ತ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತಿಕ್ಷ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ, ೨೦೧೯
೩.	"ಸಂಕಿಪ್ತ ಕನ್ನಡ ನಿಘಂಟು" (ಪರಿಷ್ಕೃತ), ಕನ್ನಡ ಸಾಹಿತ್ಯಪರಿಷತ್, ಬೆಂಗಳೂರು.
೪.	"ಕನ್ನಡ ಅನುಭವ", (ಪರಿಷ್ಕೃತ) ರಾ.ವಿ.ತಾಂತಿಕ್ಷ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು.

Assessment and Evaluation Pattern (Online Mode)		
	CIE (Online Mode)	**SEE (Online Mode)**
Weightage	**50%**	**50%**
Test – I	Each test will be conducted for 50 marks adding to 100 marks. Final test marks will be reduced to 40 marks	**Final assessment will be conducted for 50 marks**
Test – II		
Experiential Learning	10 Marks	
Communication Skills- Activity based test – Script writing, Essay Writing, Role plays. Any other activity that enhances the Communication skills. The students will be assigned with a topic by the faculty handling the batch. The students can either prepare a presentation/write essay/role play etc. for the duration (4-5 minutes per student). **Parameters for evaluation of the Presentation** a. Clarity in the presentation/ Speaking/Presentation skills. b. Concept / Subject on which the drama is enacted/ scripted		
Maximum Marks	50 Marks	**50 Marks**
Total marks for the course	**50**	**50**

Semester: I						
BALAKE KANNADA/ ಬಳಕೆ ಕನ್ನಡ **Category: Humanities and Social Sciences** **Common to all Programmes** **Theory**						
Course Code	**:**	**HS113KB/HS123KB**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**1:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**15L**		**SEE Duration**	**:**	**01 Hours**

Unit I	**05 Hrs**
1. Introduction: Necessity of learning a local language. Methods to learn the Kannada language. (Hints for correct and polite conversation, Listening and Speaking Activities) ೧. ಪರಿಚಯ: ಸ್ಥಳೀಯ ಭಾಷೆಯಾದ "**ಕನ್ನಡ ಭಾಷೆ**"ಯ ಪರಿಚಯದ ಅವಶಕ್ಯತೆ. ನೂತನ / ಸರಳ ಚಟುವಟಿಕೆಯ ಮೂಲಕ ಕನ್ನಡ ಭಾಷೆಯ ಕಲಿಕೆ. 2. Kannada aksharamaale, pronunciation and usage of the kannada letters. ೨. ಕನ್ನಡ ಅಕ್ಷರಗಳ ಪರಿಚಯ ಮತ್ತು ಉಚ್ಚಾರ್ಣೆ: 3. Personal Pronoun, Possessive Forms, Interrogative words. Nouns, pronouns, use of pronouns in kannada sentences. ೩. ವೈಯಕಿಕ್ತ ಸಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು. ನಾಮ ಪದಗಳು ಮತ್ತು ಸರಳ ವಾಕ್ಯಗಳ ಬಳಕೆ.	

Unit II	**05 Hrs**
1. Singular and plural nouns, Genders, Interrogative words ೧. ಬಹುವಚನ ನಾಮರೂಪಗಳು, ಲಿಂಗಗಳು, ಪಶ್ನಾರ್ಥಕ ಪದಗಳು. 2. Adjectives and its usage, inappropriate pronunciation, Numbers, fractions, colors ೨. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣ/ ಬಣ್ಣವಿಶೇಷಣಗಳು. 3. Questions constructing words ೩. ಪಶ್ನಾರ್ಥಕ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳ ರಚನೆ.	

Unit III	**05 Hrs**
1. List of vegetables, directions, Fruits, taste ೧. ಸಂಭಾಷಣೆಯಲ್ಲಿದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು. (ತರಕಾರಿಗಳ ಹೆಸರು, ದಿಕುಗಳು, ಹಣುಗಳ ಹೆಸರು) 2. verbs, Adverbs, conjunctions, prepositions, simple communicative sentences in kannada ೨. ಕ್ರಿಯಾಪದಗಳು: ದಿನನಿತ್ಯಬಳಕೆಯ ವಾಕ್ಯಗಳಲ್ಲಿಕ್ರಿಯಾ ಪದದ ಉಪಯೋಗ. 3. Activities in kannada, conversations. ೩. ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿಸರಳ ಸಂಭಾಷಣೆಯ ಚಟುವಟಿಕೆಗಳು.	

Course Outcomes	
CO1	Importance of learning local language Kannada. To understand the necessity of learning of local language for comfortable life ಸ್ಥಳೀಯ ಭಾಷೆಯಾದ ಕನ್ನಡ ಕಲಿಕೆಯ ಪಾಮುಖ್ಯತೆ ಮತ್ತು ದೈನಂದಿನ ಚಟುವಟಿಕೆಯಲ್ಲಿ ಅದರ ಉಪಯೋಗ.
CO2	Trying to understand the words, simple sentence and language. ಸಂಭಾಷಣೆಯಲಿನ್ನ ಸರಳ ವಾಕ್ಯಗಳನ್ನುಅರ್ಥೈಸಿಕೊಳುವರು.
CO3	Construction of simple sentences, according to the situation. Easy communication with everyone. ಸಂದರ್ಭಕ್ಕೆಅನುಗುಣವಾಗಿ ಸರಳ ವಾಕ್ಯಗಳ ರಚನೆ ಹಾಗು ಸಂಭಾಷಣೆ
CO4	Students are able to speak polite kannada conversation ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿಸರಳ ವಾಕ್ಯಗಳೊಂದಿಗೆ ಮಾತನಾಡಲು ಪಯತಿಷ್ಟುತಾರ್ತೆ.

Reference Books	
1.	"Balake Kannada", patyapusthaka, L. Thimmesh, and V. Keshavamurthy, Prasaranga Visveshvaraya University, Belgaum. "ಬಳಕೆ ಕನ್ನಡ" ಪಠ್ಯಪುಸಕ್ತ, ಎಲ್.ತಿಮ್ಮೇಶ್ ಮತ್ತು ವಿ. ಕೇಶವಮೂರ್ತಿ, ಪಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತಿಕ ವಿದಾಲಯ, ಬೆಳಗಾವಿ.
2.	"Kannada Kali", K. N. Subramanya, S. Narahari, H. G. Srinivasa Prasad, S. Ramamurthy and S.Sathyanarayana, 5th Edition, 2019, RV College of Engineering Bengaluru. "ಕನ್ನಡ ಕಲಿ" ಕೆ.ಎನ್. ಸುಬಮಣ್ಯ ಎಸ್.ನರಹರಿ, ಹೆಚ್.ಜಿ. ಶ್ರೀನಿವಾಸ ಪಸಾದ್, ಎಸ್.ರಾಮಮೂರ್ತಿ ಮತ್ತು ಎಸ್.ಸತ್ಯನಾರಾಯಣ ಈನೇ ಆವೃತಿ, ೨೦೧೯, ಆರ್.ವಿ. ತಾಂತಿಕ ಮಹಾವಿದಾಲಯ
3.	"Spoken Kannada", Kannada Sahithya Parishat, Bengaluru. " ಸ್ಪೋಕನ್ ಕನ್ನಡ"(ಮಾತನಾಡುವ ಕನ್ನಡ), ಕನ್ನಡ ಸಾಹಿತ್ಯಪರಿಷತ್ ಬೆಂಗಳೂರು.

Assessment and Evaluation Pattern (Online Mode)		
	CIE (Online Mode)	**SEE (Online Mode)**
Weightage	**50%**	**50%**
Test – I	Each test will be conducted for 50 marks adding to 100 marks. Final test marks will be reduced to 40 marks	**Final assessment will be conducted for 50 marks**
Test – II		
Experiential Learning	10 Marks	
Communication Skills- Activity based test – Script writing, Essay Writing, Role plays. Any other activity that enhances the Communication skills. The students will be assigned with a topic by the faculty handling the batch. The students can either prepare a presentation/write essay/role play etc. for the duration (4-5 minutes per student). **Parameters for evaluation of the Presentation** a. Clarity in the presentation/ Speaking/Presentation skills. b. Concept / Subject on which the drama is enacted/ scripted		
Maximum Marks	50 Marks	**50 Marks**
Total marks for the course	**50**	**50**

Semester: I/II						
FUNDAMENTALS OF INDIAN CONSTITUTION **Category: Humanities and Social Sciences** **Common to all Programmes** **Theory**						
Course Code	**:**	**HS114TC/HS124TC**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**1:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**15L**		**SEE Duration**	**:**	**01 Hours**
Unit I						**05 Hrs**
Indian Constitution - Introduction, Salient features of Indian Constitution, Preamble to the Indian Constitution and Fundamental Rights and its restrictions with Case Laws, Right to Information Act 2005.						
Unit II						**05 Hrs**
Directive Principles of State Policy and its present relevance in Indian Society, Fundamental Duties, Union **Executive:** Parliamentary system, President, Prime minister, Union Cabinet, Parliament- Lok Sabha & Rajya Sabha, Judicial System of India-Supreme court of India, and other courts, Judicial Reviews and Judicial activism.						
Unit III						**05 Hrs**
State Executive: Governor, CM, State cabinet Legislature: Vidhan Sabha & Vidhan Parishad , Election Commission, and Electoral Process, Amendment to Indian Constitution and Important constitutional amendments till today. Emergency provisions, Prohibition & Prevention of Sexual Harassment (POSH)Act 2013.						

Course Outcomes	
CO1	Demonstrate the citizen's fundamental Rights, & duties capability and to take affirmative action as a responsible citizen.
CO2	Identify the conflict management in legal perspective and judicial systems pertaining to professional environment, strengthen the ability to contribute to the resolve of human rights & Ragging issues and problems through investigative and analytical skills.
CO3	Empower individuals to prevent, recognize, and address sexual harassment, ultimately contributing to a safer, more respectful, and inclusive workplace.
CO4	To equip students with a comprehensive understanding of foundational structure, principles & functions of democratic and just society.

Reference Books	
1.	Dr. J. N Pandey, Constitutional Law of India, Central Law Agency, 2024 6th edn., ISBN-10-9392140517
2.	D. D. Basu,,Introduction to the Constitution of India Lexis Nexis 2024, 27th ed.: ISBN : 9788119403721
3.	Adv. Neeraj Salodkar, Practical Guide to the Right to Information Act, 2005 Notion Press, 2022

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE AVERAGE OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	10
2.	TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 20 MARKS**	20
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) adding upto 40 marks. **THE FINAL EL MARKS IS REDUCED TO 20 MARKS**.	20
	MAXIMUM MARKS FOR THE CIE THEORY	**50**

Semester: I/II						
SCIENTIFIC FOUNDATIONS OF HEALTH-YOGA PRACTICE **Category: Humanities & Social Sciences** (Common to all Programmes) (Practice)						
Course Code	**:**	**HS115YL/HS125YL**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**30P**		**SEE Duration**	**:**	**02 Hours**

Unit I	**10 hrs**
Introduction to Yoga: Definition and Meaning of Yoga, Aims and Objectives, Historical development of Yoga, Eight stages of Yoga, Relevance of Yoga in modern age and scope. **Prayers:** Shanthi Mantra and Loka Kalyana Mantra. Starting Practice –Swasa Kriya, Marjalaswasa, Swanaswasa, Urasandhi chalane, Greeva sandhi chalane, Kati chalane, Super Brain yoga. Suryanamaskara/Pragya Yoga: With Mantras & Breathing pattern. Meditation.	
Unit II	**10 hrs**
Standing Asanas: Trikonasana, Veerabhadrasana, Vrikshasana, Tadasana, Tiryak Tadasana, Sarvangapushti, Utkatasana. **Sitting Asanas:** Baddhakonasana, Bharadwajasana, Mandukasana, Ushtrasana, SuptaVeerasana, Vakrasana, Gomukhasana, Janushirasana, Dhanurasana, Shashankasana.	
Unit III	**10 hrs**
Lying Asanas: Pawanamuktasana, Sarvangasana, Naukasana, Halasana, Chakrasana, Bhujangasana, Shalabhasana, Dhanurasana, Yoga Nidra. Relaxative/ Meditative **Asanas:** Shavasana, Balasana, Makarasana, Sukhasana, Padmasana, Vajrasana. **Pranayama:** Mantra, Breathing – Chest, Abdominal & Yogic, Puraka, Rechaka and Kumbhaka, Anulom-Vilom, Nadishodhan, Suryabhedan, Chadrabhedan, Bhastrika, Bhramri, Sheetali, Shitkari and Kapalabhati.	

Course Outcomes	
CO1	Gain knowledge of yoga, its asanas, its benefits and practice for holistic growth. (PO6)
CO2	Demonstrate various postures of Yoga and know the scientific way to improve health. (PO6, PO11)
CO3	Develop physical and mental coordination and enhance confidence through multiple yoga practices. (PO6, PO11)
CO4	Analyse, assess, the performance of Pranayama (Breathing exercises) and improve Respiratory Health which in turn enhances social harmony and world peace and thereby by training to be good citizens. (PO6, PO11)

Reference Books	
1.	Light on Yoga, B.K.S. Iyengar, 2017, Harper Collins Publishers, ISBN: 9780008267919.
2.	Light on Pranayama, B.K.S. Iyengar, 2013, Harper Collins Publishers, ISBN: 978-8172235413.
3.	Asana Pranayama Mudra Bandha, Swami Satyananda Saraswathi, 12th Edition, 2002, Published by Yoga Publications Trust, Bihar School of Yoga, ISBN:9788186336144.
4.	Yoga Nidra, Swami Satyananda Saraswathi, 2009, Published by Yoga Publications Trust, ISBN: 9788185787121.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (Practice)		
#	**COMPONENTS**	**MARKS**
1	QUIZZE: 1 Quiz will be conducted in online/offline mode. Quiz will be evaluated for 10 Marks.	10
2	TESTS: One Demonstration Test will be conducted for 40 Marks	30
3	Experiential Learning	10
	MAXIMUM MARKS FOR THE CIE THEORY	**50**
RUBRIC FOR SEMESTER END EXAMINATION (PRACTICE)		
Q.NO.	**CONTENT**	**MARKS**
1	Demonstration of Asanas and Pranayama SEE for 50 marks is executed by means of an examination	**50**

Skill Laboratory

Department of Aerospace Engineering
First Year – Skill Lab
Skill Training Lab on Lathe Machining and Fitting

Section	Details
Skill Learning Objectives	1. Use Vernier caliper, micrometer, and gauges to measure precisely (accuracy ±0.02 mm) and apply tolerances and fits. 2. Perform marking, sawing, filing, and assembly to achieve flatness, squareness, and sliding/mating fits (accuracy ±0.1 mm). 3. Carry out centering, facing, turning, step turning, and chamfering with required dimensional accuracy and good surface finish (Ra ~3.2 µm). 4. Execute drilling, reaming, knurling, threading, and parting-off to produce quality components within tolerance limits. 5. 05. Combine fitting and machining skills to fabricate and assemble mini-projects (e.g., bush–shaft assembly, clamp/coupling) with GD&T compliance, inspection, and safety practices.
Module I (08 Hrs)	Introduction to Fitting and Lathe Workshop Practices – Introduction to fitting tools and measurement accuracy, safety rules for fitting and lathe operation, demonstration of lathe components and controls, hands-on measurement of specimens (rods, plates) using micrometer & Vernier.
Module II (08 Hrs)	Fitting Operations – Marking, sawing, filing a rectangular plate to a given dimension, practice of parallel filing, square filing, and finishing, simple fitting exercise: preparation of two mating pieces for a sliding fit (male-female fit).
Module III (08 Hrs)	Basic Lathe Operations – Centering and facing operation on a mild steel workpiece, cylindrical turning to a given dimension, step turning, chamfering operation.
Module IV (08 Hrs)	Advanced Lathe Operations – Drilling and reaming using tailstock, external and internal threading practice, parting-off operation to finish component.
Module V (08 Hrs)	Integrated Project – Assembly & Finishing – Fabricate a bush–shaft assembly with proper fit, prepare a “mini clamp”/“coupling” involving both lathe machining and fitting, ensure surface finishing, dimensional accuracy, and assembly tolerance, inspection of final product using Vernier/micrometer.
Training Outcomes	1. Ability to use precision measuring instruments and achieve specified dimensional accuracy and surface finish. 2. Competence in performing fitting and basic machining operations safely and effectively. 3. Proficiency in executing advanced lathe operations to produce components within tolerance limits. 4. 04. Capability to integrate fitting and machining skills to fabricate, inspect, and assemble functional mechanical parts or mini-projects.
Tools Used	Vernier caliper, micrometer, steel rule, surface plate, scriber, punch, hacksaw, files (flat, round, half-round), hammer, bench vice, center lathe, 3-jaw chuck, 4-jaw chuck, tailstock with drill chuck, single-point cutting tool, HSS tool bit, knurling tool, parting tool, threading tool, spanners, screwdrivers, taps, dies.

Department of AI & ML
First Year – Skill Lab
Skill Training Lab on Data Analytics and Business Intelligence Tools

Section	Details
Skill Learning Objectives	1. Understand the fundamentals of data analytics and business intelligence (BI) concepts. 2. Use data analysis tools (Excel, Python libraries, SQL) to clean, transform, and visualize datasets. 3. Apply BI tools (Power BI/Tableau) to build dashboards, reports, and business insights. 4. Perform exploratory data analysis (EDA) to identify trends, patterns, and anomalies in data. 5. 05. Integrate analytics with decision-making by applying case studies and project-based learning.
Module I (08 Hrs)	**Introduction to Data Analytics & BI Tools** – Overview of data analytics lifecycle, importance of BI, introduction to Excel, SQL basics, and Python for analytics.
Module II (08 Hrs)	**Data Preprocessing & Cleaning** – Importing datasets, handling missing values, data transformation, normalization, and feature selection using Excel/Python (Pandas, NumPy).
Module III (08 Hrs)	**Exploratory Data Analysis (EDA)** – Descriptive statistics, correlation analysis, trend identification, visualization with Matplotlib/Seaborn.
Module IV (08 Hrs)	**Business Intelligence & Dashboards** – Using Power BI/Tableau for data visualization, creating interactive dashboards, KPI measurement, and generating business reports.
Module V (08 Hrs)	**Integrated Project – Data-Driven Decision Making** – End-to-end project involving dataset cleaning, analysis, visualization, and BI dashboard preparation to support business insights.
Training Outcomes	1. Ability to preprocess, analyze, and visualize structured/unstructured data effectively. 2. Competence in using Python, SQL, Excel, and BI tools for real-world datasets. 3. Proficiency in creating dashboards and reports for business intelligence and decision-making. 4. 04. Capability to integrate analytics and BI skills to deliver insights through project-based learning.
Tools Used	Microsoft Excel, SQL, Python (NumPy, Pandas, Matplotlib, Seaborn), Power BI, Tableau, Jupyter Notebook, Google Colab.

Department of Biotechnology
First Year – Skill Lab
Skill Training Lab on Water Treatment and Analysis

Section	Details
Skill Learning Objectives	1. Understand the importance of water quality parameters and their role in biotechnology and environmental applications. 2. Learn techniques for sampling, testing, and analyzing physical, chemical, and biological properties of water. 3. Gain practical knowledge of water treatment methods including filtration, coagulation, disinfection, and aeration. 4. Perform laboratory experiments for quantitative analysis of parameters like pH, hardness, turbidity, BOD, COD, and microbial contamination. 5. 05. Apply integrated water analysis and treatment skills to design solutions for safe and sustainable water use.
Module I (08 Hrs)	**Introduction to Water Quality & Standards** – Importance of water in biotechnology, BIS/WHO standards, introduction to physical, chemical, and microbiological parameters, safety and sampling techniques.
Module II (08 Hrs)	**Physical and Chemical Testing** – Measurement of pH, turbidity, conductivity, total hardness, chloride, and alkalinity in water samples.
Module III (08 Hrs)	**Biological & Microbial Analysis** – Detection of coliforms, microbial load estimation (plate count method), and waterborne pathogen analysis.
Module IV (08 Hrs)	**Water Treatment Methods** – Coagulation and flocculation experiments, filtration methods, disinfection techniques (chlorination, UV), aeration methods.
Module V (08 Hrs)	**Integrated Project – Water Quality Assessment & Treatment** – Collect real-world water samples, analyze multiple parameters, propose treatment methods, and prepare a water quality report with recommendations.
Training Outcomes	1. Ability to measure and interpret physical, chemical, and microbial properties of water. 2. Competence in applying laboratory techniques for water quality analysis. 3. Proficiency in demonstrating water treatment methods for safe water usage. 4. 04. Capability to integrate analysis and treatment knowledge to solve practical water-related challenges.
Tools Used	pH meter, turbidity meter, conductivity meter, BOD incubator, COD digester, UV spectrophotometer, autoclave, filtration unit, microscope, colony counter, chlorination setup, aeration setup, glassware (burette, pipette, conical flask, beakers).

Department of Chemical Engineering
First Year – Skill Lab
Skill Training Lab on Service and Maintenance of Water Treatment Plants

Section	Details
Skill Learning Objectives	1. Understand the working principles and components of water treatment plants (conventional and modern). 2. Learn procedures for operation, servicing, and maintenance of treatment units such as sedimentation, filtration, softening, and disinfection systems. 3. Acquire practical knowledge of troubleshooting common problems in pumps, valves, filters, and chemical dosing systems. 4. Perform inspection, preventive maintenance, and calibration of plant instruments and equipment. 5. 05. Integrate knowledge of service and maintenance to ensure safe, reliable, and sustainable operation of water treatment plants.
Module I (08 Hrs)	**Introduction to Water Treatment Plants** – Layout and process flow of treatment plants, unit operations (sedimentation, coagulation, filtration, disinfection), safety protocols.
Module II (08 Hrs)	**Operation of Treatment Units** – Working and demonstration of pumps, aerators, filters, softeners, and chemical dosing equipment.
Module III (08 Hrs)	**Servicing and Troubleshooting** – Maintenance of pumps, valves, pipelines, backwashing of filters, troubleshooting chemical dosing errors.
Module IV (08 Hrs)	**Instrumentation and Calibration** – Inspection and calibration of pH meters, flow meters, pressure gauges, turbidity meters, and dosing controllers.
Module V (08 Hrs)	**Integrated Project – Maintenance Plan Preparation** – Preparation of service manuals/checklists, predictive and preventive maintenance schedules, case study on performance improvement of a treatment unit.
Training Outcomes	1. Ability to explain working and servicing procedures of water treatment plant units. 2. Competence in operating, maintaining, and troubleshooting key components of water treatment systems. 3. Proficiency in instrument calibration and preventive maintenance practices. 4. 04. Capability to design a maintenance plan ensuring reliability and sustainability of water treatment plants.
Tools Used	Pumps, aerators, sand and carbon filters, softeners, dosing pumps, chlorination unit, UV disinfection unit, pH meter, turbidity meter, flow meter, pressure gauges, maintenance tool kits (wrenches, spanners, pliers, screwdrivers), lubrication equipment.

Department of Civil Engineering
First Year – Skill Lab
Skill Training Lab on Fusion 360 and Testing of Civil Materials

Section	Details
Skill Learning Objectives	1. Understand the fundamentals of CAD modeling using Fusion 360 for civil engineering applications. 2. Learn to create 2D sketches, 3D models, and assemblies relevant to structural and construction components. 3. Acquire practical skills in simulation and analysis of loads, stresses, and deformations using Fusion 360 tools. 4. Perform laboratory testing of civil materials such as cement, concrete, aggregates, and steel to determine strength and durability properties. 5. 05. Integrate design and testing knowledge to validate models with experimental results for real-world applications.
Module I (08 Hrs)	**Introduction to Fusion 360 for Civil Engineering** – Overview of CAD in civil applications, interface of Fusion 360, creating sketches and basic 3D shapes.
Module II (08 Hrs)	**Modeling of Civil Structures** – Developing 3D models of beams, columns, slabs, trusses, and frames; creating assemblies for structural components.
Module III (08 Hrs)	**Simulation and Analysis** – Load application, static stress analysis, deformation study, failure prediction of modeled components in Fusion 360.
Module IV (08 Hrs)	**Testing of Civil Materials** – Tests on cement (consistency, setting time), concrete (compressive strength), aggregates (impact, crushing, abrasion), and steel (tensile test).
Module V (08 Hrs)	**Integrated Project – Design and Testing Validation** – Design a simple structural element (beam/column), simulate using Fusion 360, fabricate a test specimen (concrete/steel), perform experimental testing, and compare results.
Training Outcomes	1. Ability to create and simulate civil engineering components using Fusion 360. 2. Competence in performing strength and durability tests on civil materials. 3. Proficiency in integrating CAD modeling and experimental validation for structural applications. 4. 04. Capability to present design–test results for engineering decision-making.
Tools Used	Autodesk Fusion 360, Universal Testing Machine (UTM), compression testing machine, Vicat apparatus, slump cone, sieve set, aggregate impact and abrasion testing equipment, steel tensile testing machine, curing tank, concrete mixer, standard laboratory glassware and tools.

Department of Computer Cluster
First Year – Skill Lab
Skill Training Lab on IT Essentials

Section	Details
Skill Learning Objectives	1. Understand the fundamentals of computer hardware, software, and networking components. 2. Develop hands-on skills in assembling, disassembling, and troubleshooting personal computers and peripherals. 3. Learn to install and configure operating systems, drivers, and essential application software. 4. Acquire practical knowledge of networking basics including IP addressing, connectivity testing, and LAN setup. 5. 05. Apply IT essential skills to diagnose and resolve hardware/software issues ensuring system reliability and security.
Module I (08 Hrs)	**Introduction to Computer Hardware** – Identification of hardware components (motherboard, CPU, RAM, storage devices, power supply, peripherals), safety procedures, ESD precautions.
Module II (08 Hrs)	**PC Assembly & Disassembly** – Hands-on practice in assembling a desktop system, connecting peripherals, BIOS/UEFI configuration, troubleshooting common assembly errors.
Module III (08 Hrs)	**Operating System Installation & Configuration** – Installation of Windows/Linux OS, partitioning, driver installation, system updates, and basic system utilities.
Module IV (08 Hrs)	**Networking Basics & Connectivity** – Fundamentals of networking, IP addressing, LAN setup, use of switches/routers, connectivity testing using ping and traceroute, introduction to Wi-Fi configuration.
Module V (08 Hrs)	**Integrated Project – System Setup & Troubleshooting** – Assemble and configure a complete system, install OS and applications, connect to a network, diagnose and fix common hardware/software/network issues, and document troubleshooting steps.
Training Outcomes	1. Ability to identify, assemble, and maintain computer hardware components. 2. Competence in installing, configuring, and updating operating systems and applications. 3. Proficiency in setting up and troubleshooting basic wired/wireless networks. 4. 04. Capability to integrate IT skills to ensure reliable and secure computer system operation.
Tools Used	Screwdriver kit, anti-static wrist strap, multimeter, spare hardware components (motherboard, CPU, RAM, storage devices, PSU), cables (SATA, power, Ethernet), switches, routers, Wi-Fi access points, installation media (Windows/Linux OS), diagnostic software tools.

Department of Computer Cluster
First Year – Skill Lab
Skill Training Lab on Web Essentials

Section	Details
Skill Learning Objectives	1. Understand the fundamentals of web technologies including client-server architecture. 2. Develop skills in creating static and dynamic web pages using HTML, CSS, and JavaScript. 3. Gain knowledge of responsive design principles and frameworks. 4. Learn the basics of web hosting, domain configuration, and deployment. 5. 05. Apply web development skills to design, build, and deploy a simple interactive website.
Module I (08 Hrs)	**Introduction to Web Technologies** – Basics of the internet, WWW, web browsers, servers, HTTP/HTTPS protocols, client-server communication.
Module II (08 Hrs)	**HTML Fundamentals** – Structure of HTML documents, elements, attributes, forms, tables, media integration.
Module III (08 Hrs)	**CSS for Styling and Layout** – Inline, internal, and external CSS; selectors; box model; flexbox; grid; responsive design techniques.
Module IV (08 Hrs)	**JavaScript Essentials** – Variables, functions, DOM manipulation, event handling, simple form validation, and interactive web elements.
Module V (08 Hrs)	**Web Hosting & Deployment Project** – Integrating HTML, CSS, and JavaScript into a mini-project, deploying on free hosting platforms (e.g., GitHub Pages, Netlify), and documenting the project.
Training Outcomes	1. Ability to design structured and well-formatted HTML web pages. 2. Proficiency in applying CSS for styling and responsive layouts. 3. Capability to use JavaScript for adding interactivity and dynamic features. 4. 04. Competence in hosting and deploying web applications.
Tools Used	Text editor/IDE (VS Code, Sublime Text, Atom), web browsers (Chrome, Firefox, Edge), Git/GitHub, free hosting platforms (GitHub Pages, Netlify), browser developer tools, internet connectivity.

Department of Electrical & Electronics Engineering
First Year – Skill Lab
Skill Training Lab on Solar Panel Installation, Testing & Maintenance

Section	Details
Skill Learning Objectives	1. Understand the principles of solar energy and photovoltaic (PV) systems. 2. Develop skills in installation of solar panels, wiring, and connections. 3. Gain knowledge of testing procedures for solar panel performance and efficiency. 4. Learn preventive and corrective maintenance techniques of PV systems. 5. Apply safety standards and sustainable practices in solar energy utilization.
Module I (08 Hrs)	**Introduction to Solar Energy** – Basics of solar radiation, PV effect, types of solar panels, system components (modules, inverters, batteries, charge controllers).
Module II (08 Hrs)	**Installation Practices** – Site assessment, mounting structures, panel orientation & tilt angle, electrical connections, grounding, and safety.
Module III (08 Hrs)	**Testing & Performance Evaluation** – Measurement of voltage, current, power output, IV characteristics, efficiency testing using solar meters and analyzers.
Module IV (08 Hrs)	**Maintenance & Troubleshooting** – Preventive maintenance, cleaning, inspection of wiring, fault detection in inverters and batteries, system diagnostics.
Module V (08 Hrs)	**Mini Project & Documentation** – Designing and setting up a small solar-powered system (e.g., solar lighting/charging unit), testing performance, and preparing a project report.
Training Outcomes	1. Ability to install solar panels and connect system components as per standards. 2. Proficiency in testing solar panel performance using appropriate tools. 3. Capability to identify and troubleshoot common solar PV system issues. 4. 04. Competence in applying safety procedures and maintenance practices for sustainable solar energy systems.
Tools Used	Solar panels, multimeter, IV curve tracer, solar power analyzer, charge controller, inverter, mounting structures, cables & connectors, battery bank, protective equipment (PPE).

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Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

Department of Electronics & Communication Engineering
First Year - Skill Lab
Skill Training Lab on Consumer Electronics Repair

Section	Details
Skill Learning Objectives	1. Understand the basic working principles of common consumer electronic devices. 2. Develop skills in identifying, testing, and replacing electronic components. 3. Gain hands-on experience in troubleshooting and repairing consumer electronics. 4. Learn systematic diagnostic procedures and safety practices. 5. 05. Enhance practical knowledge in using repair and testing tools effectively.
Module I (08 Hrs)	**Introduction to Consumer Electronics** – Overview of devices (TV, audio systems, mobile phones, kitchen appliances), block diagrams, and working principles.
Module II (08 Hrs)	**Component Identification & Testing** – Resistors, capacitors, diodes, transistors, ICs, SMPS circuits; testing with multimeter/oscilloscope.
Module III (08 Hrs)	**Troubleshooting Techniques** – Fault detection in power supply, display circuits, audio sections, and communication modules.
Module IV (08 Hrs)	**Repair & Maintenance Practices** – Soldering and desoldering, PCB repair, connector replacement, preventive maintenance methods.
Module V (08 Hrs)	**Mini Project & Documentation** – Repair and restoration of a faulty consumer electronic device and preparation of repair documentation/report.
Training Outcomes	1. Ability to identify and test electronic components in consumer devices. 2. Proficiency in diagnosing and troubleshooting faults in consumer electronics. 3. Skill in repairing, soldering, and maintaining electronic devices safely. 4. 04. Capability to apply structured diagnostic methods to restore device functionality.
Tools Used	Digital multimeter, oscilloscope, soldering station, desoldering pump, LCR meter, function generator, screwdriver set, magnifier lamp, safety PPE.

Department of Industrial Engineering & Management
First Year – Skill Lab
Skill Training Lab on Plumbing

Section	Details
Skill Learning Objectives	01. Understand plumbing materials, fittings, and their applications. 02. Gain skills in pipe cutting, threading, and jointing methods. 03. Learn to install and maintain basic plumbing systems. 04. Develop safety practices while handling plumbing tools. 05. Apply troubleshooting techniques for leakage and blockage issues.
Module I (08 Hrs)	**Introduction to Plumbing Materials & Tools** – Types of pipes (PVC, GI, CPVC), fittings, valves, safety measures.
Module II (08 Hrs)	**Pipe Cutting & Threading** – Hands-on practice with cutting, bending, threading, joining of pipes.
Module III (08 Hrs)	**Installation Techniques** – Taps, faucets, washbasins, water closets, traps, overhead tanks.
Module IV (08 Hrs)	**Maintenance & Troubleshooting** – Leakage repair, blockage clearance, preventive maintenance.
Module V (08 Hrs)	**Mini Project & Documentation** – Setup of a small plumbing network with proper fittings.
Training Outcomes	01. Ability to identify and select appropriate plumbing materials. 02. Skill in pipe cutting, threading, and installation. 03. Proficiency in repairing and maintaining plumbing systems. 04. Capability to apply safety and troubleshooting practices.
Tools Used	Pipe wrench, spanner set, hacksaw, pipe cutter, threading die set, pliers, Teflon tape, drill machine, safety PPE.

Department of Industrial Engineering & Management
First Year – Skill Lab
Skill Training Lab on Sheet Metal Workshop

Section	Details
Skill Learning Objectives	01. Understand sheet metal materials, tools, and operations. 02. Develop skills in cutting, bending, folding, and riveting. 03. Gain proficiency in making simple sheet metal components. 04. Learn safety practices in handling sharp tools and sheets. 05. Apply measurement and marking techniques accurately.
Module I (08 Hrs)	**Introduction to Sheet Metal Tools & Materials** – Types of sheets, gauges, marking tools, shears, hammers.
Module II (08 Hrs)	**Cutting & Shearing Operations** – Straight cutting, curved cutting, punching.
Module III (08 Hrs)	**Bending & Folding Operations** – V-bending, edge folding, seam making.
Module IV (08 Hrs)	**Joining Techniques** – Riveting, soldering, spot welding basics.
Module V (08 Hrs)	**Mini Project & Documentation** – Fabrication of small sheet metal models like trays, dustpans, tool boxes.
Training Outcomes	01. Ability to identify and use sheet metal tools effectively. 02. Skill in cutting, bending, and joining sheet metal components. 03. Proficiency in fabricating simple sheet metal products. 04. Capability to apply safety measures in sheet metal operations.
Tools Used	Sheet metal shears, mallet, ball peen hammer, stake, rivet set, punches, files, folding bar, safety PPE.

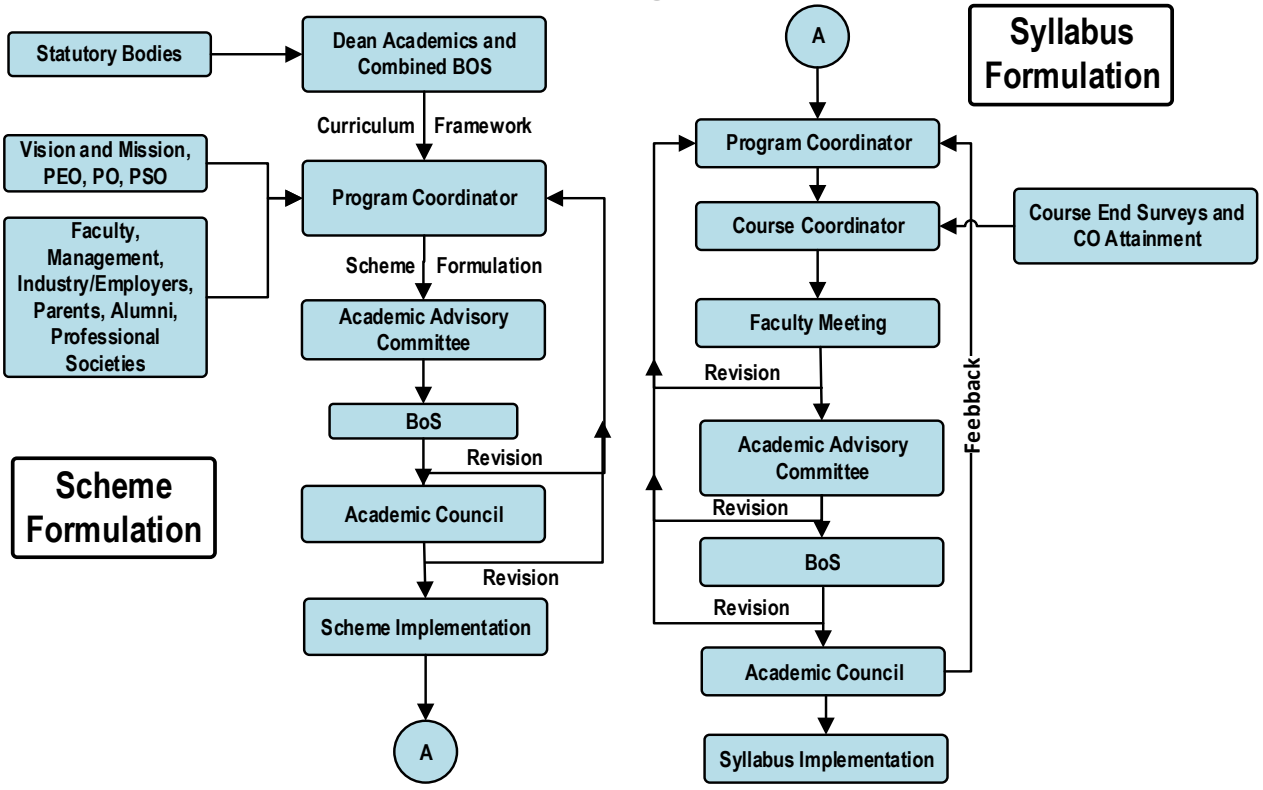
Department of Mechanical Engineering
First Year – Skill Labs
Skill Training Lab on Fundamentals and Applications of Measurement Systems

Section	Details
Skill Learning Objectives	1. Understand the fundamentals of measurement systems and units. 2. Develop skills in using precision measurement instruments. 3. Apply measurement techniques to analyze geometric shapes and tolerances. 4. Perform experiments related to fluid flow and pressure measurement. 5. 05. Measure physical parameters such as temperature, force, strain, and speed using sensors and transducers.
Module I (08 Hrs)	Basics of measurement systems – standards, units, errors in measurement, and introduction to measuring instruments.
Module II (08 Hrs)	Precision measurement – Vernier instruments, micrometers, slip gauges, dial indicators, profile projector, and CMM (demo).
Module III (08 Hrs)	Measurement of geometric shapes – flatness, squareness, roundness, angles using sine bar, surface plate, angle plates, and protractors.
Module IV (08 Hrs)	Fluid measurement systems – manometer, venturimeter, orifice meter, pitot tube, and rotameter experiments.
Module V (08 Hrs)	Physical parameter measurement systems – sensors and transducers (thermocouples, strain gauges, load cells, tachometers). Mini project: Measurement of multiple parameters of a mechanical component/system.
Training Outcomes	1. Ability to identify and operate basic and precision measurement instruments. 2. Competence in measuring geometric and dimensional parameters. 3. Skill in conducting fluid and pressure measurement experiments. 4. Understanding of physical parameter measurement using sensors and transducers. 5. 05. Ability to apply measurement techniques in practical applications and mini projects.
Tools Used	Vernier calipers, micrometers, slip gauges, dial gauges, sine bar, surface plate, manometer, venturimeter, rotameter, pitot tube, thermocouples, strain gauges, load cell, tachometer, safety gear.

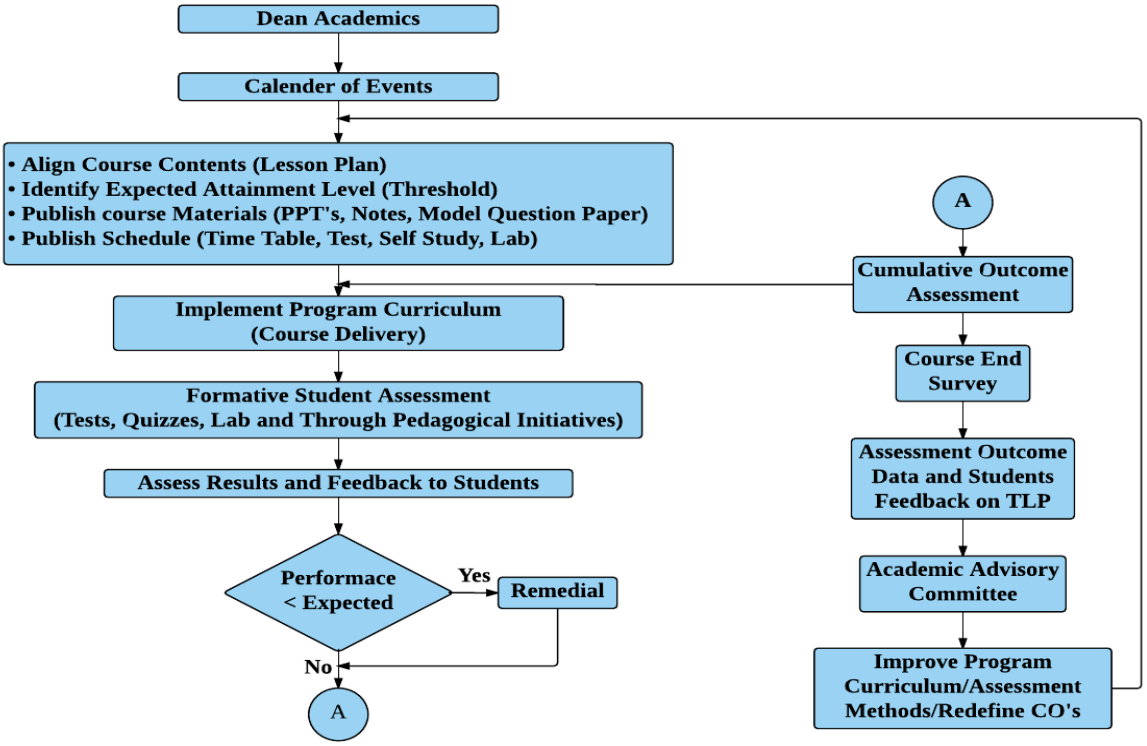
Department of Electronics & Telecommunication Engineering
First Year – Skill Labs
Skill Training Lab on Basic Networking and Hardware Services

Section	Details
Skill Learning Objectives	01. Understand computer hardware components and their functions. 02. Acquire skills in assembling and disassembling computer systems. 03. Learn the fundamentals of networking, IP addressing, and cabling. 04. Perform installation of operating systems and basic software. 05. Diagnose, troubleshoot, and repair hardware and network issues.
Module I (08 Hrs)	**Introduction to Computer Hardware & Peripherals:** dentification of CPU, motherboard, RAM, storage devices, SMPS, add-on cards, Input/output devices (keyboard, mouse, monitor, printers), Ports and connectors: USB, HDMI, VGA, RJ-45, Safety precautions: ESD handling, anti-static tools, Hardware standards and compatibility.
Module II (08 Hrs)	**System Assembly, Configuration & Software Installation:** Disassembly and reassembly of desktop PC, BIOS/UEFI setup and configuration, Installation of operating systems (Windows/Linux), Partitioning and formatting hard drives, Installation of drivers and essential utilities. Virtual machines introduction (VMware/VirtualBox)
Module III (08 Hrs)	**Networking Fundamentals:** Concepts: LAN, WAN, MAN, WLAN, Internet, OSI and TCP/IP model overview, IP addressing, subnet masks, and default gateway, IPv4 vs IPv6 basics, Static vs DHCP addressing, Introduction to network devices: switch, hub, router, modem, access point.
Module IV (08 Hrs)	**Practical Networking & Connectivity:** Cabling standards (TIA/EIA 568A & 568B)., Crimping and testing Ethernet cables, Creating straight-through and cross-over cables, • Setting up a small LAN with switches and routers, • Configuring IP addresses on PCs, Introduction to router/switch CLI configuration, • Wireless networking setup and configuration.
Module V (08 Hrs)	**Troubleshooting, Maintenance & Mini Project,** Common hardware problems: no display, beeps, overheating, faulty RAM/HDD. Network troubleshooting using ping, ipconfig, tracert, nslookup. Preventive maintenance: cleaning, thermal paste replacement, backups, Data recovery basics and antivirus utilities, • Mini project: Design, assemble, and configure a 3–5 node LAN with Internet sharing and documentation.
Training Outcomes	01. Ability to assemble, configure, and maintain computer systems. 02. Skill in setting up wired and wireless networks. 03. Competence in troubleshooting hardware and networking faults. 04. Understanding of preventive maintenance and IT support best practices. 05. Ability to document and present hardware-network setup as a project.
Tools Used	Screwdrivers set, anti-static wrist straps, crimping tool, LAN tester, Ethernet cables (Cat-5e/Cat-6), switches, routers, diagnostic software, multimeter, thermal paste, cleaning kit, safety gear.

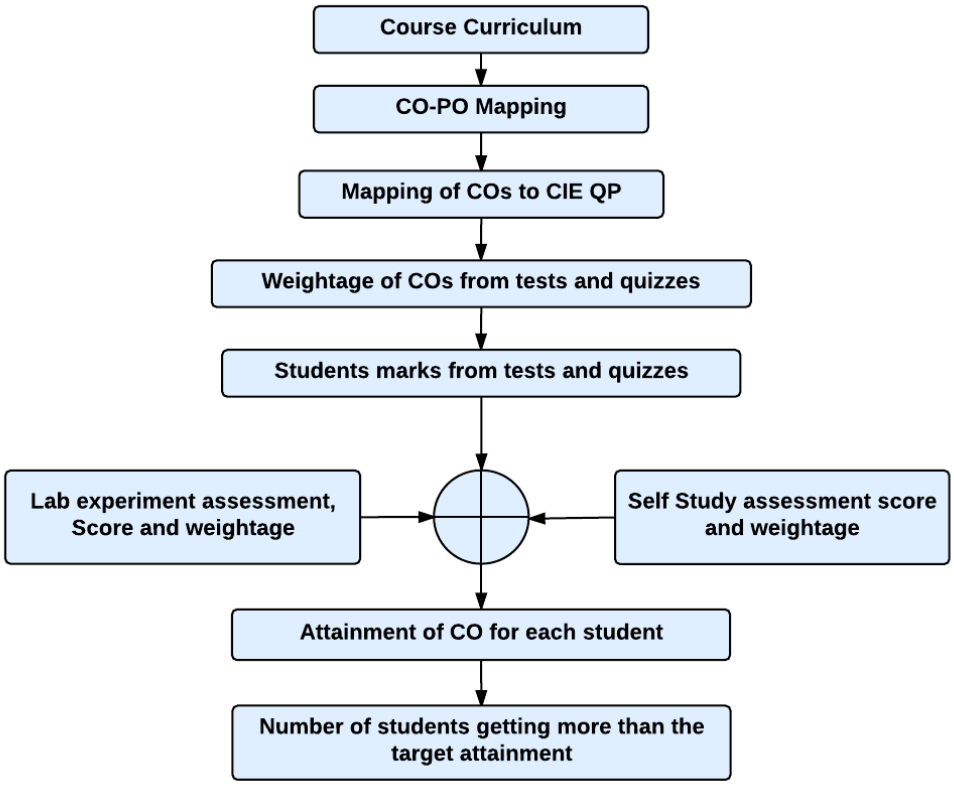
Curriculum Design Process



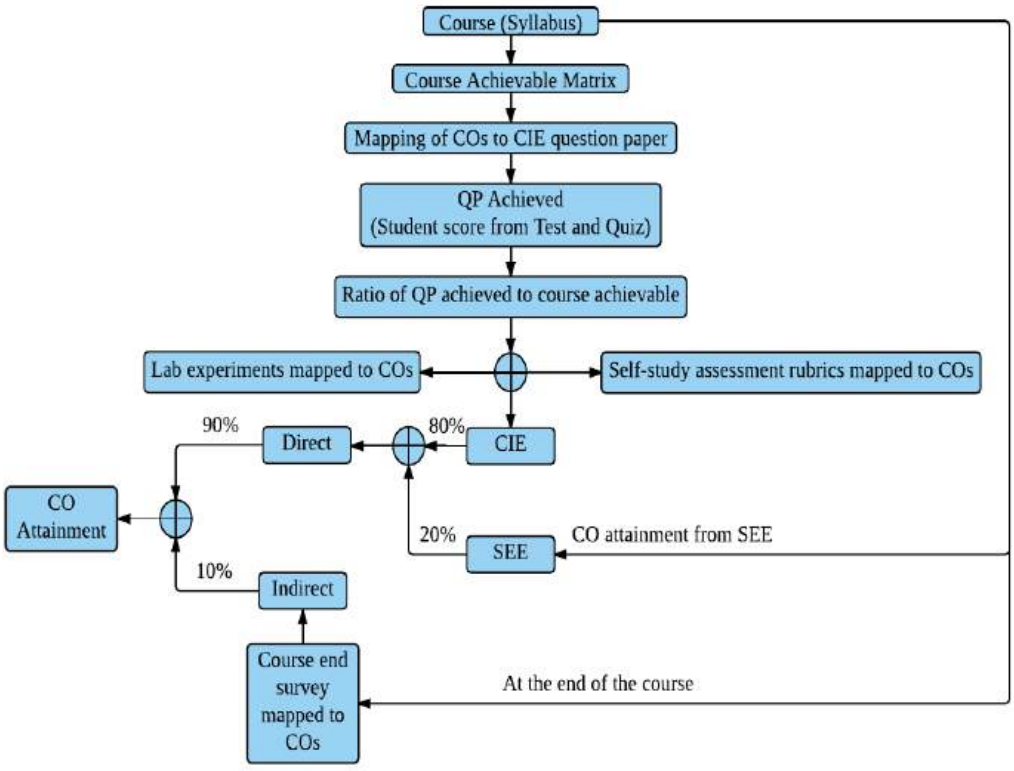
Academic Planning and Implementation



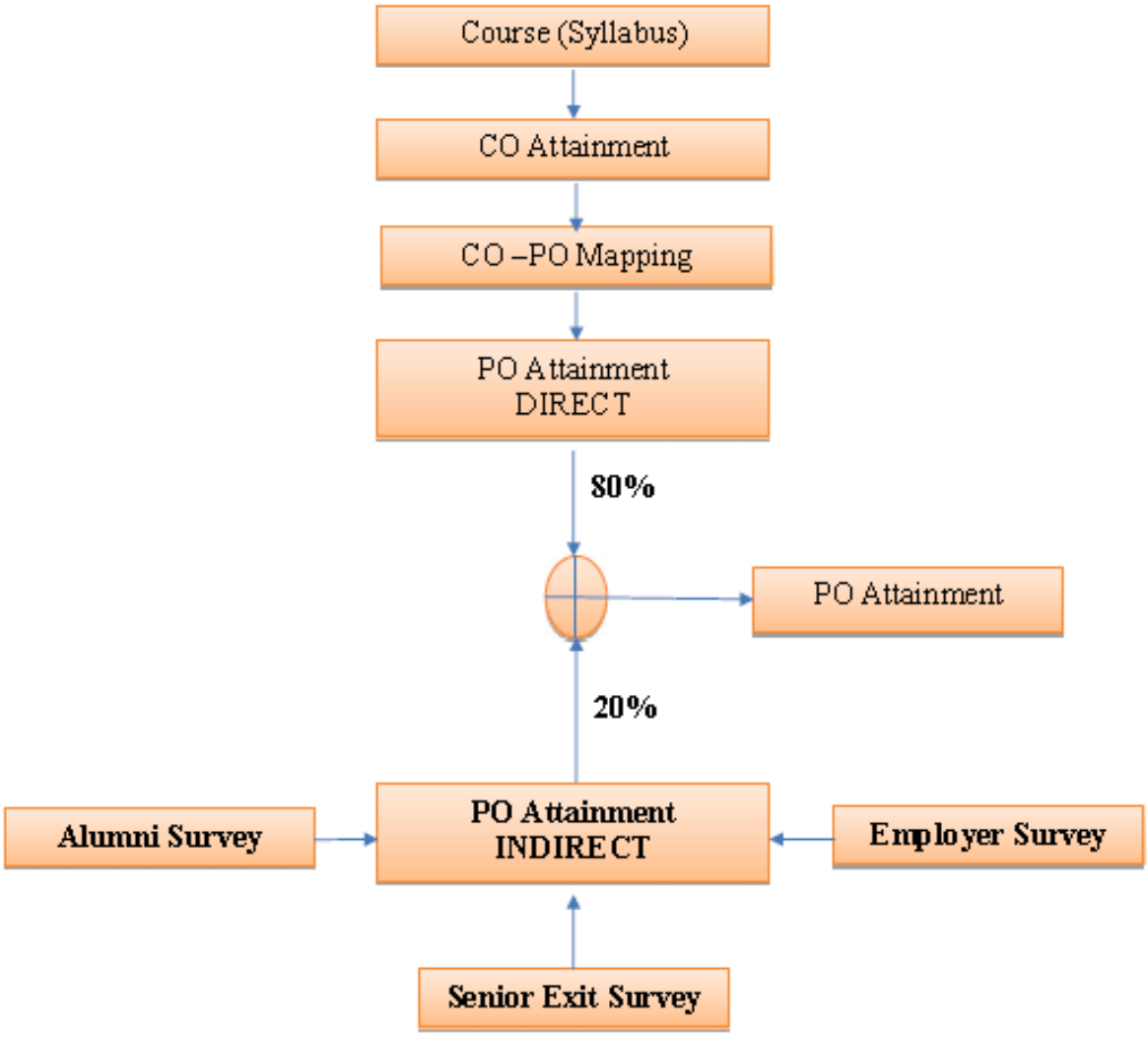
Process For Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process



Knowledge and Attitude Profile (WK)

- **WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
- **WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
- **WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- **WK4**: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
- **WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
- **WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
- **WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
- **WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
- **WK9:** Ethics, inclusive behaviour and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

New Program Outcomes (PO)

- **PO1:** Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
- **PO2:** Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- **PO3:** Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- **PO4:** Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
- **PO5:** Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
- **PO6**: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
- **PO7:** Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
- **PO8:** Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- **PO9:** Communication: Communicate effectively and inclusively within the community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- **PO10:** Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- **PO11:** Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

INNOVATIVE TEAMS OF RVCE

Ashwa Mobility Foundation (AMF): Designs and fabricates Formula-themed race cars and mobility solutions to address urban transportation issues.

Astra Robotics Team: Focuses on designing and building application-specific robots.

Coding Club: Helps students gain coding skills and succeed in competitions like GSoC and ACM-ICPC.

Frequency Club Team: Works on software and hardware, emphasizing AI and Machine Learning.

Team Garuda: Develops a supermileage urban concept electric car and E-mobility products.

Team Jatayu: Builds low-cost UAVs with autonomous capabilities for various tasks.

Team Antariksh: Focuses on space technology and the development of operational rockets.

Team Chimera: Builds a Formula Electric Car through R&D in E-Mobility.

Helios Racing Team: Designs and tests All-Terrain Vehicles, participating in SAE's BAJA competitions.

Team Krushi: Creates low-cost farming equipment to assist farmers in cultivation and harvesting.

Team Vyoma: Designs and tests radio-controlled aircraft and UAVs.

Team Dhruva: Engages in astronomy-related activities and collaborates on projects with organizations like ICTS and IIA.

Ham Club: Promotes Amateur Radio and explores technical innovations in communications, especially for disaster response.

Chitrak : It is the official electric bike team of RV College of Engineering (RVCE) in Bangalore

Anoraniya:A Quantum based technical club initiated by students. The club is dedicated to addressing various technical challenges in quantum technologies and is on the verge of delivering some fascinating results.

Accelerate Club: organizes and participates in hackathons, bootcamps, workshops, and student-led innovation drives.

Cultural Activity Teams

1. AALAP (Music club)
2. DEBSOC (Debating society)
3. CARV (Dramatics club)
4. FOOTPRINTS (Dance club)
5. QUIZCORP (Quizzing society)
6. ROTARACT (Social welfare club)
7. RAAG (Youth club)
8. EVOKE (Fashion team)
9. f/6.3 (Photography club)
10. CARV ACCESS (Film-making

NSS of RVCE

NCC of RVCE

VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology

MISSION

- To deliver outcome based Quality education, emphasizing on experientiallearning with the state of the art infrastructure.
- To create a conducive environment for interdisciplinary research and innovation.
- To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
- To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
- To focus on technologies that are sustainable and inclusive, benefiting all sections of the society.

QUALITY POLICY

Achieving Excellence in Technical Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation