RV College of Engineering®

Bachelor of Engineering (B.E)

Scheme And Syllabus Of II & II Semesters
(2022 Scheme)

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

2024

99TH
NIRF RANKING IN ENGINEERING (2024)

TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS-2023
1501+
TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS-2023 (ASIA)
501-600

EDUFUTURE EXCELLENCE AWARD
BEST PRIVATE ENGINEERING UNIVERSITY (SOUTH)
BY ZEE DIGITAL

1001+
SUBJECT RANKING (ENGINEERING)

801+
SUBJECT RANKING (COMPUTER SCIENCE)

IIRF 2023
ENGINEERING RANKING INDIA
NATIONAL RANK-10
STATE RANK - 2
ZONE RANK - 5

QS-IGUAGE DIAMOND UNIVERSITY RATING (2021-2024)

CURRICULUM STRUCTURE

61 CREDITS PROFESSIONAL CORES (PC)

23 CREDITS BASIC SCIENCE

22 CREDITS ENGINEERING SCIENCE

18 CREDITS PROJECT WORK / INTERNSHIP

12 CREDITS* OTHER ELECTIVES & AEC

12 CREDITS PROFESSIONAL ELECTIVES

12 CREDITS HUMANITIES & SOCIAL SCIENCE

160 CREDITS TOTAL

*ABILITY ENHANCEMENT COURSES (AEC), UNIVERSAL HUMAN VALUES (UHV), INDIAN KNOWLEDGE SYSTEM (IKS), YOGA.

17
Centers of Excellence

11
Centers of Competence

212
Publications On Web Of Science

669
Publications Scopus (2023 - 24)

1093
Citations

70
Patents Filed

39
Patents Granted

61
Published Patents

11
Skill Based Laboratories Across Four Semesters

MOUS: 90+WITH INSDUSTRIES / ACADEMIC INSTITUTIONS IN INDIA & ABROAD

EXECUTED MORE THAN RS.40 CRORES WORTH SPONSORED RESEARCH PROJECTS & CONSULTANCY WORKS SINCE 3 YEARS

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2024

ABBREVIATIONS

Sl. No.	Abbreviation	Meaning
1.	**VTU**	Visvesvaraya Technological University
2.	**AI**	Computer Science & Engineering–Artificial Intelligence & Machine Learning
3.	**AS**	Aerospace Engineering
4.	**BT**	Biotechnology
5.	**CD**	Computer Science & Engineering – Data Science
6.	**CH**	Chemical Engineering
7.	**CS**	Computer Science & Engineering
8.	**CV**	Civil Engineering
9.	**CY**	Computer Science & Engineering – Cyber Security
10.	**EC**	Electronics & Communication Engineering
11.	**EE**	Electrical & Electronics Engineering
12.	**EI**	Electronics & Instrumentation 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.	**EM**	Emerging Technology Course
25.	**HSS**	Humanities and Social Sciences
26.	**CIE**	Continuous Internal Evaluation
27.	**SEE**	Semester End Examination

INDEX

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

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2022 SCHEME - CREDITS AND COMPONENTS

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

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**	***	**3**	**100**	***
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	XX	2	0	1	**3**	Theory+Lab	1.5	**100**	***	**3**	**100**	***
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**
				12	**2**	**6**	**20**							

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

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**	***	**3**	**100**	***
3	CS222IA	Principles of Programming Using C	CS	2	0	1	**3**	Theory+Lab	1.5	**100**	***	**3**	**100**	***
4	XX123XTX	Engineering Science Course-II	XX	3	0	0	**3**	Theory	1.5	**100**	***	**3**	**100**	***
5	XX124XTX	Emerging Technology Course	XX	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 (Idea Development, Evaluation & Application)	ME	0	0	1	**1**	Lab	2	***	**50**	**2**	***	**50**
				14	**2**	**4**	**20**							

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2022 SCHEME - CREDITS AND COMPONENTS

I SEMESTER: PHYSICS CYCLE (EC STREAM) EC, EE, EI & 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	***		100	***
2	PY211IA	Condensed Matter Physics for Engineers	PY	3	0	1	4	Theory+Lab	1.5	100	***	3	100	***
3	EC112TA	Basic Electronics (Common to EC, EI & ET Programs)	EC	2	1	0	3	Theory	1.5	100	***	3	100	***
	EE112TA	Elements of Electrical Engineering (Only for EE Program)	EE					Theory	1.5	100	***	3	100	***
4	XX113XTX	Engineering Science Course - I	XX	3	0	0	3	Theory	1.5	100	***	3	100	***
5	XX114XTX	Emerging Technology Course	XX	3	0	0	3	Theory	1	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 (Idea Development, Evaluation & Application)	ME	0	0	1	1	Lab	2	***	50	2	***	50
				14	3	3	20							

II SEMESTER: CHEMISTRY CYCLE (EC STREAM) EC, EE, EI & 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	***	3	100	***
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	XX	2	0	1	3	Theory+Lab	1.5	100	***	3	100	***
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
				13	2	5	20							

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2022 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	***	3	100	***
3	ME112TA	Elements of Mechanical Engineering	ME	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	XX114XTX	Emerging Technology Course	XX	3	0	0	3	Theory	1	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 (Idea Development, Evaluation & Application)	ME	0	0	1	1	Lab	2	***	50	2	***	50
				14	3	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	***	3	100	***
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	XX	2	0	1	3	Theory+Lab	1.5	100	***	3	100	***
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
				12	2	6	20							

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2022 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	***	3	100	***
3	CV112TA	Engineering Mechanics	ME	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	XX114XTX	Emerging Technology Course	XX	3	0	0	3	Theory	1	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 (Idea Development, Evaluation & Application)	ME	0	0	1	1	Lab	2	***	50	2	***	50
				14	3	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	***	3	100	***
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	XX	2	0	1	3	Theory+Lab	1.5	100	***	3	100	***
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
				12	2	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)

- 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, EI & ET Programs)** **(Theory)**						
Course Code	**:**	MA211TA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42L+14T		**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 by Rayleigh's power method. Implementation using MATLAB.	
Unit – II	**09 Hrs**
Differential Calculus: Basics of polar coordinates, polar curves, angle between 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 single variable (statements only) and problems. Simulation using MATLAB.	
Unit – III	**08 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 function of two variables-Method of Lagrange multipliers. Jacobians - Properties and problems. Simulation using MATLAB.	
Unit – IV	**08 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. Simulation using MATLAB.	
Unit – V	**08 Hrs**
Numerical Methods: Finite differences, concept of forward and backward differences, introduction to interpolation and extrapolation. Newton-Gregory (N-G) forward and backward interpolation formulae, Lagrange interpolation formula, 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. Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of linear algebra, differential calculus, partial differentiation, multiple integrals and numerical methods. **(PO1, PO2)**
CO2	Apply theoretical concept of linear algebra, differential calculus, partial differentiation, multiple integrals and numerical methods and evaluate the problems arising in engineering discipline. **(PO1, PO2)**
CO3	Analyze the solution of the modern engineering problems solved using appropriate techniques of linear algebra, differential calculus, partial differentiation, multiple integrals and numerical methods. **(PO5, PO6)**
CO4	Enhance your comprehensive understanding of linear algebra, calculus, and numerical methods to effectively tackle and illustrate solutions to real-world problems. **(PO6, PO11)**

Reference Books	
1	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-933284-9-1.
2	Calculus, Saturinino L. Salas, Einar Hille and Garret J. Etgen, 10th Edition, 2022, Wiley India, ISBN: 9789390421961.
3	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 0071623663, ISBN -13: 978-0071623667.
4	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-0470458365.
5	Calculus, James Stewart, 8th Edition, 2016, Cengage Learning, ISBN: 978-1-285-74062-1.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	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	**:**	42L+14T		**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 by Rayleigh's power method. Implementation using MATLAB.	
Unit – II	**09 Hrs**
Differential Calculus: Basics of polar coordinates, polar curves, angle between 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 single variable (statements only) and problems. Simulation using MATLAB.	
Unit – III	**08 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 function of two variables-Method of Lagrange multipliers. Jacobians - Properties and problems. Simulation using MATLAB.	
Unit – IV	**08 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. Simulation using MATLAB.	
Unit – V	**08 Hrs**
Linear Ordinary Differential Equations of Higher Order: Standard form of 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. Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of linear algebra, differential calculus, partial differentiation, multiple integrals and differential equations. **(PO1, PO2)**
CO2	Apply theoretical concept of linear algebra, differential calculus, partial differentiation, multiple integrals and differential equations and evaluate the problems arising in engineering discipline. **(PO1, PO2)**
CO3	Analyze the solution of the modern engineering problems solved using appropriate techniques of linear algebra, differential calculus, partial differentiation, multiple integrals and differential equations. **(PO5, PO6)**
CO4	Enhance your comprehensive understanding of linear algebra, calculus, and differential equations to effectively tackle and illustrate solutions to real-world problems. **(PO6, PO11)**

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2	Calculus, Saturinino L. Salas, Einar Hille and Garret J. Etgen, 10th Edition, 2022, Wiley India, ISBN: 9789390421961.
3	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 0071623663, ISBN -13: 978-0071623667.
4	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-0470458365.
5	Calculus, James Stewart, 8th Edition, 2016, Cengage Learning, ISBN: 978-1-285-74062-1.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	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 AI, BT, CS, CY, CD & IS Programs)** **(Theory)**						
Course Code	**:**	MA211TC		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42L+14T		**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 by Rayleigh's power method. Implementation using MATLAB.	
Unit – II	**09 Hrs**
Differential Calculus: Basics of polar coordinates, polar curves, angle between radius vector and tangent. Curvature, radius of curvature-Cartesian, polar & parametric forms (without proof), center and circle of curvature (formulae only) and problems. Taylor's and Maclaurin's series for a function of single variable (statements only) and problems. Simulation using MATLAB.	
Unit – III	**08 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 function of two variables-Method of Lagrange multipliers. Jacobians - Properties and problems. Simulation using MATLAB.	
Unit – IV	**08 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. Simulation using MATLAB.	
Unit – V	**08 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. Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of linear algebra, differential calculus, partial differentiation, multiple integrals and Statistics. **(PO1, PO2)**
CO2	Apply theoretical concept of linear algebra, differential calculus, partial differentiation, multiple integrals and statistics and evaluate the problems arising in engineering discipline. **(PO1, PO2)**
CO3	Analyze the solution of the modern engineering problems solved using appropriate techniques of linear algebra, differential calculus, partial differentiation, multiple integrals and statistics. **(PO5, PO6)**
CO4	Enhance your comprehensive understanding of linear algebra, calculus, and statistics to effectively tackle and illustrate solutions to real-world problems. **(PO6, PO11)**

Reference Books	
1	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-933284-9-1.
2	Calculus, Saturinino L. Salas, Einar Hille and Garret J. Etgen, 10th Edition, 2022, Wiley India, SBN: 9789390421961.
3	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 0071623663, ISBN -13: 978-0071623667.

4	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-0470458365.
5	Calculus, James Stewart, 8th Edition, 2016, Cengage Learning, ISBN: 978-1-285-74062-1.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	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	**:**	42L+14T		**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 by Rayleigh's power method. Implementation using MATLAB.	
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 function of two variables-Method of Lagrange multipliers. Jacobians-Properties and problems. Simulation using MATLAB.	
Unit – III	**08 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. Simulation using MATLAB.	
Unit – IV	**08 Hrs**
Linear Ordinary Differential Equations of Higher Order: Standard form of 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. Implementation using MATLAB.	
Unit – V	**08 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. Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of linear algebra, differential calculus, partial differentiation, multiple integrals and statistics. **(PO1, PO2)**
CO2	Apply theoretical concept of linear algebra, differential calculus, partial differentiation, multiple integrals, differential equations and statistics and evaluate the problems arising in engineering discipline. **(PO1, PO2)**
CO3	Analyze the solution of the modern engineering problems solved using appropriate techniques of linear algebra, differential calculus, partial differentiation, multiple integrals, differential equations and statistics. **(PO5, PO6)**
CO4	Enhance your comprehensive understanding of linear algebra, calculus, differential equations and statistics to effectively tackle and illustrate solutions to real-world problems. **(PO6, PO11)**

Reference Books	
1	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-933284-9-1.
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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: 978-0071623667.
4	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-0470458365.
5	Calculus, James Stewart, 8th Edition, 2016, Cengage Learning, ISBN: 978-1-285-74062-1.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	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, EI & ET Programs)** **(Theory)**						
Course Code	**:**	MA221TA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42L+14T		**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, physical interpretations. Expressions for gradient, divergence, curl and Laplacian in cylindrical, spherical-polar coordinates. Simulation using MATLAB.	
Unit – II	**09 Hrs**
Vector Integration: Line, surface and volume integrals. Green's theorem, Stokes theorem and Gauss divergence theorem (statements only)-Problems, solenoidal fields and irrotational fields. Work done by a force. Simulation using MATLAB.	
Unit – III	**08 Hrs**
Laplace Transform: Existence and uniqueness of Laplace transform (LT), 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. LT of special functions - Periodic functions (square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside unit step function, unit impulse function, t - shift property. Implementation using MATLAB.	
Unit – IV	**08 Hrs**
Inverse Laplace Transform: Definition, properties, evaluation using different methods. Convolution theorem (without proof), problems. Application to solve ordinary linear differential equations. Implementation using MATLAB.	
Unit – V	**08 Hrs**
Numerical Methods: Algebraic and transcendental equations–Roots of equations, intermediate value property, Regula-Falsi and Newton-Raphson methods. Methods of solving first order ordinary differential equation - Taylor's series method, 4th order Runge-Kutta method and Milne predictor–corrector method. Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of Laplace transforms, vector calculus and numerical methods. **(PO1, PO2)**
CO2	Apply theoretical concept of Laplace transforms, vector calculus and numerical methods and evaluate the problems arising in engineering discipline. **(PO1, PO2)**
CO3	Analyze the solution of the modern engineering problems solved using appropriate techniques of Laplace transforms, vector calculus and numerical methods. **(PO5, PO6)**
CO4	Enhance your comprehensive understanding of Laplace transforms, vector calculus and numerical methods to effectively tackle and illustrate solutions to real-world problems. **(PO6, PO11)**

Reference Books	
1	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-933-2849-1.
2	Calculus, Saturinino L. Salas, Einar Hille and Garret J. Etgen, 10th Edition, 2022, Wiley India, ISBN: 978-93-904-2196-1.
3	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 0071623663, ISBN -13: 978-0071623667.

4	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-04-704-5836-5.
5	Advanced Modern Engineering Mathematics, Glyn James and Phil Dyke, 5th Edition, 2018, Pearson Education, ISBN-13 978-1292174341, ISBN-10 9780273719236.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	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	**:**	42L+14T		**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, physical interpretations. Simulation using MATLAB.	
Unit – II	**09 Hrs**
Vector Integration: Line, surface and volume integrals. Green's theorem, Stokes theorem and Gauss divergence theorem (statements only)-Problems, solenoidal fields and irrotational fields. Work done by a force. Simulation using MATLAB.	
Unit – III	**08 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	**08 Hrs**
Numerical Methods – I: Algebraic and transcendental equations–Roots of equations, intermediate value property, Regula-Falsi and Newton-Raphson methods. Methods of solving first order ordinary differential equation–Taylor's series method, 4th order Runge-Kutta method and Milne predictor–corrector method. Implementation using MATLAB.	
Unit – V	**08 Hrs**
Numerical Methods – II: Finite differences, concept of forward and backward differences, introduction to interpolation and extrapolation. Newton-Gregory (N-G) forward and backward interpolation formulae, Lagrange interpolation formula, 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 rule. Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of vector calculus, partial differential equations and numerical methods. **(PO1, PO2)**
CO2	Apply the acquired knowledge of vector calculus, partial differential equations and numerical methods and evaluate the problems of engineering applications. **(PO1, PO2)**
CO3	Analyze the solution of the modern engineering problems solved using appropriate techniques of vector calculus, partial differential equations and numerical methods to the real - world problem and optimize the solution. **(PO5, PO6)**
CO4	Enhance your comprehensive understanding of vector calculus, partial differential equations and numerical methods to effectively tackle and illustrate solutions to real-world problems. **(PO6, PO11)**

Reference Books	
1	Higher Engineering Mathematics, B. S. Grewal, 44^{th} Edition, 2015, Khanna Publishers, ISBN: 978-81-933284-9-1.
2	Calculus, Saturnino L. Salas, Einar Hille and Garret J. Etgen, 10^{th} Edition, 2022, Wiley India, ISBN: 9789390421961.
3	Advanced Engineering Mathematics, E. Kreyszig, 10^{th} Edition (Reprint), 2016, John Wiley & Sons,

	ISBN: 978-0470458365.
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: 9788122433234, 8122433235.
5	Advanced Modern Engineering Mathematics, Glyn James and Phil Dyke, 5th Edition, 2018, Pearson Education, ISBN-13 978-1292174341, ISBN-10 9780273719236.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	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 AI, BT, CS, CY, CD & IS Programs)** **(Theory)**						
Course Code	**:**	MA221TC		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42L+14T		**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, multiplicative inverses, Euler's theorem, Euler's totient function, RSA public key encryption. Implementation using MATLAB.	
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, physical interpretations. Simulation using MATLAB.	
Unit – III	**08 Hrs**
Vector Integration: Line, surface and volume integrals. Green's theorem, Stokes theorem and Gauss divergence theorem (statements only)-Problems, solenoidal fields and irrotational fields. Work done by a force. Simulation using MATLAB.	
Unit – IV	**08 Hrs**
Linear Ordinary Differential Equations of Higher Order: Standard form of 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. Implementation using MATLAB.	
Unit – V	**08 Hrs**
Numerical Methods: Finite differences, concept of forward and backward differences, introduction to interpolation and extrapolation. Newton-Gregory (N-G) forward and backward interpolation formulae, Lagrange interpolation formula, application-oriented problems. Numerical differentiation based on N-G forward and backward interpolation, applications – velocity and acceleration. Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of number theory, vector calculus, differential equations and numerical methods. **(PO1, PO2)**
CO2	Apply theoretical concept of number theory, vector calculus, differential equations and numerical methods and evaluate the problems of engineering applications. **(PO1, PO2)**
CO3	Analyze the solution of the modern engineering problems solved using appropriate techniques of number theory, vector calculus, differential equations and numerical methods to solve the problems of engineering applications. **(PO5, PO6)**
CO4	Enhance your comprehensive understanding of number theory, vector calculus, differential equations and numerical methods to effectively tackle and illustrate solutions to real-world problems. **(PO6, PO11)**

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2	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 0071623663, ISBN -13: 978-0071623667.
3	Elementary Number Theory, David M. Burton, McGraw Hill, 7th Edition, ISBN: 978-0-07-338314-9.
4	Discrete and Combinatorial Mathematics, Ralph P. Grimaldi, 5th Edition, 2006, Pearson Education, ISBN-13: 978-81-7758-424-0.

5	Advanced Modern Engineering Mathematics, Glyn James and Phil Dyke, 5th Edition, 2018, Pearson Education, ISBN-13 978-1292174341, ISBN-10 9780273719236.

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**
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1	Objective type questions covering entire syllabus	20
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3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	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	**:**	42L+14T		**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, physical interpretations. Simulation using MATLAB.	
Unit – II	**09 Hrs**
Vector Integration: Line, surface and volume integrals. Green's theorem, Stokes theorem and Gauss divergence theorem (statements only)-Problems, solenoidal fields and irrotational fields. Work done by a force. Simulation using MATLAB.	
Unit – III	**08 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 ordinary linear differential equations. Implementation using MATLAB.	
Unit – IV	**08 Hrs**
Numerical Methods – I: Algebraic and Transcendental equations–Roots of equations, intermediate value property, Regula-Falsi and Newton-Raphson methods. Taylor's and Maclaurin's series for a function of single variable and problems. Methods of solving first order ordinary differential equation–Taylor's series method, 4th order Runge-Kutta method and Milne predictor–corrector method. Implementation using MATLAB.	
Unit – V	**08 Hrs**
Numerical Methods – II: Finite differences, concept of forward and backward differences, introduction to interpolation and extrapolation. Newton-Gregory (N-G) forward and backward interpolation formulae, Lagrange interpolation formula, 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. Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of vector calculus, Laplace transforms and numerical methods. **(PO1, PO2)**
CO2	Apply theoretical concept of vector calculus, Laplace transforms and numerical methods and evaluate the problems arising in engineering discipline. **(PO1, PO2)**
CO3	Analyze the solution of the modern engineering problems solved using appropriate techniques of vector calculus, Laplace transforms and numerical methods. **(PO5, PO6)**
CO4	Enhance your comprehensive understanding of vector calculus, Laplace transforms and numerical methods to effectively tackle and illustrate solutions to real-world problems. **(PO6, PO11)**

Reference Books	
1	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-933284-9-1.
2	Calculus, Saturnino L. Salas, Einar Hille and Garret J. Etgen, 10th Edition, 2022, Wiley India, ISBN: 9789390421961.

3	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016, John Wiley & Sons, ISBN: 978-0470458365.
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: 9788122433234, 8122433235.
5	Advanced Modern Engineering Mathematics, Glyn James and Phil Dyke, 5th Edition, 2018, Pearson Education, ISBN-13 978-1292174341, ISBN-10 9780273719236.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I						
CONDENSED MATTER PHYSICS FOR ENGINEERS **Category: Applied Science Course** **Stream: Electronics (Common to EC, EE, EI & ET Programs)** **(Theory and Practice)**						
Course Code	**:**	PY211IA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	42 L + 30P		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Quantum Mechanics: de Broglie Hypothesis and Matter Waves, Phase Velocity and Group Velocity, Heisenberg's Uncertainty Principle and its application. **Wave Mechanics:** Wave Function, Time independent Schrodinger wave equation, Expectation value, Eigen functions and Eigen Values, Motion of a particle in a one-dimensional potential well of infinite depth, Numerical problems.	
Unit – II	**08 Hrs**
Basics of Solid-State Physics **Electrical Conductivity in Metals:** Quantum free electron theory and failures. Band theory of solids, Fermi energy and Fermi level, density of states, carrier concentration in metals at 0K. **Electrical Conductivity in Semiconductor:** 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).	
Unit – III	**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. Application of Lasers in Defence and Laser Printing. **Optical Fibers:** Propagation mechanism, Numerical aperture derivation, Modes of propagation. Attenuation in fiber, Discussion of block diagram of Point-to-Point communication, Optical fiber sensor. Numerical problems.	
Unit – IV	**08 Hrs**
Semiconductor devices **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, Zener diode as voltage regulator. **Transistors:** Bi-junction polar transistor, V-I characteristics in Common Emitter, Common Base and Common Collector configuration, CE configuration as an amplifier. Numerical problems.	
Unit – V	**09 Hrs**
Dielectrics and Transducers **Dielectric Properties:** Polar and non-polar dielectrics, Types of Polarization, internal fields in solid, Clausius-Mossotti equation (Derivation), solid, liquid and gaseous dielectrics. Application of dielectrics in transformers, Capacitors, Frequency dependency of dielectric constant, Electrical insulation – Dielectric breakdown Numerical problems. **Transducers**: Stress-Strain curve, moduli of elasticity, strain gauge, ultrasonic piezoelectric transducer, temperature transducer – Thermocouples. Numerical problems.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the principles of Physics in the behavioral study of materials and evaluating their properties for the design of Opto-electronic devices. **(PO1, PO2)**
CO2	Analyze the working mechanisms of engineering devices associated with Lasers, optical fibers, transducers and semiconductors. **(PO1, PO2)**
CO3	Investigate the engineering problems associated with optoelectronic devices. **(PO2)**
CO4	Develop and propose experiments and sustainable solutions for the challenges in real time applications.

	(PO3, PO5, PO6, PO8, PO11)

Reference Books	
1	Grob's basic electronics, Mitchel E Schultz, McGrahill edtion, 10th edn, 2007, ISBN 978-0-07-3373874.
2	A Textbook of Engineering Physics, M. N. Avadhanulu and P G Kshirsagar,, S. Chand publications, 2019, ISBN : 978-93-528-3399-3.
3	Physics for Degree students, C.L. Arora and Dr. P. S. Hemne,S Chand, revised 2010, ISBN: 978-81-219-33506.
4	Engineering Physics, R K Gaur and S L Gupta, Dhanpat Rai Publications, 2011, ISBN: 978-8-18-9928223.
5	Solid state electronic devices, Ben G Streetman and Sanjay Kumar Banerjee, 6th edition, PHI learning, 2009, ISBN: 978-81-203-30207.

Laboratory Experiments (EE stream)	
1	Wavelength of laser by diffraction.
2	Numerical aperture of an optical fiber.
3	Transistor characteristics.
4	Band gap of thermistor.
5	Hall coefficient experiment.
6	Black box experiment.
7	Four probe experiment.
8	Fermi Energy.
9	Charging & discharging of a capacitor.
10	Photo Diode.
11	Exp Eyes experiment: LCR
12	Exp Eyes experiment: Wavelength of LED and I-V characteristics of Zener diode.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	14
3 & 4	Unit – II: Question 3 or 4	14
5 & 6	Unit – III: Question 5 or 6	14
7 & 8	Unit – IV: Question 7 or 8	14
9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I						
CLASSICAL PHYSICS FOR ENGINEERS **Category: Applied Science Course** **Stream: Mechanical (Common to AS, CH, IM & ME Programs)** **(Theory and Practice)**						
Course Code	**:**	PY211IB		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	42 L+30P		**SEE Duration**	**:**	03 Hours

Unit – I	**06 Hrs**
Free, Damped and Forced Vibration: Simple Harmonic motion (SHM), differential equation for SHM (No derivation), Spring mass and its applications. **Theory of damped oscillations** (Derivation), Types of damping (Graphical Approach). Engineering applications of damped oscillations, Theory of forced oscillations (Qualitative), resonance and sharpness of resonance. Numerical problems	
Unit – II	**09Hrs**
Elastic Properties of Materials: Types of Stress and Strain, Stress, Strain equivalence relations, Relation between Elastic constants, Bending of beams: neutral surface and neutral axis, expression for bending moment of a beam: Single cantilever (derivation). 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**
Fundamentals of Thermodynamics: Introduction to thermodynamics: Quasi – static process. Zeroth law of thermodynamics, Liquid, gas, resistance thermometers. Joule's experiment (equivalence between heat and work), Numerical problems. **First law of thermodynamics**, work done in thermodynamic quasi static processes, Isothermal process, adiabatic process and cyclic process, Application of first law of thermodynamics for both closed system and Steady State System. Numerical problems.	
Unit – IV	**09 Hrs**
Basic concepts of Fluid Mechanics: Definition of Fluid, concept of continuum, classification of fluids, Fluid Properties, Newton's Law of viscosity, Absolute and Kinematic viscosity, No slip condition, Vapour pressure and cavitation, Bulk Modulus and Compressibility, Ultrasonic interferometer. Surface tension and capillarity. Numerical problems. **Fundamentals of Fluid Flows:** Types of Fluid Flows, Streamline, Streak line and Path line. Continuity Equation in Integral form and three-dimension Cartesian coordinates. Numerical problems.	
Unit – V	**09 Hrs**
Material Characterization: Mechanical Characterization (Tensile and yield strength, Ductility, Toughness and Hardness), Optical Characterization, current-Voltage (IV) characterization, Surface characterization (Roughness & Crystallinity, particle distribution and magnetic properties. **Instrumentation Techniques:** Principle, construction and working of X-ray Diffractometer, crystallite size determination by Scherrer equation, Principle, construction, working and applications of Atomic Force Microscopy (AFM), X-ray photoelectron spectroscopy (XPS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Numerical problems.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the principles of Physics to study the fundamental concepts of oscillations, elasticity, thermodynamics, fluid mechanics and material characterization & instrumentation. **(PO1, PO2)**
CO2	Analyse the behaviour of; different types of oscillation, elastic deformation, thermodynamic system, fluids and structural morphology of materials by applying analytical techniques to solve mechanical engineering problems. **(PO1, PO2)**

CO3	Investigate the engineering problems associated with mechanical, thermo dynamical and fluid properties of materials. **(PO4)**
CO4	Develop and propose experiments to compute the challenges in mechanical engineering applications for sustainable solutions. **(PO8, PO9, PO11)**

Reference Books	
1	Basic & Applied Thermodynamics, P K Nag, McGraw Hill Education, 2nd Edition, 2017, ISBN 10-0070151318, 13-978-0070151314.
2	Fluid Mechanics: Fundamentals and Applications, John. M. CimbalaYunus A. Cengel, McGraw-Hill Publications, 4thEdition, 2019, ISBN 10-9353166217, 13-978-9353166212.
3	A Textbook of Engineering Physics, M. N. Avadhanulu and P G Kshirsagar, S. Chand publications, 2019, ISBN : 978-93-528-3399-3.
4	Physics for Degree students, C.L. Arora and Dr. P. S. Hemne, S Chand, revised 2010, ISBN: 9788121933506.
5	Engineering Physics, R K Gaur and S L Gupta, Dhanpat Rai Publications, 2011, ISBN: 9788189928223.

Laboratory Experiments (ME stream)	
1	Spring constant experiment using expEYES17.
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	Wavelength of laser by diffraction.
7	Forced mechanical Oscillations and Resonance.
8	Fermi Energy of copper
9	Four Probe.
10	Newton's rings.
11	Exp Eyes experiment: LCR

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	14
3 & 4	Unit – II: Question 3 or 4	14
5 & 6	Unit – III: Question 5 or 6	14
7 & 8	Unit – IV: Question 7 or 8	14
9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: II						
QUANTUM PHYSICS FOR ENGINEERS **Category: Applied Science Course** **Stream: Computer Science (Common to AI, BT, CS, CY, CD & IS Programs)** **(Theory and Practice)**						
Course Code	**:**	PY221IC		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	42 L+30P		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Quantum Mechanics: De Broglie Hypothesis and Matter Waves, Phase Velocity and Group Velocity, Heisenberg's Uncertainty Principle, and its application. **Wave Mechanics:** Wave Function, Time independent Schrodinger wave equation, Expectation value, Eigen functions and Eigen Values, Motion of a particle in a one-dimensional potential well of infinite depth, Numerical problems.	
Unit – II	**08 Hrs**
Principle of Quantum Computation: Matric Mechanics: Wave Function in Ket Notation: Matrix form of wave function, Identity operator, determination of $I \mid 0 >$ and $I \mid 1 >$, Pauli matrices and its operation on 0 and 1 states, mention of conjugate and transpose, unitary matrix U, Examples: Row and Column Matrices and their multiplication (Inner Product), Probability, Orthogonality. **Principles of Quantum information and Quantum Computing:** Introduction to Quantum Computing, Moore's law and its end. Single particle quantum interference, classical and quantum information comparison. Difference between classical and quantum computing, quantum superposition and the concept of qubit. **Properties of qubit:** Mathematical representation, summation of probabilities, representation of qubit by Bloch sphere. **Quantum Gates:** Single qubit gates: Quantum not gate, Pauli – Z gate, Hadamard gate, Pauli matrices, Phase gate (S gate), T gate. Multiple qubit gates: controlled gate, CNOT gate (discuss for 4 different input states).	
Unit – III	**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. Application of laser: Bar Code scanner, Laser Printer, Laser Cooling, Numerical problems. **Optical Fibers:** Propagation mechanism, Numerical aperture derivation, Modes of propagation. Attenuation in fiber, Discussion of block diagram of Point-to-Point communication, Optical fiber sensor. Numerical problems.	
Unit – IV	**08 Hrs**
Electrical Conductivity in Solids: Postulates of Classical free electron theory (CFET), Concept of Phonon, Matheissen's rule. Quantum free electron theory (QFET), Density of states in three dimensions (qualitative) and Fermi factor. Fermi energy: variation of Fermi factor with temperature. **Band theory of solids** (qualitative approach), electron concentration in metals at 0K. Intrinsic semiconductors: electronic concentration in conduction band and hole concentration (qualitative), Fermi level in intrinsic semiconductors, Extrinsic semiconductors: Variation of carrier concentration with temperature and Fermi energy with doping, Hall effect for metals and semiconductors, Numerical problems.	
Unit – V	**09 Hrs**
Super Conductivity: Introduction to superconductors, temperature dependence of resistivity, Meissner effect, critical current, types of superconductors, temperature dependence of critical field. **BCS theory (qualitative)**, Quantum tunneling, High temperature superconductivity, Josephson junction, DC and AC SQUIDs (qualitative), Applications in quantum computing, Numerical problems.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the principles of Quantum Physics in the behavioural study of materials and evaluating their properties for the design of opto-electronic and superconducting devices. **(PO1)**
CO2	Analyse the working mechanisms of quantum devices associated with lasers, optical fibers, qubits and superconducting devices. **(PO2)**

CO3	Investigate quantitatively the quantum mechanics-based engineering problems associated with opto-electronic and superconducting devices. **(PO4)**
CO4	Develop and propose experiments and sustainable solutions for the challenges in engineering applications. **(PO1, PO8, PO9)**

Reference Books	
1	Physics for Engineers, M R Srinivasan, New Age International Publishers, 2011, ISBN: 978-81-224-2603-8.
2	A Textbook of Engineering Physics, M. N. Avadhanulu and P G Kshirsagar, 2019, S. Chand publications, ISBN: 978-93-528-3399-3.
3	Physics for Degree students, C.L. Arora and Dr. P. S. Hemne, S Chand, revised 2010, ISBN: 978-81-219-3350-6.
4	Engineering Physics, R K Gaur and S L Gupta, DhanpatRai Publications, 2011, ISBN: 978-81-899-2822-3.

Laboratory Experiments (CS Stream)	
1	Wavelength of laser by diffraction.
2	Numerical aperture of an optical fiber.
3	Transistor characteristics.
4	Band gap of thermistor.
5	Hall coefficient experiment.
6	Black box experiment.
7	Four probe experiment.
8	Fermi Energy.
9	Charging & discharging of a capacitor.
10	Photo Diode.
11	Exp Eyes experiment: LCR
12	Exp Eyes experiment: Wavelength of LED and I- V characteristics of Zener diode.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	14
3 & 4	Unit – II: Question 3 or 4	14
5 & 6	Unit – III: Question 5 or 6	14
7 & 8	Unit – IV: Question 7 or 8	14
9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: II						
APPLIED PHYSICS FOR ENGINEERS **Category: Applied Science Course** **Stream: Civil (Only to CV Program)** **(Theory and Practice)**						
Course Code	**:**	PY211ID		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	42 L+30P		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Oscillations: Simple Harmonic Motion (SHM), differential equation for SHM (No derivation), Sprig mass and its applications. Theory of damped oscillations (Derivation), Types of damping (Graphical Approach). Engineering applications of damped oscillations, Theory of forced oscillations (Qualitative), resonance and 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. Failures of engineering materials – ductile fracture, brittle fracture, stress concentration, fatigue and factors affecting fatigue (only qualitative explanation) Numerical problems.	
Unit – III	**08 Hrs**
Kinematics: Displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion and numerical problems, curvilinear motion, superelevation, projectile motion, relative motion, numerical problems, motion under gravity, numerical problems. **Kinetics:** D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.	
Unit – IV	**09 Hrs**
Fluid Mechanics: Definition of fluid and its properties, Fluid statics, buoyancy, Poiseuille's equation, determination of co-efficient of viscosity of liquid by Poiseuille's flow method. Error and correction applied to Poiseuille's formula. Variation in viscosity of liquids and gases with temperature. Bernoulli's theorem and its application. Description of fluids (qualitative). Type of fluid flows- stream line, streak line, path line, turbulence. Numerical problems.	
Unit – V	**08 Hrs**
Fundamentals of Sensors: Introduction to Sensors**,** Sensor systems and overview of sensor technologies, Classification of sensors, Sensor's characteristics. **Sensors: principles & Applications:** Temperature sensors: RTD, Thermistor, Thermocouple. Vibration sensor, Optical fiber sensor for structural health monitoring, Strain gauge sensor, Piezo electric sensors for energy harvesting.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the principles of Physics to comprehend the concepts of oscillations, elastic properties, kinematics, fluid dynamics and sensor technology to solve civil engineering problems. **(PO1, PO2)**
CO2	Analyse and interpret the impact of forces, elasticity, oscillations, fluid flow and sensor technology through analytical methods. **(PO1, PO2)**
CO3	Investigate and compute the material properties, concepts kinematics, fluid dynamics and sensor technology to enhance practical understanding and applications in civil engineering. **(PO4)**
CO4	Develop and design experiments and sustainable solutions through classical Physics and sensor technology for civil engineering challenges. **(PO3, PO6, PO7, PO11)**

Reference Books	
1	A Textbook of Engineering Physics, M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, S Chand and Company Limited, New Delhi, Revised Edition 2019, ISBN: 978-93-528-3399-3.
2	Jacob Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications, PHI Publication, 5th

	Edition 2016, ISBN: 978-1-4419-6465-6.
3	Elements of Properties of matter, D S Mathur, S Chand and Company PVT LTD, 2010, ISBN-13:978-8121908153.
4	Engineering Physics, Gaur and Gupta, Dhanpat Rai Publications LTD, 2012, ISBN-13: 978-8189928223.
5	Physics for Degree students, C L Arora and P S Hemne, S Chand and Company PVT. LTD, 2016, ISBN: 978-81-219-4059-7.
6	Engineering Physics, Hitendra K Mallik and A K Singh, Tata McGraw Hill Education, 2010, ISBN 978-0-07-067153-9.

Laboratory Experiments (CV stream)	
1	Spring constant experiment using expEYES17.
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	Wavelength of laser by diffraction.
7	Forced mechanical Oscillations and Resonance.
8	Fermi Energy of Copper.
9	Four Probe Experiment.
10	Newton's rings.
11	Exp Eyes experiment: LCR

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	14
3 & 4	Unit – II: Question 3 or 4	14
5 & 6	Unit – III: Question 5 or 6	14
7 & 8	Unit – IV: Question 7 or 8	14
9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I						
CHEMISTRY OF SMART MATERIALS AND DEVICES **Category: Applied Science Course** **Stream: Computer Science (Common to AI, BT, CS, CY, CD & IS Programs)** **(Theory and Practice)**						
Course Code	**:**	CM211IA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	42L+ 30P		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Sustainable Chemistry and E-waste management **Biomaterials:** Introduction, bio-degradable and bio-compatible polymeric materials: synthesis and applications (Polymers and hydrogels in drug delivery). **Green Chemistry**: Introduction, 12 principles with real life examples, validation of greenness. **E-waste:** Hazards and toxicity, segregation and recycling (Hydrometallurgy, pyrometallurgy and direct recycling). Extraction of valuable metals from E-waste. Battery waste management and recycling, circular economy- case studies.	
Unit – II	**08 Hrs**
Computational Chemistry: Scope, cost and efficiency of computational modeling. Stabilizing interactions: Bonded and non-bonded interactions. Molecular topology, topological matrix representation, topological indices, QSAR/QSPC concept for insilico prediction of properties. 3D co-ordinate generation for small molecules, geometry optimization.	
Unit – III	**08 Hrs**
Materials for Memory and Display Technology **Materials for memory storage:** Introduction to materials for electronic memory, classification (organic, polymeric and hybrid materials), manufacturing of semiconductor chips. Green computing: Bio-composite based memory devices. **Fabrication of Smart Materials and Devices:** photo and electro active materials for memory devices, materials for display technology (Liquid crystals display, organic light emitting diode and light emitting electrochemical cells).	
Unit – IV	**09 Hrs**
Smart Sensors and Devices **RFID and IONT materials:** Synthesis, properties and applications in logistic information, intelligent packaging systems (Graphene oxide, carbon nanotubes (CNTs) and polyaniline). **Sensors:** Introduction, types of sensors (Piezoelectric and electrochemical), nanomaterials for sensing applications (Strain sensors, gas sensor, biomolecules and volatile organic compounds).	
Unit – V	**09 Hrs**
Advanced Energy Systems **Battery technology:** Introduction to electrochemistry, characteristics of battery, Lithium-ion battery metal air batteries. Battery technology for e-mobility. **Super capacitors:** Storage principle, types (EDLC, pseudo and asymmetric capacitor) with examples and applications. **Photovoltaics:** Inorganic solar cells, organic solar cells, quantum dot sensitized (QDSSC's). Green hydrogen	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the principles of chemistry for the synthesis and selection of materials to be used in memory, energy, electronic, biomedical devices and environmental applications. **(PO1, PO11)**
CO2	Utilize the computational/green/sustainable chemistry approaches to compute materials functionalities and properties. **(PO1, PO6)**
CO3	Propose and interpret solutions for the challenges connected to memory, display, energy, smart, green and sustainable technologies. **(PO1, PO6)**
CO4	Analyze the quality parameters of engineering materials associated with environment, energy devices and sensors. **(PO1, PO6, PO8, PO9, PO11)**

Reference Books	
1	E-waste recycling and management: present scenarios and environmental issues, Khan, Anish, and Abdullah M. Asiri. 2019, Springer, Vol. 33. ISBN: 978-3-030-14186-8.
2	Essentials of computational chemistry: theories and models, Christopher J Cramer, 2013, 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., 2004 Thomson Asia pte Ltd., 8th, ISBN: 978-0-495-55828-6
E-books	
5	Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press, ISBN: 978-036-727-510-5.
6	Electrical and electronic devices, circuits and materials: Technological challenges and solutions. Tripathi, S. L., Alvi, P. A., & Subramaniam, U, 2021, John Wiley & Sons, ISBN: 978-0367564261.

Laboratory Experiments	
1	Estimation of copper from PCB.
2	Determination of total acidity of the soft drinks using pH sensors.
3	Potentiometric estimation of iron.
4	Conductometric estimation.
5	Determination of viscosity coefficient of a given liquid using Ostwald's viscometer.
6	Flame photometric estimation of sodium.
7	Colorimetric estimation of copper from E-waste.
8	Electroplating of copper.
9	Synthesis and fabrication of conducting polyaniline and its application in gas sensing (Demonstration experiment).
10	Study the surface morphology of nanomaterials using scanning electron microscopy (Demonstration experiment).
11	Fabrication of thin-film gas sensors using spin coating and electro-spinning technique (Demonstration experiment).
12	Separation of organic compounds using column chromatographic technique and monitoring by thin layer chromatographic technique (Demonstration experiment).
13	Synthesis of metal oxide nanomaterials using solution combustion synthesis.
14	Green synthesis of nanomaterials.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**

4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	14
3 & 4	Unit – II: Question 3 or 4	14
5 & 6	Unit – III: Question 5 or 6	14
7 & 8	Unit – IV: Question 7 or 8	14
9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: II						
CHEMISTRY OF FUNCTIONAL MATERIALS **Category: Applied Science Course** **Stream: Electronics (Common to EC, EE, EI & ET Programs)** **(Theory and Practice)**						
Course Code	**:**	CM221IB		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	42L+ 30P		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Energy Storage and Conversion Devices **Battery**: Introduction, types, characteristics, components/materials, working and applications of Lithium cobalt oxide and metal air batteries. **Super-Capacitors:** Introduction, types (EDLC, pseudo capacitors, asymmetric capacitors), mechanism with examples and applications. **Energy Conversion Devices:** Introduction, characteristics, materials, working and applications of H2-O2 fuel cells, amorphous Si and quantum dye sensitized solar cells.	
Unit – II	**09 Hrs**
Nanomaterials and Thin Film Fabrication Techniques **Nanomaterials:** Introduction, classification and properties. Synthesis- solution combustion, sol-gel method for thin films. **Carbon Nanomaterials:** Types, synthesis, properties, functionalization and applications of CNT and Graphene. **Thin Film Deposition Techniques**: Fabrication of thin films using CVD and PECVD and Metal organic chemical vapor deposition (MOCVD)-principle, fabrication and applications.	
Unit – III	**09 Hrs**
Chemistry of electronic materials **Inorganic semiconducting materials:** Introduction, types with examples. Semiconductors- p-type, n-type materials. Production of electronic grade silicon-Czochralski process and float zone methods. Electronic and chemical properties, applications of Gallium arsenide (GaAs), Silicon-germanium (SiGe), and Indium phosphide (InP). **Organic Semiconducting Materials**: Introduction, pentacene and fullerene derivatives, conducting polymer, principle, synthesis of polyaniline, applications in electronic devices. **Magnetic Materials**: Data storage materials, dielectric materials: Examples, properties and applications.	
Unit – IV	**08 Hrs**
Advanced Electronic Materials and E –waste: Materials, mechanism, examples and applications of photochromic, thermochromic, electrochromic, electrostrictive, magnetostrictive, RFID, MEMS and NEMS, e-skin, e-nose devices. **E-waste** - Types, environmental risks, recycle management.	
Unit – V	**08 Hrs**
Sensors and Instrumental Methods of Analysis **Sensors:** Introduction, types, principle, materials used and applications of optoelectronic sensors, piezoelectric sensor, electrochemical sensor and gas sensors. **Instrumental Method of Analysis:** Principle, instrumentation: Colorimetry, potentiometry, flame photometry and conductometry.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply principles of chemistry for the synthesis and properties of electronic materials. **(PO1, PO11)**
CO2	Evaluate the materials for their futuristic application in the field of electronics. **(PO1, PO6)**
CO3	Propose and interpret solutions for engineering problems associated with electronic materials. **(PO1, PO6)**
CO4	Analyze the quality parameters of engineering materials associated with electronic devices. **(PO1, PO6, PO8, PO9, PO11)**

Reference Books	
1	Chemistry in microelectronics, Yannick Le Tiec, 2013, Wiley Publications, ISBN: 9781848214361.
2	Electronics properties of materials, Rolf E, Hummel, 2012, Springer Publications New York, 4th Edition, ISBN 9781441981639.
3	Smart nanomaterials for sensor application, Li S, Ge Y, Li H, 2012, Bentham Science Publishers, ISBN: 9781608055425.
4	Energy storage and conversion materials, Skinner S, 2019, Royal society of chemistry, ISBN: 9781788010900.
E-Books	
5	Smart materials, Harvey, James A. Handbook of materials selection, 2002, John Wiley & Sons Canada, Limited, ISBN: 9780471359241.
6	Engineering Chemistry, Suba Ramesh, Vairam, Ananda Murthy, 2011, Wiley India, ISBN: 9788126519880.
7	Energy storage and conversion devices; Supercapacitors, batteries and hydroelectric Cells Editor: Anurag Gaur, 2021, CRC Press, ISBN: 9781000470512.
8	An overview of advanced nanomaterials for sensor applications, Rohilla D, Chaudhary S, Umar A. Engineered Science publisher. 2021, 16:47-70. DOI: 10.30919/es8d552.

Laboratory Experiments (ME stream)	
1	Estimation of copper in the E-waste.
2	Determination of pKa of a weak acid using pH sensor.
3	Potentiometric estimation of iron.
4	Colorimetric estimation of copper from PCBs.
5	Conductometric estimations.
6	Flame photometric estimation of sodium.
7	Determination of viscosity coefficient.
8	Electroplating of copper.
9	Preparation of polyaniline for sensor application (Demonstration experiment).
10	Preparation of semiconducting TiO_2 nanoparticles for DSSC applications (Demonstration experiment).
11	Determination of band gap of semiconducting material using UV-vis spectrophotometer (Demonstration experiment).
12	Study the surface morphology of nanomaterials using scanning electron microscopy (Demonstration experiment).
13	Thin films fabrication using PECVD and sputtering technique (Demonstration Experiment).
14	Fabrication of coin cell super capacitor prototype (Demonstration experiment).
15	Synthesis of iron oxide nanomaterials using solution combustion synthesis.
16	Green synthesis of nanomaterials.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**

4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	14
3 & 4	Unit – II: Question 3 or 4	14
5 & 6	Unit – III: Question 5 or 6	14
7 & 8	Unit – IV: Question 7 or 8	14
9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: 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 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	42L+ 30P		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Fuels: Thermochemistry, calorific value of fuels, numerical, knocking in internal combustion engines, reasons for knocking, octane and cetane number, antiknocking agents. Biodiesel, power alcohol **Alternative Fuels**: Green fuel- hydrogen production and storage. Rockets Fuels: Properties, characteristics and types.	
Unit – II	**09 Hrs**
Energy Storage and Conversion Devices **Batteries and Super Capacitors:** Working principle, classification, fabrication and applications of lithium-ion battery, metal air batteries, supercapacitors and super batteries. **Fuel cells and renewable energy:** Hydrogen - oxygen fuel cell, direct methanol fuel cell and their applications. Solar cell – principle, construction and working of Quantum Dot sensitized solar cells.	
Unit – III	**08 Hrs**
Corrosion Science and Management **Corrosion:** Electrochemical theory of corrosion. Types: differential aeration (pitting and water line), differential metal and stress corrosion. Factor affecting rate of corrosion. Case studies on corrosion failure. **Corrosion Control:** Metal coating-galvanization and tinning, surface conversion coating - anodizing and phosphating. Cathodic protection - sacrificial anode method. Corrosion testing by weight loss method. Corrosion penetration rate (CPR)-numerical problems. Metal finishing: Electroplating of chromium and Electroless plating of copper:	
Unit – IV	**08 Hrs**
Chemistry of Nanomaterials **Size dependent properties:** Surface area, optical and catalytic properties. Classification of nanomaterials. Synthesis: Solution combustion and Sol-gel methods. **Synthesis and applications:** Synthesis, properties and applications of carbon nano tubes and graphenes. Nano lubricants: Types of nanoparticles as lubricant additives and their application in defense, automobile and spacecrafts.	
Unit – V	**09 Hrs**
Engineering Polymers and Nanocomposites: Thermosets-bakelite and epoxy, thermoplastics- polycarbonate and polyether sulfones- preparation and specific applications in industries. Biodegradable polymer: Introduction, synthesis, properties, and application of poly lactic acid (PLA). Significance of glass transition temperature (Tg) and factors affecting Tg. **Reinforcements and testing**: Glass, carbon and natural fiber - synthesis, properties and applications in polymer composites. ASTM standards of material testing-tensile strength, flexural strength, ILSS and impact strength. Applications of polymer nanocomposites in injection moulded products, paints and 3D printing.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply principles of chemistry for the synthesis of materials and evaluation of their properties with the energy devices, polymer materials and corrosion science. **(PO1, PO11)**
CO2	Evaluate the properties of materials for the engineering application. **(PO1, PO6)**
CO3	Propose and interpret solutions for the challenges related to material performance and sustainability in engineering practices. **(PO1, PO6)**
CO4	Analyze the quality parameters of materials for sustainable engineering application. **(PO1, PO6, PO8, PO9, PO11)**

Reference Books	
1	Understanding nanomaterials, Malkiat S. Johal, Lewis E. Johnson, 2017, CRC Press, Taylor and Francis Group, ISBN: 9780815354383.
2	Engineering chemistry, Shubha Ramesh et.al., 2011, Wiley India, 1st Edition, ISBN: 9788126519880.
3	Fundamentals of analytical chemistry, Douglas A. Skoog et.al., 2004, 9th edition, Thomson Asia pte Ltd., ISBN: 9780495558286
4	Energy storage and conversion devices, Anurag Gaur, A. L. Sharma, Anil Arya, 2021, CRC Press, Taylor and Francis Group, 1st Edition, ISBN: 9781003141761.

Laboratory Experiments	
1	Volumetric analysis.
2	Analysis of alloy (Brass).
3	Ore analysis (Haematite).
4	Determination of pKa of a weak acid.
5	Potentiometric estimation of iron in rust.
6	Colorimetric estimation of copper.
7	Conductometric estimations.
8	Determination of viscosity coefficient of a given liquid using Ostwald's viscometer.
9	Flame photometric estimation of sodium in the given saline solution.
10	Preparation of nanomaterials by solution combustion method.
11	Preparation of thin films by dipcoating technique and characterization of thin film.
12	Determination of relative and kinematic viscosities of given lubricating oil at different temperatures using Redwood viscometer (Demonstration experiment).
13	To find of Tg of polymer using DSC (Demonstration Experiment).
14	Study of surface morphology of materials using SEM (Demonstration experiment).
15	Phase analysis of alloys by XRD (Demonstration experiment).
16	Synthesis of metal oxide nanomaterials using solution combustion synthesis (Demonstration experiment).
17	Green synthesis of nanomaterials (Demonstration experiment).

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	14
3 & 4	Unit – II: Question 3 or 4	14
5 & 6	Unit – III: Question 5 or 6	14
7 & 8	Unit – IV: Question 7 or 8	14
9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I						
ENGINEERING AND ENVIRONMENTAL CHEMISTRY **Category: Applied Science Course** **Stream: Civil (Only to CV Program)** **(Theory and Practice)**						
Course Code	**:**	CM221ID		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	42L+ 30P		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Green Chemistry: Introduction, principles of green chemistry, E-factor, atom economy, microwave and ultrasound assisted reactions, examples of green synthesis. **Water Chemistry**: Impurities in water, emerging pollutants, water quality parameters as per BIS, determination of fluoride, DO, BOD and COD, numericals, desalination of water by RO. Sewage treatment process.	
Unit – II	**09 Hrs**
Materials in Civil Engineering **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. **Glass:** Manufacture, properties, types and applications. **Ceramics and Refractory Materials:** Properties, types and applications.	
Unit – III	**08 Hrs**
Corrosion Science and Engineering **Corrosion:** Electrochemical theory, types: differential aeration (waterline and pitting), differential metal and stress corrosion (caustic embrittlement). Factors affecting rate of corrosion. **Corrosion Control**: Metal coating-galvanization and tinning, surface conversion coating - anodizing and phosphating. Cathodic protection - sacrificial anode method. Corrosion testing by weight loss method, corrosion penetration rate (CPR), numerical problems. **Metal finishing**: Electroplating of chromium and electroless plating of copper	
Unit – IV	**09 Hrs**
Polymers and Polymer Composites: Synthesis, properties, and applications of PMMA, PVC, polyester, polystyrene. Polymer concretes and biopolymer. **Smart Polymers**: Thermo chromic polymers, electrochromic polymers, polymer coatings, polymer binders and self-healing polymers. **Polymer Composites**: Carbon fiber composites, CNT and graphene-based composites. **Adhesives**: Synthesis and application of epoxy resins. **Geo Polymers**: Properties, types, geo polymer concrete. **Biodegradable Polymers**: Polylactic acid and its application.	
Unit – V	**08 Hrs**
Chemistry of Nanomaterials and Analytical Techniques: Properties (surface area, electrical, optical and catalytic properties), synthesis of nanomaterials: Top down and bottom-up approaches, synthesis by sol-gel, and solution combustion method. Civil engineering applications of carbon nanotubes. **Analytical Techniques**: Principle, instrumentation and applications of conductometry, potentiometry, colorimetry and pH-sensor (glass electrode).	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the principles of chemistry in synthesis of materials and evaluating their properties associated with green chemistry, water chemistry, civil engineering and corrosion science. **(PO1, PO11)**
CO2	Evaluate the materials for their application in environmental monitoring and civil engineering. **(PO1, PO6)**
CO3	Propose and interpret solutions for the challenges connected to engineering applications. **(PO1, PO6)**
CO4	Analyse the quality parameters of materials associated with sustainable environmental monitoring and civil engineering. **(PO1, PO6, PO8, PO9, PO11)**

Reference Books	
1	Chemistry for Engineers, Teh Fu Yen, Imperial college press, 2008, ISBN: 97818609747742.
2	Advances in corrosion science and technology, M.G. Fontana, R.W. Staettle, Springer publications, 2012, ISBN: 9781461590620.
3	Fundamentals of analytical chemistry, Douglas A. Skoog et.al., 8th edition, 2004, Thomson Asia pte Ltd. ISBN: 9812435131.
4	Engineering chemistry, Shubha Ramesh et.al., Wiley India, 1st Edition, 2011, ISBN: 9788126519880.

Laboratory Experiments	
1	Volumetric analysis.
2	Estimation of water quality parameter: chemical oxygen demand.
3	Estimation of CaO in cement solution.
4	Determination of pKa of a weak acid using pH meter.
5	Potentiometric estimation of iron.
6	Colorimetric estimation of copper.
7	Conductometric estimation.
8	Determination of viscosity coefficient of a given liquid using Ostwald's viscometer.
9	Flame photometric estimation of sodium.
10	Determination of relative and kinematic viscosities of given lubricating oil at different temperatures using Redwood viscometer (Demonstration Experiment).
11	To find of Tg of polymer using DSC. (Demonstration Experiment).
12	Study of surface morphology of materials using SEM (Demonstration Experiment).
13	Synthesis of iron oxide nanomaterials using solution combustion synthesis
14	Green synthesis of nanomaterials.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	14
3 & 4	Unit – II: Question 3 or 4	14
5 & 6	Unit – III: Question 5 or 6	14
7 & 8	Unit – IV: Question 7 or 8	14
9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

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 & EI Programs)** **(Theory)**						
Course Code	**:**	EC112TA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit – I	**08Hrs**
Bipolar Junction Transistors: Semiconductor Diode- Review, Regulated Power Supply. Bipolar Junction Transistors- Transistor Construction and Operation, Load-Line Analysis, Operating Point, Fixed Bias, Voltage–Divider Bias Configurations, Bias Stabilization, Transistor Switching Networks, Amplification in the AC Domain, The re Transistor Model for CE Configuration, RC Coupled Amplifier, Gain, Input Resistance and Frequency Response, Cascaded Systems. Numerical Examples.	
Unit – II	**08 Hrs**
MOSFET: Differences between BJT & FET, Enhancement Type N-MOSFET Operation. Output Characteristics, Regions of Operation, Current Equation and Transfer Characteristic, Small Signal Equivalent, Calculation of Trans-Conductance and Voltage Gain, rDS, Operation of CMOS Inverter, CMOS NAND and CMOS NOR, Numerical Examples. Basic Principles and Advantages of Negative Feedback: Feedback Concept, Advantages of Negative Feedback, Analysis of Gain and Gain Stability, Numerical Examples.	
Unit – III	**08 Hrs**
Digital Electronics **Boolean Algebra and Simplification:** Boolean Postulates and De-Morgan's Theorems. Simplification Using Postulates and Theorems. Simplification using K-Map up to 4-Variables. **Basic and Universal Gates:** Truth Tables of All Basic and Universal Gates. Half Adder, Full Adder, Realization Using Basic Gates and NAND Gates. Multiplexers, De-Multiplexers, Encoders and Decoders.	
Unit – IV	**08 Hrs**
Introduction To OP-AMP: Block Diagram of Op-Amp, Characteristics of an Ideal Op-Amp: Gain, Bandwidth, Input & Output Impedances, CMRR, PSRR, Slew Rate, Input Offset Voltage. Typical Parameters of a General Purpose Op-Amp, Pin Configuration of Op-Amp (741). Differential Amplifier, Applications: Inverting Amplifier, Non Inverting, Amplifier, Voltage Follower, Summer, Integrator, Differentiator, Comparator, Difference Amplifier, Schmitt Trigger, Instrumentation Amplifier, Numerical Examples.	
Unit – V	**08 Hrs**
Communication Systems, Sensors and Transducers **Introduction to Communication:** Block Diagram of a General-Purpose Communication System, Need for **Modulation, Types of Modulation:** AM and FM. Modulation Index, Sideband Frequencies, Bandwidth and Power, Differences Between AM and FM, Numerical Examples. Digital Communication Block Diagram. **Introduction to Transducers:** Passive Electrical Transducers- Resistive Thermometer, Linear Variable Differential Transformer (LVDT), Proximity Transducer. Active Electrical Transducer- Piezo Electric Transducer, Hall Effect Transducer. **Case Studies:** i. Automatic Headlight System ii. Pick and Place Robots.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge on operational characteristics of the semiconductor devices such as Diodes, BJTs, MOSFETs, Sensors, Operational Amplifiers, Digital logic building blocks and Communication Systems for various electronic applications. **(PO1, PO2, PO9)**
CO2	Analyze the performance of electronic circuits for different applications of electronic systems designs. **(PO1, PO2, PO5, PO6, PO8, PO9)**
CO3	Investigate and adopt possible safety measures, societal and environmental considerations through

	experiential learning and literature survey. **(PO1, PO2, PO5, PO6, PO8, PO9, PO11)**
CO4	Evaluate the performance of the electronic systems designed for the given specifications using the modern design tools. **(PO1, PO2, PO5, PO8, PO9, PO11)**

Reference Books	
1	Electronic Devices and Circuit Theory, Robert L Boylestad, Louis Nashelsky, Prentice Hall India publication, 10th Edition, 2009, ISBN: 978-317-2700-3.
2	Basic Electronics, D P Kothari,,I J Nagrath, Mc Graw Higher Ed, 2nd Edition, ISBN: 9789352606467.
3	Digital Logic and Computer Design, Morris Mano, , Prentice Hall India publication, 54th Edition, 2007, ISBN: 978-81-317-1450-8.
4	Electronic Devices and Circuits, David A. Bell, Oxford University Press, 5th Edition, 2008. ISBN:9780195693409.
5	Basic Electronics, Ravish Aradhya H V, McGraw Hill Education; 3rd edition, ISBN: 978-0071333108.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit –V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I						
ELEMENTS OF ELECTRICAL ENGINEERING **Category: Professional Core Course** **Stream: Electronics (Only to EE Program)** **(Theory)**						
Course Code	**:**	EE112TA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40 L		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
AC Circuits: Parameters of sinusoidal quantities, Generation of sinusoidal voltage, Voltage and current relationship with phasor diagram in R, L and C circuits. Analysis with phasor diagram of R-L, R-C, R-L-C Series and Parallel circuits, Power factor, real power, reactive power, apparent power, Examples. **Three-phase circuits:** Generation of three phase EMF, phase sequence, relation between phase and line values of voltage and current from phasor diagrams in Y and Δ connected systems, measurement of power in three phase circuit by two wattmeter method (Balanced load) and examples.	
Unit – II	**08 Hrs**
DC Machines: DC Generators: Basic principle, construction, Derivation for induced EMF, types, OCC and load Characteristics of shunt and series, Application, and examples **DC Motor:** Introduction, working principle, significance of back EMF, types, Derivation for power & Torque, Characteristics- shunt, series & compound, necessity of starters, 3-point starter, Application and examples	
Unit – III	**08 Hrs**
Single Phase Transformers: Necessity of transformer, principle of operation, Construction of core and shell type for single - phase, ideal transformer, derivation for induced EMF, transformer on No-Load & On-Load (inductive), constant and variable losses, OC & SC tests, efficiency & regulation, condition for maximum efficiency.	
Unit – IV	**08 Hrs**
Three phase Induction Motor: Concept of rotating magnetic field, Principle of operation, constructions, types, slip and its significance, applications, examples. **Alternators:** Principle of operation, types, construction, advantage of stationary armature, derivation for EMF equation with the concept of winding factor (distribution factor, winding factor, breadth factor), applications, examples.	
Unit – V	**08 Hrs**
Power transmission and distribution: Concept of power transmission and power distribution. Low voltage distribution system (400 V and 230 V) for domestic, commercial, and small-scale industry through block diagrams only. **Electricity bill**: Power rating of household appliances including air conditioners, PCs, laptops, printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers. **Equipment Safety measures**: Fuse and Miniature circuit breaker (MCB), Electric Shock, Earthing and its types, Safety Precautions to avoid shock.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze single phase and three phase AC circuits using basic laws and fundamental concepts of Electrical machines and power transmission and distribution circuits with safety devices in electrical systems. (**PO1, PO2, PO8, PO9, PO11**)
CO2	Evaluate the electrical quantities of AC circuits and performance parameters of AC and DC machines. **(PO1, PO2, PO8, PO9, PO11)**
CO3	Analyze the characteristics of AC & DC machines and their applications. (**PO1, PO2, PO8, PO9, PO11**)
CO4	Apply the knowledge of electrical circuits, electrical parameters to estimate electricity consumption with tariffs to estimate electricity consumption. (**PO1, PO2, PO8, PO9, PO11**)

Reference Books	
1	Electrical and Electronics Technology, E. Hughes, 10th Edition, 2010, Pearson, ISBN- 978-8131733660.
2	Basic Electrical Engineering, C.L. Wadhwa, 1st Edition, 2007, New Age international(P) Limited, ISBN- 10: 9788122421521.
3	Basic Electrical Engineering, M. V. Rao, 10th Edition, 2018, Subhas Publications, ISBN- 9789383214136.
4	Basic Electrical Engineering, D C Kulshreshtha, Revised First Edition, 2017, Tata McGraw Hill, ISBN- 13:978-0071328968.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit –V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I						
ELEMENTS OF MECHANICAL ENGINEERING **Category: Professional Core Course** **Stream: Mechanical (Common for AS, CH, IM & ME Programs)** **(Theory)**						
Course Code	**:**	ME112TA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40T		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Engineering Materials: Introduction, Classification, fabrication and applications of Metals: Ferrous and Nonferrous, Polymers (Thermoplastics, Thermosets and Elastomers), Ceramics and Composites. Thin films, Sensors, semiconductor	
Unit – II	**10 Hrs**
Lathe and Lathe operations: Classification, specifications of a lathe. Lathe operations (Turning, Taper Turning, drilling, boring, knurling, and thread cutting). Introduction to CNC Machines. **Joining processes & Non-destructive testing:** Introduction to metal joining process-permanent & temporary joints, Soldering & welding, types and applications, accessories consumables and safety, Welding defects and causes, Non-Destructive testing: Liquid penetrate testing, Magnetic particle testing, Ultrasonic testing, Eddy current testing.	
Unit – III	**08 Hrs**
Turbines: Steam and its properties, property charts, steam turbines. Classification of hydraulic turbines, working of Pelton, Francis and Kaplan turbines; comparison between impulse and reaction turbines, Working of Gas Turbines (Brayton cycle). **Refrigeration:** Refrigeration effect, working principle of Vapour Compression refrigeration systems, ton of refrigeration, COP, refrigerants and their properties.	
Unit – IV	**08 Hrs**
Mechanical Drives: Classification of IC Engines, Working of 4-S direct injection engines, Performance Characteristics, Classification of gears, velocity ratio for simple and compound gear trains. **Electrical Drives:** History, Well to Wheel analysis, Electric vehicles, Configurations, EV/ICEV comparison, Performance, Traction Motor Characteristics, Concept of Hybrid Electric Drive Trains, Classification of hybrid electric vehicles.	
Unit – V	**06 Hrs**
Mechatronics: Introduction: Evolution of Mechatronic system, measurement & control system, basic elements of control system, Applications-water level controller, washing machine, Engine management system (EMS), Anti-lock Braking System (ABS). **Robotics:** Robots- Basic Structure of Robots, Robot Anatomy, Complete 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	Understanding the fundamentals of basic engineering materials, manufacturing processes, refrigeration systems, prime movers, mechatronics, and automation. **(PO1)**
CO2	Explain the classification of engineering materials, machine tools, refrigeration cycles, engines, automation, and mechatronics systems. **(PO1, PO5)**
CO3	Apply knowledge of engineering materials, manufacturing processes, and thermodynamic principles to solve problems and perform analyses in various industrial applications. **(PO2, PO5)**
CO4	Assess and contrast the performance of engineering materials, manufacturing processes, and mechanical systems for various industrial applications. **(PO2)**

Reference Books	
1	Elements of Mechanical Engineering, K. R. Gopalakrishna, Subhas Publications, 18th Edition. ISBN:5551234002884
2	Material Science & Engineering- William D Callister, 2 / 10th Edition, ISBN 978-1-119-45520-2.
3	Welding Technology (PB), Khanna O P, Dhanpat Rai publication, 4th Edition, ISBN 9383182555.
4	Electric and Hybrid Vehicles, Design Fundamentals – Iqbal Husain, CRC Press, 2nd Edition, 2010. ISBN – 13-978-1439811757.
5	Modern Electric, Hybrid Electric & Fuel Cell Vehicles, Fundamentals, Theory and Design – Mehrdad Ehsani, CRC Press, 1st Edition, 2005. ISBN – 13- 978-0849331541.
6	Mechatronics – Electronic control systems in Mechanical and Electrical Engineering, William Bolton, Pearson, 6th Edition, ISBN: 978-1-292-07668-3, 2015.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit –V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: II						
PRINCIPLES OF PROGRAMMING USING C **Category: Professional Core Course** **Stream: Computer Science (Common to AI, BT, CS, CY, CD & IS Programs)** **(Theory and Practice)**						
Course Code	**:**	CS222AI		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	28L+30P		**SEE Duration**	**:**	03 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.	
Unit – II	**05 Hrs**
Decision Control and Looping Statements: Introduction to decision control, conditional branching statements, iterative statements, Nested loops, Break and continue statements, goto statements **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.	
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 strings, reversing a string, String and character Built in functions. **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. Recursion.	
Unit – IV	**06 Hrs**
Structures: Introduction: Structure Declaration, Type of declaration, initialization of structures, accessing members of a structures, copying and comparing structures, array of structures, Structures and functions. **Pointers:** Introduction to pointers, declaring pointer variables, pointer expressions and pointer arithmetic, null pointers, passing arguments to functions using pointers, pointers and arrays.	
Unit – V	**05Hrs**
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: After completing the course, the students will be able to	
CO1	Apply logical skills to solve the problems using C programming constructs across various domains such as engineering, mathematics and data processing. **(PO1, PO2)**
CO2	Design and implement a sustainable solution using C programming with societal and environmental concern by engaging in lifelong learning for emerging technology. **(PO1, PO2, PO3, PO4, PO5, PO6, PO11)**

CO3	Evaluate the appropriate method/data structure required in C programming to develop solutions by investigating the problem. **(PO1, PO2, PO4, PO5, PO7, PO11)**
CO4	Demonstrate programming skills to solve inter-disciplinary problems using modern tools effectively by exhibiting teamwork through oral presentation and written reports. **(PO1, PO2, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11)**

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.

Laboratory Experiments

PART A

Implement the following programs using cc/gcc compiler

Practice Programs:

a) Familiarization with programming environment: Concept of creating, naming and saving the program file in gedit/vi editor, Concept of compilation and execution, Concept of debugging in GDB environment.

b) Implementation and execution of simple programs to understand working of
- Printf, formatted printf, Escape sequences in C.
- Using formula in a C program for specific computation.
- Example: computing area of circle, converting Celsius to Fahrenheit, area of a triangle, converting distance in centimeters to inches, etc.
- Preprocessor directives (#include, #define)

c) Execution of erroneous C programs to understand debugging and correcting the errors like:
- Syntax / compiler errors
- Linker errors
- Logical errors
- Semantical errors

d) Implementation and execution of simple programs to understand working of operators like:
- Unary
- Arithmetic
- Logical
- Relational
- Conditional
- Bitwise

Programming Assignments:

1. Assignment statements.
2. Control Statements.
3. Loop Statements.
4. One dimensional Arrays – Searching and sorting.
5. Two dimensional arrays – Matrix operations.
6. Functions.
7. Recursion.
8. Structures.
9. Pointers
10. Linked Lists
11. Dynamic memory allocation
12. Files.

PART B
Design and development of a working model using any of the following combination of hardware and software. • Develop a model that helps the user to monitor whether, health condition, environment parameters etc using Arduino board. • Develop a simple Robot that can assist the user to perform simple activities home sanitization, lifting things etc using Raspberry pi. • Hardware interfacing (**Ardunio Board, Finch, Lego WeDo 2.0**) with scratch to design various models to solve simple problems. Develop applications using Nvidia Jetson Kit.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**
RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	14
3 & 4	Unit – II: Question 3 or 4	14
5 & 6	Unit – III: Question 5 or 6	14
7 & 8	Unit – IV: Question 7 or 8	14
9 & 10	Unit –V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: II						
ENGINEERING MECHANICS **(Category: Professional Core Course)** **(Stream: Civil)** **(Theory)**						
Course Code	**:**	CV112TA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Resultant of coplanar force system: Basic dimensions and units, Idealizations, Classification of force system, principle of transmissibility of forces, composition of forces, resolution of forces, moment, Principle of moments, couple, Resultant of coplanar concurrent force system, Resultant of coplanar non-concurrent force system, Numerical examples.	
Unit – II	**08 Hrs**
Equilibrium of coplanar force system: Equilibrium of coplanar concurrent force system, Lami's theorem, Equilibrium of coplanar parallel force system, types of beams, types of loadings, types of supports, Free body diagrams, Equilibrium of coplanar non-concurrent force system, support reactions of statically determinate beams subjected to various types of loads, Numerical examples.	
Unit – III	**08 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	**08 Hrs**
Centroid of plane areas: Introduction, Locating the centroid of rectangle, triangle, circle, semicircle, quadrant and sector of a circle using method of integration, centroid of composite areas and simple built up sections, Numerical examples.	
Unit – V	**08 Hrs**
Moment of inertia of plane areas: Introduction, Polar moment of inertia, polar moment of inertia, product of inertia, radius of gyration, parallel axes theorem, perpendicular axis theorem, moment of inertia of rectangular, triangular and circular areas from the method of integration, moment of inertia of composite areas and simple built up sections, Numerical examples.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the fundamental concepts of mechanics to analyze rigid bodies. (**PO1, PO2, PO11)**
CO2	Compute centroid and second moment of area for plane and composite sections. (**PO1, PO2, PO11)**
CO3	Demonstrate the applications of mechanics to solve complex Engineering problems. (**PO1, PO2, PO3, PO8, PO9, PO11)**

Reference Books	
1	Mechanics for Engineers, Statics and Dynamics, Beer F.P. and Johnston E. R., McGraw-Hill Inc., US; 4th Revised Edition, 1987, ISBN-13 : 978-0070045842.
2	Engineering Mechanics Statics and Dynamics, Irving H. Shames, Dorling Kindersley Pvt Ltd. 4th Edition, 2005, ISBN: 9788177581232
3	Engineering Mechanics: Principles of Statics and Dynamics, Hibbler R. C., Pearson Press. 14th Edition, 2017, ISBN-13 : 978-9332584747.
4	Engineering Mechanics, Timoshenko S, Young D. H., Rao J. V.,Pearson Press. 5th Edition, 2017, ISBN-13:978-1259062667.
5	Engineering Mechanics, Bhavikatti S S, New Age International Private Limited, 8th Edition, 2021,

	ISBN-13:978-9388818476.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
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7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit –V: Question 9 or 10	16
	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)**

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

LABORATORY EXPERIMENTS

Part-A: Basic Sensor and Actuator Interfacing Experiments

1. a) LED On/Off
   - Objective: To control the ON/OFF state of a single LED using a microcontroller.

   b) Multiple LED On/Off
   - Objective: To control the ON/OFF state of multiple LEDs, demonstrating basic GPIO pin handling.
2. LED with Switch Interface
   - Objective: To interface a physical switch with a microcontroller to control the ON/OFF state of an LED.
3. Ultrasonic Sensor with LED and Buzzer Interface (Optional: DC Pump Control)
   - Objective: To measure distance using an ultrasonic sensor and trigger an LED and buzzer when an object is detected within a threshold. Optionally, control a DC pump based on sensor input.
4. Temperature & Humidity Sensor with LCD Interface (Optional: DC Motor Control)
   - Objective: To read environmental data using a temperature and humidity sensor and display it on an LCD. Optionally, control a DC motor based on the sensor data.
5. Flame Sensor Interfacing with Buzzer and LED (Optional: DC Motor/Pump Control)
   - Objective: To detect fire using a flame sensor, trigger an LED and buzzer, and optionally control a DC motor or pump for safety measures.
6. Float Sensor Interfacing with Buzzer and LED (Optional: DC Pump Control)
   - Objective: To monitor liquid levels using a float sensor, activating a buzzer and LED when a certain level is reached. Optionally, control a DC pump to regulate liquid levels.

Part-B: Advanced Sensor and Actuator Interfacing Experiments

7. Touch Sensor Interfacing with LED (Optional: Solenoid Lock Control)
   - Objective: To detect touch using a touch sensor and activate an LED. Optionally, control a solenoid lock for security applications.
8. Interfacing Magnetic Door Sensor with LED and Buzzer
   - Objective: To interface a magnetic door sensor for security purposes, activating an LED and buzzer when the door is opened or closed.
9. Interfacing LDR Sensor with Arduino UNO to Control LED or 230V Bulb Using 5V Relay
   - Objective: To detect ambient light using an LDR sensor and control the state of an LED or a 230V bulb via a 5V relay.
10. Smoke Sensor Interfacing with LED and Buzzer
    - Objective: To detect smoke using a smoke sensor, triggering an LED and buzzer for safety and warning purposes.
11. Interfacing Soil Moisture Sensor with Arduino UNO (Optional: DC Pump Control)
    - Objective: To measure soil moisture levels using a soil moisture sensor and control a DC pump for irrigation purposes based on the moisture readings.
12. Interfacing Heartbeat Sensor with Arduino UNO
    - Objective: To monitor heart rate using a heartbeat sensor and display or process the data using Arduino.
13. Robot Demonstration
    - Objective: To demonstrate the working of a robot that integrates various sensors and actuators,

showcasing a complete automation solution.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply fundamental principles of mathematics, science, and engineering to design and implement interface circuits. **(PO1, PO10)**
CO2	Develop creative solutions for sensor-based systems. **(PO3, PO5)**
CO3	Investigate, analyze, and solve complex problems related to automation. **(PO4, PO5, PO6)**
CO4	Demonstrate the ability to work collaboratively in diverse teams to design and implement intelligent systems. **(PO8, PO9, PO10)**

Reference Books	
1	Geddes, M. (Year). Arduino project handbook: Volume one: Complete guide to creating with the Arduino. Sketch Publishing. ISBN-10: 0992952603.
2	Blum, J. (Year). Exploring Arduino: Tools and techniques for engineering wizardry. Wiley. ISBN-10: 1119405378.
3	Schwartz, M. (Year). Internet of things with ESP8266. Packt. ISBN-13: 9781786468024.
	https://www.arduino.cc/reference/en/

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (LAB)		
#	**COMPONENTS**	**MARKS**
1.	Conduction of laboratory exercises, lab report, observation, and analysis **(30 marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to **50 Marks.**	**50**
	MAXIMUM MARKS FOR THE CIE	**50**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q. NO.	**CONTENTS**	**MARKS**
1.	TWO lab exercises with implementation of the program.	40
2.	Viva	10
	TOTAL	**50**

Semester: I / II						
COMPUTER AIDED ENGINEERING GRAPHICS **(Common for all Programs)** **(Theory & Practice)**						
Course Code	**:**	ME112GL/ME122GL		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	1:0:2		**SEE**	**:**	50 Marks
Total Hours	**:**	15(T)+60 (P)		**SEE Duration**	**:**	03 Hours

Unit – I	**12 Hrs**
Introduction: Significance of engineering graphics, BIS conventions, drawing sheets, drawing scales, dimensioning, line conventions, material conventions. Symbolic representation of fasteners - bolts and nuts, riveted, welded, brazed and soldered joints, bars and profile sections, electrical & electronic elements and piping. **Use of Simple CAD tools:** Overview of CAD software [Menu bar, tabs -sketch, modify, dimension, annotation and commands]. **Orthographic Projections:** Principles of orthographic projections - quadrant systems, projection of points (All quadrants); Projection of lines (first angle projection); Projection of planes - inclined to HP and VP (first angle projection).	
Unit – II	**12 Hrs**
Projection of Solids: Prisms, pyramids, cylinder & cone with axis inclined to HP and VP (first angle projection). (Computer Drafting)	
Unit – III	**18 Hrs**
Isometric projection: Isometric scale, Isometric Projection of regular solids and combination of two simple solids (Computer Drafting). **3D modelling of components:** Conversion of isometric view to orthographic views and sectional views. (Computer Drafting)	
Unit – IV	**15 Hrs**
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) (Computer Drafting).	
Unit - V	**18 Hrs**
Engineering components Assembly of Hexagonal bolt with nut (with washer)-3D Riveted joint: - butt joint with two covering plate (chain riveting): 3D Union joint, butt muff coupling, socket and spigot joint: 3D Basic building drawing (Plan and Elevation): 2D Electrical wiring and lighting drawing: 2D Electronic PCB drawings: 2D	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply BIS standards to create technical drawings, incorporating conventions for symbols, dimensions, and material representations. **(PO1)**
CO2	Generate orthographic and isometric projections of solids using first-angle projection in both manual and CAD environments. **(PO1, PO5)**
CO3	Develop lateral surfaces of engineering solids and create 3D models and assemblies of engineering components using CAD software. **(PO5)**
CO4	Create 2D drawings for various engineering domains, including building plans, electrical wiring, and electronic PCBs using CAD software. **(PO1, PO5)**

Reference Books	
1	Textbook of Engineering Graphics by K R Gopalakrishna, Sudhir Gopalakrishna, Subhash Publishers, 40th Edition, 2018; ISBN 978-9383214204.

2	SOLIDWORKS 2020 for Designers by Sham Tickoo Purdue University, CADCIM Technologies, 18th Edition, 2019; ISBN: 978-1640570849.
3	Machine drawing by N. D. Bhatt, V. M. Panchal, Charotar Publishing House, 50th Edition, 2016; ISBN: 978-9385039232.
4	NPTEL :: Mechanical Engineering - Engineering Drawing.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)	
ASSESSMENT AND EVALUATION PATTERN Theory & quizzes questions are to be framed using Bloom's Taxonomy Levels - Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating.	**MARKS**
WEIGHTAGE	**CIE (50%)**
Practice session	
Manual Drawing: Practice session	**10**
Computer Drafting: Practice Session	**15**
A. TESTS: Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to 10	
Test – I for 50 Marks	**10**
Test – II for 50 Marks	
B. EXPERIENTIAL LEARNING: Experiential Learning comprises of the modelling and simulation of various engineering components .	**15**
TOTAL MARKS FOR THE COURSE (Lab Course)	**50**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A **(TWO questions to be answered out of THREE Questions)**	
Unit – I	One Question to be set from the chapters Points, Lines & Planes. Each question carrying 5 marks.	**10**
	PART B **(TWO questions to be answered out of THREE Questions)**	
Unit – II	Question on Projection of Solids (15 marks)	**15**
Unit -III	Question on Isometric Projection (15 marks)	**15**
Unit -IV	Question on Development of Surfaces (15marks)	**15**
	PART C **(ONE question to be answered out of FOUR Questions)**	
Unit – V	Question on Assembly of Hexagonal bolt and nut or Riveted Joint	**10**
	Question on Basic building drawing	**10**
	Question on Electrical wiring and lighting drawings	**10**
	Question on Electronic PCB drawings	**10**
	MAXIMUM MARKS FOR THE SEE THEORY	**50**

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 Course** **(Common to all Programs Except CS Stream Programs)** **(Theory)**						
Course Code	**:**	CS113ATA/CS123ATA		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit – I	**06 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	**08 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.	
Unit – III	**08 Hrs**
Decision Control and Looping Statements: Introduction to decision control, conditional branching statements, iterative statements, Nested loops, Break and continue statements, goto statements. **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.	
Unit – IV	**10 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 strings, reversing a string. String and character Built in functions. **Functions:** Introduction, using functions, Function declaration/function prototype, Function definition, Function call, Return statement.	
Unit – V	**08 Hrs**
Functions: Passing parameters to a function, Built-in functions. Passing arrays to functions. Recursion. **Structures and Pointers:** Introduction: Structure Declaration, Typedef declaration, initialization of structures, accessing members of a structures, structure within structures. Introduction to pointers, declaring pointer variables.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply logical skills to solve the problems using C programming constructs across various domains such as engineering, mathematics and data processing. **(PO1, PO2)**
CO2	Design and implement a sustainable solution using C programming with societal and environmental concern by engaging in lifelong learning for emerging technology. **(PO1, PO2, PO3, PO4, PO5, PO6, PO11)**
CO3	Evaluate the appropriate method/data structure required in C programming to develop solutions by investigating the problem. **(PO1, PO2, PO4, PO5, PO7, PO11)**
CO4	Demonstrate programming skills to solve inter-disciplinary problems using modern tools effectively by exhibiting teamwork through oral presentation and written reports. **(PO1, PO2, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11)**

Reference Books	
1	Programming in C, Reema Thareja, 2018, Oxford University Press. ISBN: 9780199492282.
2	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, 2015, 2nd Edition, Prentice Hall, ISBN (13): 9780131103627.
3	Turbo C: The Complete Reference, H. Schildt, 2000, 4th Edition, McGraw Hill Education,

	ISBN-13: 9780070411838.
4	Let Us C: Authentic Guide to C PROGRAMMING Language, Yashavant Kanetkar 17th Edition, 2020, BPB PUBN , ISBN- 9789389845686.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit –V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
ELEMENTS OF CIVIL ENGINEERING **Category: Engineering Science Course** **(Common to all Programs Except CV Program)** **(Theory)**						
Course Code	**:**	CV113ATB/CV123ATB		**CIE**	**:**	100 Marks
Credits: L: T: P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Introduction to Civil Engineering: Surveying, Structural Engineering, Geotechnical Engineering, Hydraulics & Water Resources, Transportation Engineering, Environmental Engineering, Construction planning & Project management. **Analysis of force systems:** Concept of idealization, system of forces, principles of superposition and transmissibility, Resolution and composition of forces, Law of Parallelogram of forces, Resultant of concurrent and non-concurrent coplanar force systems, moment of forces, couple, Varignon's theorem, free body diagram, equations of equilibrium, equilibrium of concurrent and non-concurrent coplanar force systems.	
Unit – II	**08 Hrs**
Basic Materials of Construction: Bricks, Cement & mortars, Plain, Reinforced & Pre-stressed Concrete, Structural steel, Construction Chemicals. **Structural elements of a building:** foundation, plinth, lintel, chejja, Masonry wall, column, beam, slab and staircase including geometric design. Plinth area, carpet area, floor area ratio, numerical problems, local building byelaws.	
Unit – III	**08 Hrs**
Environmental Engineering: Water Supply and Sanitary systems, Water quality and Security. Urban air pollution -causes and remedial measures, Solid waste management- types, sources, collection and disposal methods, Urban flood- types, causes and control. **Built-Environment:** Energy efficient buildings, recycling, Temperature and Sound control in buildings, Security systems, Smart buildings.	
Unit – IV	**08 Hrs**
Transportation Engineering: Importance and classification of roads and railways, types of highway pavements and its functions. Functions and types of Tunnels, Harbours, Airport. Concepts of Multimodal transportation system- relevance and integration.	
Unit – V	**08 Hrs**
Geotechnical Engineering: Origin and formation of soil, Foundations- Importance, Types, and Factors to be considered in selection of foundations. **Novel areas:** Concepts of Automation and Robotics in Construction, Concept of Sustainability in Civil Engineering, Introduction to sustainable development goals, Concept of Smart, Clean and Safe city.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge of Civil Engineering in the infrastructural development of society. **(PO1, PO2, PO11)**
CO2	Comprehend the importance of construction materials for Civil Engineering applications. **(PO1, PO2)**
CO3	Illustrate the latest technologies in Civil Engineering for sustainable practices. **(PO1, PO2)**
CO4	Exhibit the knowledge of Civil Engineering in interpreting engineering problems. **(PO1, PO2, PO8, PO9, PO11)**

Reference Books	
1	Principles of Transportation Engineering, Partha Chakroborty, Animesh Das, PHI Learning Pvt. Ltd., 2nd Edition, 2003, ISBN: 9788120320840.
2	Engineering Mechanics, Bhavikatti S S, New Age International Private Limited, 8th Edition, 2021, ISBN-13:978-9388818476.

3	Basic Civil Engineering, G.K. Hiraskar, Dhanpat Rai Publications, 1st Edition, ISBN-13 978-9383182022: .
4	Basic Civil Engineering and Engineering Mechanics, R.K. Bansal, Laxmi Publications, 3rd Edition, 2015, ISBN-13:978-9380856674
5	Basic Civil Engineering, B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications; 1st Edition, 2003, ISBN-13 : 978-8170084037.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit –V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
PRINCIPLES OF ELECTRONICS ENGINEERING **Category: Engineering Science Course** **(Common to all Programs Except EC, EI & ET Programs)** **(Theory)**						
Course Code	**:**	EC113ATC/EC123ATC		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit – I	**08Hrs**
Regulated Power Supply: Block Diagram, Bridge Rectifier with filter, Zener diode as Voltage Regulator, Photo diode, LED. **Amplifiers:** CE Amplifier with and without feedback, Multistage amplifier, BJT as a switch, Cutoff and Saturation modes.	
Unit – II	**08 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 (Only Concepts, Working, Waveforms, No mathematical derivations). **Operational Amplifiers:** Op-Amp basics, Practical Op-amp circuits- Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, Summer, Integrator, Differentiator (Only Concepts, Working, Waveforms, No mathematical derivations)	
Unit – III	**08 Hrs**
Boolean Algebra And Logic Circuits: Binary numbers, Number base conversion and Hexadecimal Numbers, Complements, Basic definitions, Basic theorems and properties of Boolean Algebra, Boolean functions, Canonical and Standard forms, Digital Logic gates, Demorgan's Laws, Ex-OR realization using NAND and NOR, Kmaps (Up-to 4 variable). **combinational logic:** Introduction, Design procedure, Adders-Half adder, Full adder.	
Unit – IV	**08 Hrs**
Communication Systems: Introduction, Elements of Communication system, Modulation- AM, FM (Only concepts, working principle, waveform and Comparison), Super heterodyne receiver, Digital Communication block diagram. **Introduction To Microprocessor and Microcontroller:** Microprocessor, Microcontroller (Only concepts, working principle, and Comparison). **Case studies:** i. Development board based on Microprocessor (Raspberry Pi). ii. Development board based on Micro controller (Arduino).	
Unit – V	**08 Hrs**
Transducers: Introduction to Transducers: Passive Electrical transducers- Resistive thermometer, Linear variable differential transformer (LVDT), Proximity transducer. Active Electrical transducer- Piezo electric transducer, Hall effect Transducer. **Sensors:** Introduction to sensors: LDR, Biomedical Sensor, Humidity sensor, ultra sonic Sensor, Touch Sensor (Only concepts, working principle). Case studies: Automatic Headlight System, Pick and Place Robots.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge on operational characteristics of the semiconductor devices such as Diodes, BJTs, Sensors, Operational Amplifiers, Digital logic building blocks and Communication Systems for various electronic applications. **(PO1, PO2, PO9)**
CO2	Analyze the performance of electronic circuits for different applications of electronic systems designs. **(PO1, PO2, PO5, PO6, PO8, PO9)**
CO3	Investigate and adopt possible safety measures, societal and environmental considerations through experiential learning and literature survey. **(PO1, PO2, PO5, PO6, PO8, PO9, PO11)**

CO4	Evaluate the performance of the electronic systems designed for the given specifications using the modern design tools. **(PO1, PO2, PO5, PO8, PO9, PO11)**

Reference Books	
1	Basic Electronics, D P Kothari, I J Nagrath, 2nd Edition, McGraw Hill Education (India), Private Limited, 2018.
2	Electronic Devices and Circuit Theory, Robert L Boylestad, Louis Nashelsky, Prentice Hall India publication, 11th Edition, 2009.
3	Digital Logic and Computer Design, Morris Mano, Prentice Hall India publication, 54th Edition, 2007, ISBN: 978-81-317-1450-8.
4	Electronic Devices and Circuits, David A. Bell, Oxford University Press, 5th Edition, 2008, ISBN: 9780195693409.
5	Microelectronics circuits: Theory and applications, Adel S Sedra & Kenneth C Smith, Oxford University Press, 5th Edition, ISBN: 9780198062257.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit –V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
BASICS OF ELECTRICAL ENGINEERING **Category: Engineering Science Course** **(Common to all Programs Except EE Program)** **(Theory)**						
Course Code	**:**	**EE113ATD/EE123ATD**		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	100 Marks
Total Hours	**:**	**40L**		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits excited by independent voltage sources. Derivation for Power and energy, Thevenin Theorem & Maximum Power Transfer Theorem applied to the series circuit and its applications.	
Unit – II	**08 Hrs**
AC Fundamentals: Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form, and peak factors. Voltage and current relationship, with phasor diagrams, in R, L, and C circuits. **Single-phase Circuits**: Analysis of single-phase ac series circuits R, L, C, RL, RC, RLC, resonance in series RLC circuit	
Unit – III	**08 Hrs**
Three phase circuits: Generation of three-phase power, representation of balanced star and delta connected loads the relation between phase and line values of voltage and current from phasor diagrams, advantages of three-phase systems. Measurement of three-phase power by two-wattmeter method. **Transformers**: Single phase transformers: Construction, principle of working, EMF equations, voltage and current ratios, losses, definition of regulation and efficiency.	
Unit – IV	**08 Hrs**
Three Phase Induction motors: Three-phase induction motors. Principle of operation, construction, types. Rotating magnetic field, significance of torque-slip characteristic. **Single Phase Induction Motor:** Single-phase induction motor. Construction, Principle of operation, Types of single-phase induction motors.	
Unit – V	**08 Hrs**
Power transmission and distribution: Concept of power transmission and power distribution. through block diagrams only. **Electricity bill: C**alculation 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: After completing the course, the students will be able to	
CO1	Analyze the basic laws and theorems of electrical circuits (AC/DC), fundamental concepts of electrical machines, distributed circuits, components and protective devices. **(PO1, PO2, PO6, PO8, PO9, PO11)**
CO2	Compute the parameters of electrical (AC/DC) circuits, basic parameters of electrical machines and distribution networks. **(PO1, PO2, PO8, PO9, PO11)**
CO3	Analyze the characteristics of electrical machines with their applications. **(PO1, PO2, PO8, PO9, PO11)**
CO4	Apply the knowledge of electrical circuits, safety devices and tariffs to accurately estimate electricity consumption. **(PO1, PO2, PO6, PO7, PO8, PO9, PO10, PO11)**

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

	ISBN-13: 978-8121908719.
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 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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit –V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I/II						
FUNDAMENTALS OF MECHANICAL ENGINEERING **Category: Engineering Science Course** **(Common to all Programs Except ME Stream Programs)** **(Theory)**						
Course Code	**:**	ME113ATE/ME123ATE		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40T		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Engineering Materials: Introduction, Classification, Metals (Magnetic and Non-Magnetic), Materials. Properties & applications: physical, mechanical, optical, electrical and electronics, thermal, Chemical, Properties. Applications: Aerospace, Automotive, Electronic and Biomedical.	
Unit – II	**08 Hrs**
Vision system in Manufacturing: Introduction, Role of human vision in computer interaction, importance, types of computer vision in manufacturing, Architecture of a Vision System, Artificial Intelligent v/s Computer vision, applications of Computer vision in various industries, **A case study:** Computer inspection of Two-stage Soldering Defect in PCB board. **Joining process:** Welding- Arc welding & Gas welding, defects, types of flames, Soldering and brazing.	
Unit – III	**10 Hrs**
Automation in Manufacturing: Automation, Types of Automation, Historical Development, Definitions, Introduction to CNC Machines. Relative Merits and Demerits, CNC- Elements, merits, de-merits. **Robotics in Manufacturing:** Robots- Basic Structure of Robots, Robot Anatomy, Complete Classification of Robots, Fundamentals about Robot Technology, Basic Robot Configurations and their Relative Merits and Demerits.	
Unit – IV	**08 Hrs**
Mechanical Drives: Classification of IC Engines, Working of 4-S direct injection engines, Performance characteristics, Classification of gears, velocity ratio for simple and compound gear trains. **Electrical Drives:** History, Well to Wheel analysis, Electric vehicles, Configurations, EV/ICEV comparison, Performance, Traction Motor Characteristics, Concept of Hybrid Electric Drive Trains, Classification of hybrid electric vehicles.	
Unit - V	**06 Hrs**
Mechatronics: Introduction: Evolution of Mechatronic system, measurement & control system, basic elements of control system, Applications-water level controller, washing machine, Engine management system (EMS), Anti-lock Braking System (ABS). **Energy Sources:** Introduction and applications of Energy sources like Fossil fuels, nuclear fuels, Hydel, Solar, wind, and bio- fuels, Environmental issues like Global warming and Ozone depletion.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understanding the fundamentals of basic engineering materials, vision system in manufacturing processes, energy source, refrigeration systems, prime movers, mechatronics, and automation. **(PO1)**
CO2	Explain the classification of engineering materials, machine tools, refrigeration cycles, engines, Energy, automation, and mechatronics systems. **(PO1, PO5)**
CO3	Apply knowledge of engineering materials, manufacturing processes, and thermodynamic principles to solve problems, environmental issues and perform analyses in various industrial applications. **(PO2, PO5)**
CO4	Assess and contrast the performance of engineering materials, energy resources, manufacturing processes and mechanical systems for various industrial applications**. (PO2)**

Reference Books	
1	Elements of Mechanical Engineering, K. R. Gopalakrishna, Subhas Publications, 18th Edition. ISBN 5551234002884.
2	Material Science & Engineering- William D Callister, 2 / 10th Edition, ISBN 978-1-119-45520-2.

3	Welding Technology (PB), Khanna O P, Dhanpat Rai publication, 4th Edition, ISBN 9383182555.
4	Electric and Hybrid Vehicles, Design Fundamentals – Iqbal Husain, CRC Press, 2nd Edition, 2010. ISBN –13-978-1439811757.
5	Modern Electric, Hybrid Electric & Fuel Cell Vehicles, Fundamentals, Theory and Design – Mehrdad Ehsani, CRC Press, 1st Edition, 2005. ISBN – 13- 978-0849331541.
6	Mechatronics – Electronic control systems in Mechanical and Electrical Engineering, William Bolton, Pearson, 6th Edition, ISBN: 978-1-292-07668-3, 2015.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit –V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Emerging Technology Courses

- **INTRODUCTION TO INTERNET OF THINGS (AI114ATA/AI124ATA)**
- **INTRODUCTION TO DRONE TECHNOLOGY (AS114ATB/AS124ATB)**
- **BIOINSPIRED ENGINEERING (BT114ATC/BT124ATC)**
- **GLOBAL CLIMATE CHANGE (CH114ATD/CH124ATD)**
- **ELEMENTS OF BLOCKCHAIN TECHNOLOGY (CS114ATE/CS124ATE)**
- **INTRODUCTION TO CYBER SECURITY (CS114BTF/CS123BTF)**
- **GREEN BUILDINGS (CV114ATG/CV124ATG)**
- **INFRASTRUCTURE FOR SMART CITIES (CV114BTH/CV124BTH)**
- **FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY (CM114ATJ/CM124TJ)**
- **FUNDAMENTALS OF SEMICONDUCTOR DEVICES (EC114ATK/EC124ATK)**
- **INTRODUCTION TO EMBEDDED SYSTEMS (EC114BTM/EC124BTM)**
- **RENEWABLE ENERGY SOURCES (EE114ATN/EE124ATN)**
- **FUNDAMENTALS OF SENSOR TECHNOLOGY (EI114ATO/EI124ATO)**
- **HUMAN FACTORS IN ENGINEERING (IM114ATP/IM124ATP)**
- **DIGITAL HUMANITIES (IS114ATQ/IS124ATQ)**
- **SMART MATERIALS AND SYSTEMS (ME114ATR/ME124ATR)**
- **ELEMENTS OF INDUSTRY 4.0 (ME114BTS/ME124BTS)**

Semester: I / II						
INTRODUCTION TO INTERNET OF THINGS **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	**AI114ATA/AI124ATA**		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	100 Marks
Total Hours	**:**	**40L**		**SEE Duration**	**:**	03 Hours

Unit – I	**09 Hrs**
Applications: Asset Management, Biometrics Identification, Smart Home, Bird Strike Avoidance Radar System, River Navigation Safety System. Introduction to IoT Concept, Related Concepts to IoT, The Intrinsic Characteristics of IoT, IoT Development and Application, Future IoT Vision. **Architecture and Fundamentals:** Research on IoT Architecture, Ubiquitous IoT (U2IoT) Architecture, Layered Models for IoT, Layered Model Proposed and Social Attributes Discussion for U2IoT, IoT Development Phases Summary and Discussion, Science Category and Supporting Technologies for IoT.	
Unit – II	**07 Hrs**
Sensors and Actuators for IoT: Introduction, Sensors and Actuators, Ubiquitous Sensing, Networking and Communications, Management and Data Centers (M&DCs), Case Study for IoT.	
Unit – III	**08 Hrs**
Ubiquitous Internet of Things: Introduction, Local Internet of Things, Industrial Internet of Things, National Internet of Things, Transnational Internet of Things Application, Global Application IoT and a Typical Example.	
Unit – IV	**08 Hrs**
Resource Management: Introduction, Object Coding and Resolving, Resolving Discussion for nID Objects, Resource Naming, Recourse Addressing, Resource Discovery, Resource Allocation, Resource Management Scheme in U2IoT.	
Unit – V	**08 Hrs**
Security and Privacy for IoT: Introduction, Security Challenges in U2IoT, The Security Framework for U2IoT, Hybrid Authentication and Hierarchical Authorization Scheme, Entity Activity Cycle–Based Security Solution.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge of IoT and related science to develop the engineering solutions. **(PO1)**
CO2	Analyse the applicability of IoT in various engineering disciplines. **(PO2)**
CO3	Design a sustainable solution using IoT with societal and environmental concern by engaging in lifelong learning. **(PO3)**
CO4	Demonstrate the solutions using various IoT principles by exhibiting teamwork and effective communication. **(PO8, PO9)**

Reference Books	
1	Huansheng Ning - Unit and Ubiquitous Internet of Things, CRC Press; 1st edition,2018, ISBN-10: 113837475X, ISBN-13: 978-1138374751.
2	Hakima Chaouchi - The Internet of Things Connecting Objects to the Web, Wiley-ISTE; 1st Edition,2010, ISBN-10:1848211406, ISBN-13: 978-1848211407.
3	Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley,1st edition,2013, ISBN-10: 111843062X, ISBN-13: 978-1118430620.
4	Dawid Borycki - Programming for the Internet of Things PHI Learning Pvt. Ltd, Microsoft Press,2019, ISBN-10: 9387472558, ISBN-13 : 978-9387472556.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
INTRODUCTION TO DRONE TECHNOLOGY **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	AS114ATB/AS124ATB		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Basics of Drones: History of UAVs, need of unmanned aerial systems, India and drones, Overview of UAV Systems-System Composition, Classes and Missions of UAVs-Classification of UAVs based on size, range and endurance.	
Unit – II	**08 Hrs**
Aerodynamics of Drones: Airfoil nomenclature, Generation of Lift on Airfoils and Wings, Basic aerodynamics of fixed, rotary and flapping wing UAVs.	
Unit – III	**08 Hrs**
Drones Propulsion Systems: Thrust Generation, Powered Lift, Sources of Power for UAVs- Piston, Rotary, Gas turbine engines, electric or battery powered UAVs.	
Unit – IV	**08 Hrs**
Drone Airframe Systems: Loads on UAVs, Materials for UAV construction, and Construction Techniques	
Unit – V	**08 Hrs**
Sensors and Payloads: Barometers, Accelerometer, Magnetometer, RADAR and range finder, non-dispensable and dispensable Payloads- Optical, electrical, weapon, imaging payloads. **Regulations:** DGCA regulations, Operational and procedural requirements, No drone zones**.**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of UAVs in systems, sub-systems and components level. **(PO1, PO2)**
CO2	Apply theoretical concept of UAVs in systems, sub-systems and components level and evaluate the problems arising in engineering discipline. **(PO1, PO2)**
CO3	Analyze the solution of the modern engineering problems solved using appropriate techniques pertaining to UAVs in systems, sub-systems and components level. **(PO3, PO6)**
CO4	Develop the overall knowledge of UAVs in systems, sub-systems and components level gained to demonstrate the problems arising in real world situations. **(PO6, P07)**

Reference Books	
1	Unmanned Aircraft Systems UAV design, development and deployment, Reg Austin, 1st Edition, 2010, Wiley, ISBN 9780470058190.
2	Introduction to UAV Systems, Paul G Fahlstrom, Thomas J Gleason, 4th Edition, 2012, Wiley, ISBN: 978-1-119-97866-4.
3	Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy, Kimon P. Valavanis, 1st Edition, 2007, Springer ISBN 9781402061141.
4	Design of Unmanned Air Vehicle Systems, Dr. Armand J. Chaput, 3rd Edition, 2001, Lockheed Martin Aeronautics Company, ISBN: 978-1-60086-843-6.

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,	**40**

	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.**	
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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
BIOINSPIRED ENGINEERING **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	**BT114ATC/BT124ATC**		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	100 Marks
Total Hours	**:**	**40L**		**SEE Duration**	**:**	03 Hours

Unit – I	**07 Hrs**
Introduction to Bio-inspired Engineering: Prologue to cellular entities. Stem cells; types and applications. Synthetic Biology; Bottom-up' and 'top-down' engineering approaches. Synthetic/ artificial life. Biological Clock, Genetic Algorithms	
Unit – II	**08 Hrs**
Principles of bioinspired materials: Biological and synthetic materials, Self-assembly, hierarchy and evolution. Biopolymers, Bio-steel, Bio-composites, multi-functional biological materials. Thermal Properties. Antireflection and photo-thermal biomaterials, Microfluidics in biology, Invasive and non-invasive thermal detection inspired by skin	
Unit – III	**10 Hrs**
Lessons from Nature-Bioinspired Materials and mechanism: Firefly-Bioluminescence, Cockleburs –Velcro, Lotus leaf - Self-cleaning materials, Gecko - Gecko tape, Whale fins - Turbine blades, Box Fish / Bone - Bionic car, Shark skin - Friction reducing swimsuits, Kingfisher beak - Bullet train, Coral - Calera cement, Morpho butterfly- Structural color, Namib beetle- Water collecting, Termite mound passive cooling, Birds/Insects- flights/ aerodynamics, Mosquito inspired micro needle.	
Unit – IV	**07 Hrs**
Biomedical Inspiration-Concept and applications: Organ system- Circulatory- artificial blood, artificial heart, pacemaker. Respiratory- artificial lungs. Excretory- Artificial kidney and skin. Artificial Support and replacement of human organs: artificial liver and pancreas. Total joint replacements- artificial limbs. Visual prosthesis -artificial eye/ bionic eye	
Unit – V	**08 Hrs**
Biomimetics: Inventions in nature for Human Innovation: Photosynthesis and Photovoltaic cells, Bionic/Artificial leaf. Bio-ink and 3D-Bioprinting. Biosensors: Artificial tongue and nose. Biomimetic echolation. Insect foot adaptations for adhesion. Thermal insulation and storage materials. Bees and Honeycomb Structure. Artificial Intelligence, Neural Networking and bio-robotics.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Envisage a deep understanding of biological systems, mimetics structures, and functions that inspire engineering innovations for adaptability and sustainability. **(PO1, PO2, PO8, PO11)**
CO2	Apply biological principles from nature driven techniques to design engineering systems for solving real-world challenges. **(PO1, PO2, PO3, PO8, PO11)**
CO3	Evaluate the bioinspired materials for their advanced applications in the domain of health, energy and environmental sustainability. **(PO1, PO2, PO3, PO4, PO8, PO11)**
CO4	Interpret biomimicry and ethics in bioinspired engineering designs, ensuring that their solutions are environmentally responsible and socially conscious. **(PO1, PO7, PO8, PO11)**

Reference Books	
1	Yoseph Bar-Cohen. Biomimetics: Biologically Inspired Technologies D. Floreano and C. Mattiussi, "Bio-Inspired Artificial Intelligence", CRC Press, 2018. ISBN: 9781420037715.
2	Guang Yang, Lin Xiao, and Lallepak Lamboni. Bioinspired Materials Science and Engineering. John Wiley, 2018. ISBN: 978-1-119-390336.
3	M.A. Meyers and P.Y. Chen. Biological Materials, Bioinspired Materials, and Biomaterials

	Cambridge University Press, 2014 ISBN 978-1-107-01045.
4	Tao Deng. Bioinspired Engineering of Thermal Materials. Wiley-VCH Press, 2018. ISBN: 978-3-527-33834-4.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
GLOBAL CLIMATE CHANGE **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	CH114ATD/CH124ATD		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Introduction to the climate change: Climate, climate change, temperature anomalies, radiation and energy balance.	
Unit – II	**08 Hrs**
Simple Climate models: Source of energy, energy loss, greenhouse effect, carbon cycle, atmosphere–land-biosphere–ocean carbon exchange.	
Unit – III	**08 Hrs**
Prediction and impacts of climate change: Factors that control emissions, emissions scenarios, physical impacts, abrupt climate changes.	
Unit – IV	**08 Hrs**
Strategies to mitigate climate change: Adaptation: technology, politics personal actions, conventional regulations, market-based regulations, information and voluntary methods.	
Unit – V	**08 Hrs**
Climate change conventions: Technical summary of IPCC reports, conference of parties and climate change protocols.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the fundamentals of science to understand climate change and its implications. **(PO1, PO8)**
CO2	Analyze scientific reasons for climate change through simple models. **(PO1, PO7, PO8)**
CO3	Identify the external factors contributing to climate change. **(PO1, PO7)**
CO4	Ideate mitigation strategies. **(PO1, PO2, PO6, PO7, PO8)**

Reference Books	
1	Introduction to Modern Climate Change, Andrew E. Dessler, Cambridge University Press, ISBN-10- 1108793878, ISBN-13- 978-1108793872, 3rd edition, 2021
2	Introduction to Climate Science, Andreas Schmittner, Oregon State University, https://open.oregonstate.education/climatechange/
3	IPCC — Intergovernmental Panel on Climate Change https://www.ipcc.ch
4	UNFCC – United nations framework convention on climate change https://unfccc.int

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
ELEMENTS OF BLOCKCHAIN TECHNOLOGY **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	CS114ATE/CS124ATE		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	36L		**SEE Duration**	**:**	03 Hours

Unit – I	**07 Hrs**
Blockchain Fundamentals: Defining Blockchain, Elements of Blockchain, Qualities of Blockchain, Blockchain and Economics, Blockchain Technology, Origins of Bitcoin and Blockchain, Types of Blockchains, Business and Blockchain, Use cases, Ethical issues with Blockchain.	
Unit – II	**07 Hrs**
Blockchain Technology: Blockchain technology stack, monetizing the Blockchain, Blockchain Wallet, Sorting Blocks, Consensus, Blockchain as a Service, IT Use cases for Blockchain-Storage, IPFS, Edge Computing, Web 3.0 and Blockchain, Obstacles in Blockchain.	
Unit – III	**07 Hrs**
Bitcoin and Crypto-assets: Introduction to Crypto-assets, Crypto-currencies, Crypto-commodities, Crypto-tokens, Bitcoin, Ethereum, Digital Token Exchanges, Financial modelling for cryptocurrencies.	
Unit – IV	**07 Hrs**
Ethereum and Smart Contracts: Basics of Ethereum, Ethereum Virtual Machine, Ether, Smart Contract, On-chain versus Off-chain versus Side chain, Mining Ethereum.	
Unit – V	**08 Hrs**
Blockchain Use Cases: Cross-functional Blockchain Use cases – Identity management, Asset Tracking, IoT integration; Functional Area Blockchain Use Cases for Business – Finance, Marketing/Sales, Supply Chain Management, Accounting, Human Resources; Use Cases for Specific Industries – Insurance, Real Estate, Healthcare, Energy.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Define the core concepts of blockchain technology, including its structure, working principles, and consensus mechanisms. **(PO1, PO2, PO3, PO5, PO6, PO11)**
CO2	Compare major blockchain platforms such as Bitcoin, Ethereum, and others, understanding their architecture, use cases, and differences. **(PO1, PO2, PO3, PO5, PO11)**
CO3	Analyze the response of governments and regulatory bodies to blockchain innovations, cryptocurrencies, and decentralized finance (DeFi). **(PO1, PO2, PO3, PO5, PO7, PO11)**
CO4	Evaluate ethical implications and future trends in blockchain technology, including decentralized governance, data immutability, interoperability, and privacy-enhancing technologies in industrial and business applications. **(PO1, PO2, PO3, PO4, PO5, PO8, PO10, PO11)**

Text books	
1	Basics of Blockchain – A guide for building literacy in the economics, technology and business of blockchain, Bettina Warburg, Bill Wagner, and Tom Serres, 2019, Animal Ventures LLC, Edition 1.0
Reference Books	
1	Mastering Blockchain – Distributed ledger technology, decentralization and smart contracts, Imran Bashir, 2018, Packt, Second Edition

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
INTRODUCTION TO CYBER SECURITY **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	CS114BTF/CS124BTF		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Introduction to Cyber Space: History of Internet, History and evolution of Information Security and cyber-Security, introduction to cyber space and information security, computer ethics and security policies. **Introduction to Cybercrime:** Definition and Origins of the Word, Cybercrime and Information Security, who are Cybercriminals? Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws. Global Perspectives. Different Types of Cyber Crimes, Scams and Frauds	
Unit – II	**08 Hrs**
Cyber Offenses: How Criminals Plan Them: Introduction, how criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber Cafe & cybercrimes, Botnets: The fuel for cybercrime, Attack Vector. **Attacker Techniques and Motivations:** How Hackers Cover Their Tracks (Anti-forensics), How and Why Attackers Use Proxies, Tunnelling Techniques, Fraud Techniques.	
Unit – III	**08 Hrs**
Social Media Overview and Security: Introduction to Social networks. Types of social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of social media, Case studies.	
Unit – IV	**08 Hrs**
E - Commerce and Digital Payments: Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related to common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007	
Unit – V	**08 Hrs**
Digital Devices security, Tools, and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply cyber-attack principles across various domains such as social media, E-commerce, and digital devices, demonstrating how vulnerabilities are exploited by attackers. **(PO1, PO2, PO5, PO11)**
CO2	Analyze vulnerabilities in different domains and apply attacking techniques to demonstrate how these weaknesses are leveraged for cyber-attacks. **(PO1, PO2, PO4, PO5, PO7, PO8, PO11)**
CO3	Evaluate various methods and strategies for covering vulnerabilities and safeguarding systems against cyber-attacks. **(PO1, PO2, PO4, PO5, PO6, PO7, PO8, PO11)**
CO4	Investigate and evaluate modern tools and technologies used to mitigate cybercrime and utilize these solutions to protect systems from potential threats. **(PO1, PO2, PO4, PO5, PO11)**

Reference Books	
1	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd, 1st Edition 2011, Reprint 2022, ISBN:978-81-265-2179-1.
2	Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson, CRC Press, 2011 Taylor and Francis Group. ISBN13: 978-1-4398-5126-5.
3	Information Systems Security: Security Management, Metrics, Frameworks and Best Practices by Nina Godbole, 2nd Edition, Wiley publishers, 2017. ISBN: 9788126564057.
4	Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, John Wiley & Sons, 2005, ISBN: 978-0764573972.
5	Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform, Pearson, 2001, ISBN: 9781516821020.
6	Electronic Commerce by Elias M. Awad, Pearson, 1st edition, 2001, ISBN: 978-0130193223.
7	Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers & Distributors, 2011, ISBN: 978-8187336891.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
GREEN BUILDINGS **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	CV114ATG/CV124ATG		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit-I	**08 Hrs**
Introduction to the concept of cost-effective construction: Uses of different types of materials and their availability - Stone and Laterite blocks-M Sand- Burnt Bricks - Concrete Blocks- Stabilized Mud Blocks- Lime-Pozzolana Cement - Gypsum Board. Light weight beams - Fiber Reinforced Cement Components- Fiber Reinforced Polymer Composite- Bamboo. Availability of different materials- Recycling of building materials – Brick- Concrete- Steel- Plastics - Environmental issues related to building materials.	
Unit – II	**08 Hrs**
Environment friendly and cost-effective Building Technologies: Different substitute for wall construction-Cavity Wall. Ferro Cement and Ferro Concrete constructions – different precast members using these materials. Wall and Roof Panels – Beams – Columns - Door and Window frames - Water tanks - Septic tanks - Alternate roofing systems - Filler slab - Composite Beam and Panel Roof. Pre-engineered and ready to use building elements - wood products - steel - plastic.	
Unit – III	**08 Hrs**
Global Warming: Definition - Causes and Effects - Contribution of buildings towards Global Warming. Carbon Footprint – Global Efforts to reduce carbon Emissions. Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits. Major Energy efficient areas for buildings – Embodied Energy in Materials. Green Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.	
Unit – IV	**08 Hrs**
Green Building rating Systems: BREEAM – LEED - GREEN STAR –GRIHA, IGBC for new buildings – Purpose - Key highlights - Point System with Differential weightage. Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only)	
Unit – V	**08 Hrs**
Utility of Solar Energy in Buildings: Utility of Solar energy in buildings - concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. **Green Composites for Buildings:** Concepts of Green Composites. Water Utilization in Buildings, Low Energy approaches to Water Management. Management of Solid Wastes. Management of Sullage and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Outline the concept of cost effective, eco-friendly building materials and technologies. **(PO1, PO2, PO6, PO11)**
CO2	Apply the knowledge of energy efficient building materials in sustainable construction technologies. **(PO1, PO2, PO6, PO11)**
CO3	Apply the importance of design principles in green buildings and rating systems. **(PO1, PO2, PO11)**
CO4	Demonstrate the knowledge of emerging technologies in green buildings. **(PO1, PO2, PO3, PO8, PO9, PO11)**

Reference Books	
1	Green Building Fundamentals, G Harihara Iyer, Notion Press, 1st Edition, 2022, ISBN-13:979-8886416091.
2	Green Building: Principles & Practices, Harshul Savla, Notion Press, 1st Edition, 2021, ISBN-13: 978-1685866044.
3	Green Building Guidance: The Ultimate Guide for IGBC Accredited Professional Examination, Karthik Karuppu, Notion Press; 1st Edition, 2019, ISBN-13: 978-1684667291.
4	Handbook of Green Building Design and Construction LEED, BREEAM, and Green Globes, Sam Kubba, Joe Hayton publisher, 1st Edition, 2017, ISBN: 978-0-12-810433-0.
5	Sustainable Construction: Green Building Design and Delivery, Charles J. Kibert, Wiley Publication, 5th Edition, 2022, ISBN-13:978-1119706458.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
INFRASTRUCTURE FOR SMART CITIES **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	CV114BTH/CV124BTH		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit-I	**08 Hrs**
Fundamental of smart city & Infrastructure: Importance of livability, Introduction of Smart City, need and concept of smart city systems, Challenges of managing infrastructure in India and world, various types of Infrastructure systems. Various stake holders in smart city. IoT applications in smart cities.	
Unit – II	**08 Hrs**
Planning and development of Smart city Infrastructure: Affordable housing, smart and green buildings-Objectives, features, benefits, different parameters considered –photo voltaic, water, materials and environment.	
Unit –III	**08 Hrs**
Intelligent transport systems: Public transportation management, Smart vehicles and fuels, traffic safety management, mobility services, E-ticketing. Smart mobility requirements, Smart City cases of G.I.S in mobility, smart roads.	
Unit –IV	**08 Hrs**
Management of water resources and related infrastructure: Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system.	
Unit –V	**08 Hrs**
Infrastructure Management system & Policy for Smart city: Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city. Worldwide policies for smart city Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Outline the necessity and types of infrastructure in planning and management of smart cities. **(PO1, PO6, PO11)**
CO2	Apply the concept of smart cities in development and management of conveyance systems. **(PO1, PO2, PO11)**
CO3	Analyze the impact of national and global policies to implement smart cities development. **(PO1, PO2, PO6, PO11)**
CO4	Demonstrate the knowledge of emerging technology to provide solutions for smart cities. **(PO1, PO2, PO8, PO9, PO11)**

Reference Books	
1	Sustainable Smart Cities in India: Challenges and Future Perspectives, Poonam Sharma , Swati Rajput , Springer; 1st Edition, 2017, ISBN-13: 978-3319471440.
2	Smart City in India Urban Laboratory, Paradigm or Trajectory?, Binti Singh, Manoj Parmar, , Routledge India, 1st Edition, 2019, ISBN 9780367462598.
3	The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities), Nicos Komninos, Routledge India, 1st Edition, 2014, ISBN-13 : 978-1138782198,
4	Smart Cities, Germaine Halegoua, The MIT Press, 1st Edition, 2020, ISBN-13 : 978-0262538053.
5	Smart Cities, Smart Future: Showcasing Tomorrow, Mike Barlow , Cornelia Levy-Bencheton, Wiley; 1st Edition, 2018, ISBN-13: 978-111951618.

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**
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5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	CM114ATJ/CM124ATJ		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42L		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
History of nano science and technology: Historical developments of nanomaterials, nanotechnology in ancient Indian practices: Ayurveda medicine, cosmetics, and metallurgy. **Learning from nature**: Gecko feet, spider web and lotus leaf. Fundamentals of nanotechnology and classification of nanomaterials.	
Unit – II	**08 Hrs**
Preparation of nanomaterials: Top-down approach: physical vapor deposition (PVD), molecular beam epitaxy, sputtering and ion beam process. **Bottom-up approach:** Chemical vapor deposition (CVD), precipitation method, electrochemical method and green synthesis of nanomaterials.	
Unit – III	**09 Hrs**
Characterization of nanomaterials and their properties: Characterization: Introduction, UV-Vis absorption spectroscopy, Scanning electron microscopy, scattering techniques (particle size analyzer). **Properties:** Physical properties**:** Size, surface area and optical properties), Chemical properties **-** catalytic properties.	
Unit – IV	**08 Hrs**
Nanomaterials for agriculture and healthcare: Agriculture: Application of nanotechnology in modern day agriculture practices, micronutrients. **Water and food technology**: Membrane technology, nanomaterials for water purifications. **Nanomaterials in healthcare**: Cosmetics and nano medicine.	
Unit – V	**09 Hrs**
Engineering applications of nanomaterials: Energy: Materials for energy production and storage. **Electronics:** Nano materials for display technology, circuit elements and their advantages over conventional materials. **Mechanical industry**: Self-cleaning surfaces, automobile industry and nanocomposites **Civil construction**: High strength materials and fire-retardant materials.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge of material science with special emphasize on nanostructured materials and its historical developments. **(PO1, PO11)**
CO2	Utilize the principles of nanoscience for synthesis/ fabrication of different types of nanostructured material. **(PO1, PO6)**
CO3	Evaluate and interpret the nanomaterial properties by characterization techniques. **(PO1, PO6)**
CO4	Propose suitable sustainable solutions for environmental and emerging technology through nanostructured materials. **(PO1, PO6, PO8, PO9, PO11)**

Reference Books	
1	Nanostructures and nanomaterials synthesis, properties, and applications, Guozhong Cao and Ying Wang, 2011, 2nd, ISBN: 9789814324557.
2	Nanoscience: The Science of the small in physics, engineering, chemistry, biology and medicine", Hans-Eckhardt Schaefer, 2010, Springer. ISBN: 3642105580.
3	Introduction to nanoscience and nanotechnology, Gabor L. Hornyak, H.F. Tibbals, Joydeep Dutta, John J. Moore, 2020, CRC press, ISBN: 9781420047790.
4	Nano biotechnology-concepts, applications in health, agriculture and environment, R. Tomar, 2020,

	Apple Academic Press: ISBN: 9780429292750.

E-book	
5	Nanotechnology advances and real-life applications, Bhargava and Amit Sachdeva, 2021, CRC press, ISBN: 9780367536732.

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	
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7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
FUNDAMENTALS OF SEMICONDUCTOR DEVICES **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	EC114ATK/EC124ATK		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Semiconductor Basics: Energy Levels to Energy Bands, Crystalline, Polycrystalline, and Amorphous Semiconductors, Miller Indices, Properties of Common Semiconductors, Free Carriers in Semiconductors, Doping.	
Unit – II	**08 Hrs**
Semiconductor Quantum behaviour: The Wave Equation, Quantum Confinement, Quantum Tunnelling and Reflection, Electron Waves in Crystals, Density of States, Fermi Function, Carrier Concentrations	
Unit – III	**08 Hrs**
Semiconductor Transport: Carrier Transport, Generation, and Recombination- The Landauer Approach, Current from the Nanoscale to Macroscale, Drift-Diffusion Equation, Carrier Recombination, Carrier Generation, Mathematical Formulation, Energy Band Diagrams, Quasi-Fermi Levels, Minority Carrier Diffusion Equation	
Unit – IV	**08 Hrs**
Quantum Computing Basics: Difference between classical & quantum computing, Quantum Qubits, Single Qubits states, Postulates of Quantum Mechanics	
Unit – V	**08 Hrs**
Hardware of Quantum Computers: Quantum measurement, Quantum Gates and Circuits, Introduction to building blocks of a quantum computer, Quantum materials, Spin Qubits	

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend and apply the fundamental principles of semiconductor materials with energy bands, doping, wave equations and quantum tunnelling to classical and quantum computing hardware. **(PO1, PO5, PO11)**
CO2	Apply quantum mechanical principles to analyse electron behaviour in semiconductors, quantum confinement, transport phenomena as applied to the study of qubits and quantum computing systems. **(PO1, PO2, PO4, PO5, PO11)**
CO3	Investigate carrier transport, generation, and recombination processes in semiconductors with mathematical formulations and energy band diagrams; analyse nanoscale semiconductor devices and quantum computing hardware principles. **(PO1, PO2, PO4, PO5, PO11)**
CO4	Examine the relationship between semiconductor physics and the hardware of quantum computers. Apply these principles in practical scenarios involving real-world semiconductor devices, quantum gates, and computing circuits. **(PO1, PO3, PO4, PO5, PO11)**

Reference Books	
1	Semiconductor Device Fundamentals, Robert F. Pierret, 2006, Pearson, ISBN 9780201543933
2	Advanced Semiconductor Fundamentals, R.F. Pierret, 2nd ed., Pearson Education, Inc., 2003, ISBN-0-13-061792-X
3	Operation and Modeling of the MOS Transitor , Y.P. Tsividis, Colin McAndrew, 3rd Edition, 2014, Oxford Univ Press, ISBN:978-0195170153
4	Nielsen, M., & Chuang, I. (2010). Quantum Computation and Quantum Information: 10th Anniversary Edition. Cambridge: Cambridge University Press.
5	Lecture Notes, Quantum Computation, California Institute of Technology, http://theory.caltech.edu/~preskill/ph219/ph219_2021-22.html [accessed as on 30-11-2022]
6	Learn Quantum Computation using Qiskit, Online Textbook, https://qiskit.org/textbook/preface.html,

	[accessed as on 30-11-2022]

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 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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
INTRODUCTION TO EMBEDDED SYSTEMS **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	EC114BTM/EC124BTM		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Introduction: Definition of Embedded Systems, Typical examples, and Application domains (Automotive, Consumer, etc.), Characteristics, Typical block diagram, Input, Core, Output, Commercial Off the Shelf Components (COTS). Processing Components, Microprocessors & Microcontrollers, Indicative Examples (Microcontrollers on Arduino boards), Development boards (Arduino boards), Concepts and brief introduction to Memory, Interrupts, Power Supply, Clocks, Reset. Case Studies: Washing Machine, Antilock Brake Systems (Block diagram & Working Principle).	
Unit – II	**08 Hrs**
Integrated Development Environment (Ide) And Programming: Basics of Embedded C Programming, Data Types, Arithmetic & Logical Operators, Loops, Functions, #define Macros, Structures (Declaration and Accessing data members). Integrated Development Environment tools: Editor, Compiler, Linker, Loader, Debugger (Definitions only). Practice: Working with Arduino IDE (Simple programs on Operators, Loops and Functions).	
Unit – III	**08 Hrs**
Serial And Parallel Interfaces: Digital Data, Analog data, Serial Vs Parallel Data Transfer, UART, I2C, SPI (only block diagram and working), Arduino board with schematics, Port pins and GPIOs, Data Sheets Practice: Interfacing Serial Modules like GSM, GPS, LEDs, Switches, Interfacing Temperature & Humidity Sensors, Interfacing LCD Module	
Unit –IV	**08 Hrs**
Data Converters: Real world analog signals (Temperature, Bio medical signals, etc.), Analog to digital conversion, Successive Approximation ADC Type, FLASH Type (Block Diagram and Explanation). Digital to Analog Conversion, R-2R DAC type, (Block Diagram and Explanation). Selection criteria of ADC and DAC for different applications **Practice**: Programming ADC of Arduino Board, Interfacing Analog Temperature Sensor, Gas sensor, Generation of PWM Wave.	
Unit –V	**08 Hrs**
Electro Mechanical Actuators: DC motor, Principle of Operation, DC Motor Driver, Stepper Motor, Principle of Operation, Stepper Motor Driver, Servo Motor, Principle of Operation, Servo Motor Driver. (Working principles and Typical Diagrams). Planning, Design and Implementation: Smart Street Lights Practice: Interfacing, Speed Control and Direction control of DC motor, Servo Motor, Stepper Motors.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the role, characteristics and challenges of embedded systems in real-world applications; programming concepts ensuring optimized performance of each block. **(PO1, PO4, PO5, PO9, PO11)**
CO2	Interpret the embedded systems development cycle and use the tools supporting such development, suitable serial communication modules, analog-to-digital conversion, and motor drivers to develop modern embedded applications. **(PO1, PO4, PO5, PO8, PO9, PO11)**
CO3	Analyze the importance of data sheets to characterize & select of different components, methods for designing and developing safe, reliable, and fault tolerant embedded systems for real-world applications. **(PO1, PO2, PO4, PO5, PO8, PO9, PO11)**
CO4	Demonstrate developmental board schematics, GPIO functionalities and debugging tools to verify proper

	system performance on a dedicated target system. **(PO1, PO2, PO4, PO5, PO8, PO9, PO11)**

Reference Books	
1	Embedded System Design: A Unified Hardware / Software Introduction, Tony Givargis and Frank Vahid. Wiley. ISBN-10: 812650837X.
2	Designing Embedded Systems with Arduino: A Fundamental Technology for Makers, Tianhong Pan, Yi Zhu, Springer, ISBN 978-981-10-4417-5.
3	Embedded Systems: Architecture, Programming and Design, Raj Kamal, 2nd Edition, The McGraw Hill, ISBN: 13:978-0-07-066764-8
4	Introduction to Embedded Systems, Shibu K V, 2009, Tata McGraw Hill Education Private Limited, ISBN: 10: 0070678790.
5	Embedded System Design: A Unified Hardware / Software Introduction, Tony Givargis and Frank Vahid. Wiley. ISBN-10: 812650837X.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
RENEWABLE ENERGY SOURCES **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	EE114ATN/EE124ATN		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Unit-I	**08 Hrs**
Introduction: Energy systems model causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India. **Solar Energy:** Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Application. Block diagram of solar energy conversion.	
Unit – II	**08 Hrs**
Photo Voltaic Systems: PV Cell, Module and array, equivalent electrical circuit, OC Voltage and SC Current I-V and V-I characteristics, Array design, peak power tracking, system components of Solar Cell System, Types of PV system- Standalone, Grid connected, Hybrid, Applications of Solar PV Systems. **Wind Energy:** Basic Principles of wind energy conversion, nature of wind, power in wind, forces on blades, wind energy conversion, wind data and energy estimation, site selection considerations, Block diagram and basic components of WECS, Advantages & disadvantages.	
Unit – III	**08 Hrs**
Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production through block diagram, Use of Hydrogen Energy, Merits and Demerits, Problems Associated with Hydrogen Energy. **Biomass Energy:** Introduction, Biomass Production through block diagram, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and their Classifications, Updraft, Downdraft and Cross-draft Gasifiers, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier.	
Unit – IV	**08 Hrs**
Geothermal Energy: Introduction to Geothermal Systems, Block diagram, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects. **Tidal Energy:** Introduction, Tidal Energy Resource, Block diagram, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Issues Faced in Exploiting Tidal Energy.	
Unit – V	**08 Hrs**
Energy storage: Hydro Pump Storage, Compressed Air Storage, Thermal Storage, Electrochemical Storage or Battery Storage, Hydrogen Energy Storage, Inertial Storage, Superconducting Magnetic Energy Storage. **Challenges in Renewable Energy Adoption:** Energy Storage, The high initial cost of installation, Lack of infrastructure, Non-renewable energy monopoly, Lack of knowledge and awareness, Lack of policies, subsidies.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze the concepts of energy generation, characteristics, and performance of various renewable sources & Energy storage. Apply these decentralized renewable energy systems to address the electrical energy scarcity issue. **(PO1, PO2, PO3, PO4, PO6, PO8, PO9, PO11)**
CO2	Evaluate parameters of different renewable energy system like solar, wind, hydrogen, biomass, geothermal, and tidal. Interpret their operating principles, efficiency and performance characteristics. **(PO1, PO2, PO3, PO4, PO8, PO9, PO11)**
CO3	Model and Evaluate power generated from the renewable sources and different ways to store energy. Apply the knowledge to design a renewable based system that satisfies the load requirement. **(PO1, PO2, PO3, PO4, PO8, PO9, PO11)**
CO4	Apply the knowledge to discuss new policies, subsidies and develop an efficient sustainable renewable

	energy solution. Comprehend the global and local scenario of renewable sources, available infrastructure, resources and capital. **(PO6, PO7, PO8, PO9, PO11)**

Reference Books	
1	Non-conventional Energy Resources, Shobh Nath Singh, 1st Edition, 2015, Pearson, ISBN- 978-93-325-4357-7
2	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.
3	Wind and solar Power system design, Analysis and operation, Mukund R. Patel, 2 nd Edition
4	Non-Conventional sources of energy, G. D. Rai, 4th Edition, 2009, Khanna Publishers, ISBN8174090738, 9788174090737

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
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9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I /II						
FUNDAMENTALS OF SENSOR TECHNOLOGY **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	**EI114ATO/EI124ATO**		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	100 Marks
Total Hours	**:**	**40L**		**SEE Duration**	**:**	03 Hours

Unit – I	**08 Hrs**
Sensing and Sensor fundamentals: Introduction to Sensors**,** Sensor systems and overview of sensor technologies, Classification of sensors, Characteristics of sensors. **Principle of operation and applications**: **Measurement of Temperature:** Thermistor, Thermocouple, Pyroelectric sensor. **Measurement of Force, Pressure and Displacement:** Strain gauges, Inductive and Capacitive Sensors.	
Unit – II	**10 Hrs**
Miscellaneous sensors: **Principle of operation:** Moisture sensor, humidity sensors, gas sensors, Direction sensor, Ultrasound sensor, Accelerometers, Alcohol sensor, SpO_2 sensor, Color sensor. **Photo sensors**: Photovoltaic cell, Photo resistor, Phototransistor. **Tactile sensors:** Construction and operation, types.	
Unit – III	**07 Hrs**
Special Sensors: Thin film sensors and deposition techniques, Smart sensors: Principles and applications. **Sensor materials:** Silicon, Plastics, Metals, Ceramics, Glasses, Nanomaterials.	
Unit – IV	**09 Hrs**
Sensor technologies: Key Sensor Technology Components: Hardware and Software Overview: Sensor platforms, Introduction to MEMS Sensors and Nano Sensors. **MEMS Technology** **Surface processing**: Sputtering, Chemical vapor deposition, Electroplating. **Microtechnology:** Photolithography, LIGA process.	
Unit – V	**06 Hrs**
Case studies: Sensors for Smart home automation, Sensors for Automobile applications, Sensors for agriculture, Sensors for mobile phone applications.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge of sensors to comprehend instrumentation systems. **(PO1, PO8, PO9)**
CO2	Analyse and evaluate the performance of different sensors for various applications. **(PO1, PO2, PO5, PO8, PO9)**
CO3	Develop an instrumentation system using appropriate sensors for a particular application. **(PO1, PO5, PO8, PO9)**
CO4	Develop an application to provide solutions for sustainable development goals. **(PO1, PO5, PO8, PO9)**

Reference Books	
1	Handbook of Modern Sensors: Physics, Designs, and Applications, Jacob Fraden, PHI Publication, 5th Edition, 2016, ISBN: 978-1-4419-6465-6.
2	Sensors and Actuators: Control systems Instrumentation, Clarence W.de Silva, CRC Press, 2013 Edition, ISBN: 978-1-4200-4483-6.
3	Electrical and Electronic Measurements and Instrumentation, A.K.Sawhney, Dhanpat Rai and Sons, 18th Edition, 2008, ISBN: 81-7700-016-0.
4	Sensor technologies, Michael J McGrath, Intel Labs, 2013 Edition, ISBN: 9781430260141.

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 **(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)		
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9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
HUMAN FACTORS IN ENGINEERING **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	IM114ATP/IM124ATP		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42L		**SEE Duration**	**:**	03 Hours

Unit – I	**09 Hrs**
Introduction to Ergonomic Design: Description of human-machine systems, Introduction to the concept of ergonomics, Ergonomic Design, history of ergonomics, Principles of Human –Centered Design, Ergonomic Criteria, Models of human Performance, Macro ergonomics, Trends in Industry that impact Ergonomics, Organizations associated with Ergonomics, Ergonomic methods.	
Unit – II	**08 Hrs**
Human System: Components of human body, skeletal sub system, Muscles, Anthropometry, Body movements, Musculoskeletal systems as levers	
Unit – III	**08 Hrs**
Human System: Sensory sub systems, Support subsystems. Cognitive ergonomics: an overview. Design of work areas: Introduction, Applied Anthropometry, Drafting templates, Design of work areas and stations, Basic ergonomic design principles, principles for design of seating, Office design.	
Unit – IV	**09 Hrs**
Design of tools and equipment: Design of tools and equipment and related principles, Protective equipment for the operator, Accommodating people with disabilities. **Assessment and Design of Physical Environment**: Introduction, Cleanliness, Clutter and Disorder, Lighting and Illumination, Conceptual overview of basic lighting principles, Noise **(Conceptual Treatment only)**	
Unit – V	**08 Hrs**
Assessment and Design of Physical Environment: Temperature and Humidity, Control strategies for hot and cold environments, Hazards and control measures. **(Conceptual Treatment only),** Consequences of not incorporating Ergonomics in design of workspaces, Ergonomics and Digital Transformation. statement & guidelines, Smart cities in India, Case studies of smart city.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Recognize the importance of ergonomics and human factors in the design of workspaces. **(PO1, PO4, PO6, PO7, PO11)**
CO2	Interpret human anatomy, physiology and psychology from a system's perspective. **(PO5, PO6)**
CO3	Analyze the role of anthropometric data and modeling techniques in the workplace design. **(PO5, PO7)**
CO4	Explain the importance of physical environment in ergonomic design of work settings. **(PO6)**

Reference Books	
1	Introduction to Human Factors and Ergonomics for Engineers, Lehto Mark, Steven J Landry,2nd Edition, 2013, CRC Press, ISBN:978-1-4398-5394-8
2	Ergonomics for Beginners-A quick reference guide, Jan Dul, Bernard Weerdmeester,3rd Edition,2008, CRC Press, ISBN 978-1-4200-7751-3
3	Introduction to Ergonomics, R S Bridger, 3rd Edition, 2008, CRC Press, ISBN: 9780849373060**.**
4	Human Factors in Engineering and Design; Mark S. Sanders and Ernest J Mc Cormick; 7th Edition, McGraw-Hill and Co. Singapore 1992. ISBN 0-07-112826-3.

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**	**20**

	WILL BE THE FINAL QUIZ MARKS.	
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**
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RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
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9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
DIGITAL HUMANITIES **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	IS114ATQ/IS124ATQ		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42L		**SEE Duration**	**:**	03 Hours

Unit – I	08 Hrs
Introduction to Digital Humanities: What is digital humanities? Principals and Scenarios for digital humanities. **Reasons to Engage with the Digital Humanities:** Defining the Digital Humanities, Motivations for Engaging with the Digital Humanities, Digital Futures.	
Unit – II	**09 Hrs**
Humanities to Digital Humanities: Designing digital humanities. **Computational activities in digital humanities:** Computation, Processing, Digitization, Classification, Organization, Navigation	
Unit – III	**09 Hrs**
Generating Humanities: Humanities as the new core**. Towards an Encounter between Humanities and Computing:** Formalisation in humanity computing, Cultures of formalization**. Transdisciplinary and digital humanity:** Beyond interdisciplinarity, Methodological transformation and transdisciplinary.	
Unit – IV	**09 Hrs**
Digital Methods: Five Challenges. **Digital Humanities** Mapping Change the Possibilities for the Spatial Humanities in India, Digital Space and Databases. Case study "Graphs, Maps, Trees abstract models for literary history", Franco Moretti.	
Unit – V	**07 Hrs**
Designing class roam activities: Activity design, Digital events, Physical Computing and Critical Making	

Course Outcomes: After completing the course, the students will be able to	
CO1	Demonstrate significant knowledge and understanding in subcategories of the digital humanities. **(PO1, PO3, PO6, PO10)**
CO2	Applying digital humanities in different sub areas of society and assign individual responsibility. **(PO1, PO3, PO8, PO11)**
CO3	Analyse, assess, and manage complex phenomena, questions, and situations related to the digital humanities as a field of study and work. **(PO2, PO4, PO5, PO7)**
CO4	Evaluate the prospects and limitations of science and technology in digital humanities. **(PO2, PO3, PO5, PO7)**

Reference Books	
1	Introduction to Digital Humanities by Kathryn C. Wymer, Taylor & Francis, ISBN: 978-0-367-71110-8 published in 2021
2	An Introduction to Digital Methods for Research and Scholarship By Johanna Drucker, Taylor & Francis, ISBN 9780367565756 Published March 25, 2021
3	Understanding Digital Humanities by David M. Berry, Palgrave Macmillan, ISBN: 978–0–230–29264–2, published in 2012
4	Digital Humanities by Anne Burdick, Johanna Drucker, Peter Lunenfeld, Todd Presner & Jeffrey Schnapp, The MIT Press Cambridge, Massachusetts London, England, ISBN 978-0-262-01847-0, published in 2012
5	Using Digital Humanities in the Classroom by Claire Battershill and Shawna Ross, Second Edition Blooms Burt Academic, ISBN: HB: 978-1-3501-8090-1 published in 2017

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 **(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	
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	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
SMART MATERIALS AND SYSTEMS **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	ME114ATR/ME124ATR		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3: 0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42T		**SEE Duration**	**:**	03 Hours

Unit – I	**06 Hr**
Introduction: Characteristics of metals, polymers and ceramics. Introduction to smart materials. Classification of smart materials, Components of a smart System, Applications of Smart Materials and Smart Materials Manufacturing in Industries in India.	
Unit – II	**08 Hrs**
Smart Materials: Piezoelectric materials, Electro strictive Materials, Magnetostrictive materials, Magnetoelectric Materials, Magnetorheological fluids, Electrorheological fluids, Shape Memory materials. **Processing of Smart Materials:** Semiconductors and their processing, Metals and metallization techniques, Ceramics and their processing, Polymers and their synthesis, UV radiation curing of polymers.	
Unit – III	**10 Hrs**
Advances in smart Materials: Self-Sensing Piezoelectric Transducers, Energy Harvesting Materials, Artophagous Materials, Self-Healing Polymers, Intelligent System Design, Emergent System Design. **Sensors**: Introduction, Conductometric sensors, Capacitive sensors, Piezoelectric sensors, Magnetostrictive sensors, Piezoresistive sensors, Optical sensors, semiconductor-based sensors, Acoustic sensors, polymerize sensors, Carbon nanotube sensors.	
Unit – IV	**10 Hrs**
Actuators: Introduction, Electrostatic transducers, Electromagnetic transducers, Electrodynamic transducers, Piezoelectric transducers, Electro-strictive transducers, Magneto-strictive transducers, Electro thermal actuators, Comparison of actuation, Applications. **Magnetostrictive Mini Actuators**, Polymeric Actuators, Shape Memory Actuators, Active Vibration Control, Active Shape Control, Passive Vibration Control, Hybrid Vibration Control.	
Unit – V	**08 Hrs**
Measurement, Introduction, Definition, Signal and Signal Processing, Device Drive and Control system: open type and closed type; Static and Dynamic Measurement Methods; Signal conditioning and devices. **Calibration techniques**; Calibration, Significance of calibration, Benefit of calibration, Calibration method, Classification of calibration, Lab calibration, Curve fitting method of calibration,	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamental characteristics and properties of metals, polymers, ceramics, and various types of smart materials. **(PO1, PO6)**
CO2	Analyze the working principles and properties of different types of smart materials, such as piezoelectric, magnetostrictive, and shape memory materials, along with their processing techniques like semiconductor fabrication, metallization, and polymer synthesis. **(PO2, PO5)**
CO3	Evaluate the advancements in smart materials such as self-sensing transducers, self-healing polymers, and energy harvesting systems, as well as their application in sensor technology, focusing on various types of sensors used in smart systems. **(PO3, PO4)**
CO4	Design actuator-based systems and implement techniques for vibration and shape control using smart actuators. Apply knowledge of measurement methods, signal processing, and calibration techniques for enhancing control systems in smart materials and devices. **(PO3, PO10)**

Reference Books	
1	Fundamentals of Smart Materials, (2020) Mohsen Shahinpoor, Print ISBN 978-1-78262-645-9, ePub eISBN, 978-1-78801-946-0
2	Smart Material Systems and MEMS: Design and Development Methodologies, V. K. Varadan,

	K. J. Vinoy, S. Gopalakrishnan, John Wiley and Sons, England, 2006.
3	Smart Structures: Analysis and Design, A. V. Srinivasan, Cambridge University Press, Cambridge, New York, 2001.
4	Encyclopedia of Smart Materials, ISBN: 9780128157329, eBook ISBN: 97801281573
5	Functional and Smart Materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2021, ISBN 9780367275105
6	Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors, Materials and Amplifiers, G. Gautschi, Springer, Berlin, New York, 2002.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
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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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	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
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9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
ELEMENTS OF INDUSTRY 4.0 **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	ME114BTS/ME124BTS		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42L		**SEE Duration**	**:**	03 Hours

Unit – I	**06 Hrs**
Industry 4.0 – Introduction: The Various Industrial Revolutions, Need – Reason for Adopting Industry 4.0, Definition, Goals and Design Principles – Interoperability, Virtualization, Decentralization, Real-time Capability, Road to Industry 4.0 – Industrial Internet of Things (IIoT).	
Unit – II	**10 Hrs**
Opportunities and Challenges: Lack of resources, Availability of skilled workers, Broadband infrastructure, Policies, Future of Works and Skills in the Industry 4.0 Era. **Horizontal and Vertical Integration:** End-to-end engineering of the overall value chain, Digital integration platforms, Role of machine sensors, Sensing classification according to measuring variables, Machine-to-Machine communication.	
Unit –III	**10 Hrs**
Smart Worker: Augmented and Virtual Reality, Industrial Applications – Maintenance, Assembly, Collaborative operations, Training. **Digital-to-Physical:** Additive Manufacturing technologies, Advantages, impact on environment, Applications – Automotive, Aerospace, Electronics, and Medical.	
Unit – IV	**08 Hrs**
Digital Twin, Virtual factory, Total Productive Maintenance, Understanding I 4.0 in MSMEs, Industry 5.0 **Cloud Computing:** Fundamentals, Cloud / Edge Computing and Industry 4.0, The IT/OT convergence, Cyber Security.	
Unit - V	**08 Hrs**
Artificial Intelligence: Fundamentals, Case Studies, Technology paradigms in production logistics - Intelligent conveyor system, Intelligent commissioning system, Intelligent production machine, Intelligent load carrier, Applications. **Intelligent Objects** (user-oriented functions), Technological realization of Intelligent Objects (product-oriented functions).	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the design principles of Industry 4.0 in modern manufacturing. **(PO1, PO6)**
CO2	Analyze the challenges of Industry 4.0, such as resource constraints, workforce skill gaps, and technological infrastructure, and propose possible solutions. **(PO2, PO3, PO5)**
CO3	Utilize modern engineering technologies, such as cloud computing, to simulate smart manufacturing processes. **(PO4, PO5)**
CO4	Evaluate the impact of intelligent systems on production logistics and society and identify ethical considerations in implementing Industry 4.0 technologies. **(PO6, PO7, PO11)**

Reference Books	
1	Industry 4.0: Managing The Digital Transformation, Alp Ustundag, Emre Cevikcan, 2017, Springer, ISBN 978-3-319-57869-9, ISBN 978-3-319-57870-5.
2	The Concept Industry 4.0 - An Empirical Analysis of Technologies and Applications in Production Logistics, Christoph Jan Bartodziej, 2017, Springer Gabler, ISBN 978-3-658-16501-7 ISBN 978-3-658-16502-4.
3	Industry 4.0 - The Industrial Internet of Things, Alasdair Gilchrist, 2016, APRESS, ISBN-13 978-1-4842-2046-7 ISBN-13 978-1-4842-2047-4.
4	Digitizing the Industry – Internet of Things connecting the Physical, Digital and Virtual Worlds, Ovidiu

	Vermesan, 2016, River Publishers, ISBN 978-87-93379-81-7 ISBN 978-87-93379-82-4.

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 entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit – I: (Compulsory)	16
3 & 4	Unit – II: Question 3 or 4	16
5 & 6	Unit – III: Question 5 or 6	16
7 & 8	Unit – IV: Question 7 or 8	16
9 & 10	Unit – V: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
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Go, change the world

Programming Language Lab Courses

- **INTRODUCTION TO PYTHON PROGRAMMING (AI115AIA/AI125AIA)**
- **INTRODUCTION TO WEB PROGRAMMING (CS115AIB/CS125AIB)**
- **BASICS TO JAVA PROGRAMMING (CS115BIC/CS125BIC)**
- **INTRODUCTION TO C++ PROGRAMMING (IS115AID/IS125AID)**

Semester: I / II						
INTRODUCTION TO PYTHON PROGRAMMING **Category: Programming Language Course** **(Common to all Programs)** **(Theory & Practice)**						
Course Code	**:**	**AI115IA/AI125IA**		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	28L+28P		**SEE Duration**	**:**	03 Hours

Unit – I	**05 Hrs**
Getting Started: Introducing Python, Setting Up Python in windows, Setting Up Python in other Operating Systems, introducing IDLE. **Types, Variable, and Simple I/O:** Using Quotes with Strings, Concatenating and Repeating Strings, Working with Numbers, Understanding the Variable, Getting User Input, Converting Values	
Unit – II	**05 Hrs**
Branching, While Loops, and Program Planning: Using the If statement, Using the else Clause, Using the elif clause, creating while Loops, Avoiding Infinite Loops, Creating Intentional infinite Loops, Using Compound Conditions.	
Unit – III	**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. **Lists and Dictionaries:** Using Lists, Using List Methods, understanding when to use the tuple instead of Lists	
Unit – IV	**06 Hrs**
Functions: Creating Functions, Using Parameters and Return Values, Using Keyword Arguments and Default Parameters Values, Using Global Variables and Constants. **Files and Exceptions:** Reading from Text Files, Writing to Text Files, Handling Exceptions.	
Unit – V	**06 Hrs**
Software Objects: Defining a Class, Defining Method, Instantiating an Object, invoking a Methods, Using Constructor, Using Class Attributes and Static Methods, Understanding Object Encapsulation. **Object-Oriented Programming:** Using Inheritance to Create New Classes, creating a Base Class, inheriting from a Base Class, extending a Derived Class, Using the Derived Class, extending a Class through Inheritance, Understanding Polymorphism.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply fundamental knowledge of computing to solve multi-disciplinary problems. **(PO1)**
CO2	Identify the problems in various engineering domains and solve them using different concepts of Python programming. **(PO2)**
CO3	Design a solution using Python programming to address some of the concerns related to SDG. **(PO3)**
CO4	Demonstrate the use of modern tools by exhibiting teamwork and effective communication skills. **(PO8, PO9)**

Reference Books	
1	Michael Dawson, Python programming for the absolute beginner, 3rd Edition, CENGAGE, ISBN-13:978-93-86668-00-4, ISBN-10: 93-86668-00-9, 2010.
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	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.
4	Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3.6, 3rd Edition, The Pragmatic Bookshelf, ISBN-13: 978-1-6805026-8-8, 2017.

5	Mark Lutz, Learning Python, 5th Edition, 2013, Oreilly Media, ISBN: 978-1-449-35573-9.
6	Burkhard A. Meier, Python GUI Programming Cookbook, Packt Publishing, 2015, ISBN 978-1-78528-375-8.

Laboratory Experiments	
PART-A	
1	Introductory Lab-Installation and Working with the Sample Programs
2	Write a program to find the largest prime factor of a given integer
3	Write a program to find the height of the ball thrown by a basketball player.
4	Write a program to find the Golden ratio.
5	Read a paragraph from the user and count the number of words, and frequency of Words appearing, and search for the specific word.
6	Consider a sequence of numbers with some missing values. Write a python program for inserting the missing values and remove some of the values from the sequence. Also, add a few more values to the existing sequence.
7	Create an Employee 'Employee' Database using dictionaries and perform the insert, search and display operations.
8	Implement Set and Tuple Operations
9	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.
PROGRAMMING ASSIGNMENT	
Design and develop a python GUI application connected to interested Sustainable Development Goals (SDG)	

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
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5 & 6	Unit – III: Question 5 or 6	14
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9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
INTRODUCTION TO WEB PROGRAMMING **Category: Programming Language Course** **(Common to all Programs)** **(Theory & Practice)**						
Course Code	**:**	CS115AIB/CS125AIB		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	28L+28P		**SEE Duration**	**:**	03 Hours

Unit – I	**05 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; Pattern matching using regular expressions.	
Unit – V	**05 Hrs**
Database access through Web: Relational databases, Introduction to SQL, Architecture for database access, The MySQL Database System, Programming Examples and Demonstration of Connectivity Example code.	

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. **(PO1, PO2, PO5, PO11)**
CO2	Apply the concepts of different web frameworks to build static and dynamic web pages. **(PO1, PO2, PO5, PO7, PO11)**
CO3	Design and Develop client side of the application using an appropriate web programming tool and server-side logic. **(PO1, PO2, PO4, PO5, PO6, PO8, PO9, PO10, PO11)**
CO4	Demonstrate real world web-based applications for different domains. **(PO1, PO2, PO5, PO8, PO9, PO11)**

Reference Books	
1	Programming the World Wide Web – Robert W. Sebesta, 7th Edition, Pearson Education, 2013, ISBN-13:978-0132665810.
2	Web Programming Building Internet Applications – Chris Bates, 3rd Edition, Wiley India, 2006, ISBN: 978-81-265-1290-4.
3	Internet & World Wide Web How to H program – M. Deitel, P.J. Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004, ISBN-10: 0-130-89550-4
4	The Complete Reference to HTML and XHTML- Thomas A Powell, 4th Edition, Tata McGraw Hill, 2003, ISBN: 978-0-07-222942-4.

Laboratory Experiments	
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 WITH 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. **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). **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 30 MARKS.**	**30**
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) **ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation **(10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
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2	Unit – I: (Compulsory)	14
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5 & 6	Unit – III: Question 5 or 6	14
7 & 8	Unit – IV: Question 7 or 8	14
9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I/II						
BASICS TO JAVA PROGRAMMING **Category: Programming Language Course** **(Common to all Programs)** **(Theory & Practice)**						
Course Code	**:**	CS115BIC/CS125BIC		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	28L+28P		**SEE Duration**	**:**	03 Hours

Unit – I	**06 Hrs**
An Overview of Java: Object-Oriented Programming, The Java Class Libraries, Data Types, Variables, Operators, Control Statements, Arrays and Strings.	
Unit – II	**05 Hrs**
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, Method overloading.	
Unit – III	**06 Hrs**
Inheritance: Inheritance Basics, Using Super, Method Overriding, Abstract Classes, Using final with Inheritance.	
Unit – IV	**05 Hrs**
Packages: Defining a Package, Importing Packages, **Interfaces**: Defining an Interface, Default Interface Methods. **Exception Handling**: Exception-Handling Fundamentals – Exception Classes, Exception Types.	
Unit – V	**06 Hrs**
Multithreaded Programming: The Java Thread Model, The Main Thread, creating a Thread, Creating Multiple Threads, Thread Priorities.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply features of object-oriented programming of Java to solve real world problems. **(PO1, PO2, PO3, PO4, PO5, PO11)**
CO2	Design and develop the real-world models and entities using Java programming. **(PO1, PO2, PO3, PO4, PO5, PO11)**
CO3	Implement the object-oriented applications using features such as Inheritance, Packages, Interfaces, Exception Handling, Multi-threaded Programming and Strings. **(PO1, PO2, PO3, PO4, PO5, PO11)**
CO4	Demonstrate the real-world applications and programming skills to solve inter disciplinary problems effectively and exhibit teamwork through presentations and reports using Java programming. **(PO1, PO2, PO3, PO4, PO5, PO6, PO10)**

Reference Books	
1	The Complete Reference - Java, Herbert Schildt, 10th Edition, 2017, McGraw Hill Education Publications, ISBN-10: 9789387432291, ISBN-13: 978-9387432291
2	Introduction to Java Programming, Y Daniel Liang, 10th Edition, 2014, Comprehensive Version Pearson education, ISBN 10: 0-13-376131-2, ISBN 13: 978-0-13-376131-3
3	Core Java – Vol 1, Cay S. Horstmann, 10th Edition, 2016, Pearson Education, ISBN-10: 9332582718, ISBN-13: 978-9332582712
4	Object-Oriented Analysis and Design With applications, Grady Booch, Robert A Maksimchuk, Michael W Eagle, Bobbi J Young, 3rd Edition, 2013, Pearson education, ISBN :978-81-317-2287-9.

Laboratory Experiments (ME stream)	
PART A	
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.	
1	**Classes, Objects and Methods** • Create user defined classes and objects. • Define class members and their properties. • Define Methods, constructors, demonstrate method / constructor overloading. • Make necessary changes to the classes by making all the instance variables private and adding getter and setter methods for the instance variables.

2	**Inheritance and Polymorphism** • Create user defined classes and objects using Inheritance concept • Define class members to demonstrate Polymorphism
3	**Package and Interfaces** • Creation of simple package. • Accessing a package/ use of different Access Specifiers Implementing interfaces
4	**Exception handling** Handling predefined exceptions.
5	**Multithreading** Create multiple threads: a) Using Thread class. b) Using Runnable interface
PART B	
Design and develop an application to demonstrate appropriate Object-Oriented concepts and Core Java programming features: **Develop standalone Java application** to demonstrate the important features of Object-Oriented approach (Abstraction/Encapsulation/Data Hiding, Inheritance and Polymorphism) and also the important features of Java such as Inheritance, Interfaces, Packages, Exception Handling, Multithreaded Programming and Collection Framework	

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH 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. **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). **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 30 MARKS.**	**30**
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**) ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation **(10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
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9 & 10	Unit – V: Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**

Semester: I / II						
INTRODUCTION TO C++ PROGRAMMING **Category: Programming Language Course** **(Common to all Programs)** **(Theory & Practice)**						
Course Code	**:**	IS115AID/IS125AID		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	28L+28P		**SEE Duration**	**:**	03 Hours

Unit – I	**05 Hrs**
Introduction to Object Oriented Programming Concepts: Principles of object-oriented programming: Procedure oriented programming Vs object-oriented programming, Underlying concepts of object oriented programming, Benefits and applications of object oriented programming. The Origins of C++, A Closer Look at the I/O Operators, the bool Data Type, The C++ Headers, Namespaces, C++ programming fundamentals, Introducing C++ Classes & objects, Constructors and Destructors, The C++ Keywords.	
Unit – II	**06 Hrs**
Classes & Objects: Discovering Classes, Interfaces, Encapsulation, Abstraction, Member Functions, Classes and Objects, Object has an interface, Structures and Classes, Unions and Classes, Friend Functions, Friend Classes, Inline Functions, Static Class Members, Static Data, Static Member Functions, Constructors and Destructors, The Scope Resolution Operator, Nested Classes, Local Classes, Passing Objects to Functions, Returning Objects, Object Assignment and Accessing Data Fields.	
Unit – III	**06 Hrs**
Inheritance and Polymorphism: Inheritance, Access Control in derived classes, Encapsulation & protected access, Advanced operations with inheritance, Function Overloading and Default arguments, Polymorphism, operator overloading, Virtual functions and Abstract Classes.	
Unit – IV	**05 Hrs**
Exception Handling: Exception Handling Fundamentals, Catching Class Types, Using Multiple catch Statements, Handling Derived-Class Exceptions, Exception Handling Options, Catching All Exceptions, Understanding terminate () and unexpected ().	
Unit – V	**06 Hrs**
Generic Programming: Template Functions, compile-time Polymorphism, Template Classes, Template Linked List, Nontape Template Arguments, Setting Behavior Using Template Arguments, **Standard Template Library (STL) of C++:** Template Class "vector", Template Class "map", Template Class "list", Iterators and Algorithms the Standard Function Library and The Standard C++ Class Library.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Demonstrate competence in designing and implementing programs by selecting appropriate Object-Oriented Programming concepts. **(PO1, PO2, PO5)**
CO2	Design and analyze classes and objects using Object-Oriented paradigms to model and solve real-world case studies, showcasing modular and reusable software design. **(PO2, PO3, PO5)**
CO3	Implement Object-Oriented solutions for real-time problems by applying core concepts such as inheritance, polymorphism, encapsulation, ensuring efficient problem-solving and design reuse. **(PO3, PO4, PO5)**
CO4	Apply C++ features, such as templates and operator overloading, to enhance the efficiency and flexibility of programs, and critically evaluate their impact on overall performance. **(PO4, PO5, PO11)**

Reference Books	
1	The Complete Reference C++, Herbert Schildt, 5th Edition, 2020, Mc Graw Hill, 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
Laboratory Experiments Implement the following programs using cc/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 includes 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. f. 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	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.
7	Write a C++ program to create a vector of integers. Copy the vector contents into a list, sort the contents, then copy selected items into another vector (like elements less than 10 etc).
8	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.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH LAB)		
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	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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	MAXIMUM MARKS FOR THE SEE THEORY	**100**

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 Programs)** **(Online English Course)**						
Course Code	**:**	HS111EL		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	0:0:1		**SEE**	**:**	50 Marks
Total Hours	**:**	30P		**SEE Duration**	**:**	2 Hours

Online English Course: Standardized Test of English Proficiency – From The Hindu Group	
Unit – I	**06 Hrs**
Identifying main ideas and details in a reading text - Understanding places on a map - Understanding new words using Punctuation Clues - Previewing Vocabulary - Organizing, drafting, editing, and writing an email - Researching and Documenting, Listening for and visualizing directions, Listening to an advertisement - Role-play: talking about places on campus, Role-play: returning merchandise to a store - Comparing shopping in a store and online shopping - Conducting research and giving a presentation.	
Unit – II	**06 Hrs**
Skimming a text using headings, subheadings, and images, identifying text organization - Reading and answering a questionnaire - Brainstorming and making notes on pros and cons, writing a paragraph using the words should and shouldn't - Listening for conversation starters, advice, instructions, complaints, Voice mail messages - Leaving voicemail messages, describing people, changing nouns to adjectives - Using model verbs to give advice.	
Unit – III	**06 Hrs**
Reading and Understanding graphs, identifying a good summary - Reading faster: reading in phrases - Summarizing facts and ideas in a written text, Identifying narrative sequence, Recognizing and writing conclusions, Understanding pronouns and pronoun reference - Thinking critically about cultural events and celebrations - Recognizing polite and impolite expressions of disagreement.	
Unit – IV	**06 Hrs**
Understanding chronological events, Using Organizers to organize ideas in reading text - Summarizing Events and Describing feelings, Writing a summary statement, Understanding paragraph function - Listening to work-place complaints, Job interviews, future plans, Listening for expressions used in restaurant, instruction in following a recipe - Discussing future plans, careers, and work-related issues, healthy and unhealthy eating habits and nutrition.	
Unit – V	**06 Hrs**
Understanding relationships between ideas - writing a questionnaire and an opinion blog post - posting a comment - Expressing an opinion - Listening to conversations about travel plans, travel information, activities, an opinion, agreement and disagreement - Discussing travel plans, fares, transportation, sights, and activities, Using conditional forms to support an argument, Using parts of speech to classify word families.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamental concepts of Academic English LSRW skills with Grammar - Articles, Pronouns, Prepositions, Nouns, Verbs and Tenses.
CO2	Use appropriate Vocabulary in real-life scenarios that students might face in professional and social situations.
CO3	Construct grammatically correct sentences, Learn basics of professional e-mail writing, Blog post.
CO4	Introduce Oneself in detail, preparing for interview, small talk, conversations, voice email messages, discussing future plans, careers, work related issues, environmental problem and travel conversations.

Reference Books	
1	Standardized Test of English Proficiency-from The Hindu Group: e-books.

About the Course: STEP (Standardized Test of English Proficiency) train is a 20 hours of adoptive 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..

ASSESSMENT AND EVALUATION PATTERN (ONLINE MODE)		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to **40 MARKS**	Final Assessment will be conducted for 50 marks **(ONLINE MODE)**
Test – II		
EXPERIENTIAL LEARNING		
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.	**10**	
MAXIMUM MARKS	**50 MARKS**	**50 MARKS**
TOTAL MARKS FOR THE COURSE	**50**	**50**

Semester: II						
COMMUNICATIVE ENGLISH - II **Category: Humanities & Social Sciences** **(Common to all Programs)** **(Online English Course)**						
Course Code	**:**	HS121EL		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	0:0:1		**SEE**	**:**	50 Marks
Total Hours	**:**	30P		**SEE Duration**	**:**	2 Hours

Online English Course: Standardized Test of English Proficiency – From The Hindu Group	
Unit – I	**06 Hrs**
Describing a weather phenomenon – Using transition words and phrases to connect cause and effect – Vocabulary words related to weather and climate situations – Listening to weather forecast - Introduction yourself and others – speaking from notes and discussing study habits and body language – Assessing good study habits and Evaluating why some students may not graduate – Casual expressions for making new friends – Distinguish between Can and can't – Identifying the meaning and importance of sign – Words related to learning from history.	
Unit – II	**06 Hrs**
Identifying and Expressing opinions, Using arguments and examples to support an opinion, Creating an outline or mind map – Vocabulary on words related to food, healthy and unhealthy eating habits – Using modal verbs such as should, must and have to – Identifying paragraph, main text and supporting ideas – Drafting, editing, reviewing and finalizing the text and Blogging – Speaking about food shopping and recipes.	
Unit – III	**06 Hrs**
Verbs and expression used to explain home maintenance – Comparing reduced and unreduced pronunciation – Identfying True or false information – Using idioms and discourse markers. Expression for apologizing - Identifying and practicing stressed words and reduced forms - Giving and receiving apologies – Vocabulary words related to homes through time, ancestry, home and family – Recognizing punctuation and phrase clues.	
Unit – IV	**06 Hrs**
Conducting a interview – Using a graphic organizer: Problem – Solution chart – Discussing the benefits of a healthy lifestyle - Vocabulary words on health and stress issues and fitness issues - Describing symptoms – Summarizing a story plot – Vocabulary words and phrases about TV and Social Media – Using reducing pronunciation.	
Unit – V	**06 Hrs**
Role-playing – Preparing a 30 second speech – Expression of like and Dislikes – Reporting survey results – Conducting a review – Identifying and practicing stresses words and reduced forms – Identifying speaker attitudes - Understanding left-out words and reference - Understanding literal meaning and reference - Interpreting and rewording quotes - Identifying negative prefixes.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamental concepts of Academic English LSRW skills with Grammar - Articles, Pronouns, Prepositions, Nouns, Verbs and Tenses
CO2	Use appropriate Vocabulary in real-life scenarios that students might face in professional and social situations.
CO3	Construct grammatically correct sentences, Learn basics of professional e-mail writing, Blog post.
CO4	Introduce Oneself in detail, preparing for interview, small talk, conversations, voice email messages, discussing future plans, careers, work related issues, environmental problem and travel conversations.

Reference Books	
1	Standardized Test of English Proficiency-from The Hindu Group: e-books.

About the Course: STEP (Standardized Test of English Proficiency) train is 20 hours of adoptive 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.

<table>
<tr><th colspan="3">ASSESSMENT AND EVALUATION PATTERN (ONLINE MODE)</th></tr>
<tr><td></td><td>CIE</td><td>SEE</td></tr>
<tr><td>WEIGHTAGE</td><td>50%</td><td>50%</td></tr>
<tr><td colspan="3">Evaluation of CIE
(Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)</td></tr>
<tr><td>Test – I</td><td rowspan="2">Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to 40 MARKS</td><td rowspan="3">Final Assessment will be conducted for 50 marks
(ONLINE MODE)</td></tr>
<tr><td>Test – II</td></tr>
<tr><td>EXPERIENTIAL LEARNING</td><td rowspan="2">10</td></tr>
<tr><td>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.</td><td>50 MARKS</td></tr>
<tr><td>MAXIMUM MARKS</td><td>50 MARKS</td><td>50 MARKS</td></tr>
<tr><td>TOTAL MARKS FOR THE COURSE</td><td colspan="2">50</td></tr>
</table>

Semester: I / II					
SAMSKRUTHIKA KANNADA **Category: Humanities & Social Sciences** **(Common to all Programs)**					
Course Code	:	**HSS112SK / HSS122SK**	**CIE**	:	50 Marks
Credits: L:T:P	:	1:0:0	**SEE**	:	50 Marks
Total Hours	:	15	**SEE Duration**	:	1 Hrs

Unit-I – ಲೇಖನಗಳು & ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ	**06 Hrs**
1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ 2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ 3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ.ವಿ. ಕೇಶವಮೂರ್ತಿ	
1. ವಚನಗಳು: ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮ ಪ್ರಭು, ಜೇಡರ ದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ 2. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ- ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು 3. ತತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳ ಸಿಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ	
Unit –III ಆಧುನಿಕ ಕಾವ್ಯ ಭಾಗ & ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ	**06 Hrs**
1. ಡಿವಿಜಿರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು 2. ಕುರುಡು ಕಾಂಚಾಣ: ದಾ.ರಾ. ಬೇಂದ್ರೆ 3. ಹೊಸಬಾಳಿನ ಗೀತೆ: ಕುವೆಂಪು	
1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ: ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ- ಎ.ಎನ್. ಮೂರ್ತಿರಾವ್ 2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ: ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ	
Unit –V ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ	**03 Hrs**
1. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ 2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
CO2	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
CO3	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಕಾವ್ಯಗಳ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
CO4	ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

Reference Books (ಪರಾಮರ್ಶನ ಪುಸ್ತಕ)	
1	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

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**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
1	Objective type questions (MCQs) covering the entire syllabus	**50**
	MAXIMUM MARKS FOR THE SEE THEORY	**50**

Semester: I						
BALAKE KANNADA **Category: Humanities & Social Sciences** **(Common to all Programs)**						
Course Code	**:**	HA113KB/HS123KB		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	1:0:0		**SEE**	**:**	50 Marks
Total Hours	**:**	16		**SEE Duration**	**:**	90 Minutes

Course Learning Objectives of Vyavaharika Kannada: The students will be able to	
1	Motivate students to learn Kannada language with active involvement.
2	Learn basic communication skills in Kannada language (Vyavaharika Kannada).
3	Importance of learning local language Kannada.

To those students who does not know Kannada	
Unit – I	**04 Hrs**
Parichaya (Introduction): Necessity of learning local language, Tips to learn the language with easy methods, Hints for correct and polite conversation, History of kannada language.	
Unit – II	**04 Hrs**
Kannada alphabtets and Pronunciation: Kannada aksharmale, Kannada stress letters (vattakshara), Kannada Khagunitha, Pronunciation, memorisation and usage of the Kannada letters.	
Unit – III	**04 Hrs**
Kannada vocabulary for communication: Singular and Plural nouns, Genders, Interrogative words, Antonyms, Inappropriate pronunciation, Number system, List of vegetables, Fractions, Menu of food items, Names of the food items, words relating to time,words relating to directions, words relating to human's feelings and emotion, Parts of the human body, words relating to relationship.	
Unit – IV	**04Hrs**
Kannada Grammar in Conversations: Nouns, Pronouns, Use of pronouns in Kannada sentences, Adjectives and its usage, Verbs, Adverbs,Conjunctions, Prepositions, Questions constructing words, Simple communicative sentences in kannada. Activities in Kannada, Vocabulory, Conversation.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Usage of local language in day today affairs.
CO2	Construction of simple sentences according to the situation.
CO3	Usage of honorific words with elderly people.
CO4	Easy communication with everyone.

Reference Books	
1	Vyavaharika Kannada patyapusthaka, L. Thimmesh, and V. Keshavamurthy, Prasaranga Visveshvaraya University, Belgaum.
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.
3	Spoken Kannada**,** Kannada Sahithya Parishat, Bengaluru.

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**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
1	Objective type questions (MCQs) covering the entire syllabus	**50**
	MAXIMUM MARKS FOR THE SEE THEORY	**50**

Semester: I / II						
FUNDAMENTALS OF INDIAN CONSTITUTION **Category: Humanities & Social Sciences** **(Common to All Programs)** **(Theory)**						
Course Code	**:**	HS114TC/HS124TC		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	1:0:0		**SEE**	**:**	50 Marks
Total Hours	**:**	15		**SEE Duration**	**:**	1 Hours

Unit - I	**05 Hrs**
Indian Constitution- Necessity of Constitution, Societies before and after the constitution adoption, Introduction to Indian Constitution, Making of the constitution, Role of constituent assembly, Salient features of Indian Constitution ,Preamble to the Indian Constitution and key concept of preamble. Fundamental Rights and its restrictions.	
Unit – II	**05 Hrs**
Directive Principles of State Policy and its present relevance in Indian Society, Fundamental Duties and its scope and significance in nation. Union Executive: Parliamentary system, President, Prime minister, Union Cabinet, Parliament- LS & RS, Parliamentary committees, Important Parliamentary terminologies. 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: VS & VP, Election Commission, Election and Electoral Process, Amendment to Indian Constitution and Important constitutional amendments till today. Emergency provisions.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Navigate their academic and personal lives more effectively & principles derived from the Constitution, such as equality, justice, and non-discrimination which make them to uphold these principles in project management, teamwork, and ethical decision-making. **(PO6)**
CO2	Understand the mechanisms available for addressing grievances and ensuring compliance with constitutional rights & they will be familiar with how to seek legal remedies if their rights are infringed and engage with constitutional bodies for redress. **(PO7)**
CO3	Analyze and evaluate the impact of executive policies and decisions on various sectors and demographics, enhancing their ability to contribute to policy discussions & participation in democratic processes, including voting, advocacy, and public discourse. **(PO8)**
CO4	Understanding the administrative process will prepare students for roles in public administration, law and policymaking relating to constitutional and managerial issues. **(PO8)**

Reference Books	
1	Dr. J. N Pandey, Constitutional Law of India, Central Law Agency, 2020 edition
2	Avtar Singh: Law of Consumer Protection: Principles and Practice, Eastern Book Company, 5th Edition, 2015, ISBN -13:978-9351452461
3	S.C. Srivastava: Industrial Relation and Labour Laws, Vikas Publishing House, 6th Edition, 2012, ISBN: 9789325955400
4	Jr. Charles E Harris, Michael. S. Pritchard and Michael J Rabins, Engineering Ethics, Wadsworth Cengage Learning, 5th Edition, 2009, ISBN-978-0495502791

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**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
1	Objective type questions (MCQs) covering the entire syllabus	**50**
	MAXIMUM MARKS FOR THE SEE THEORY	**50**

Semester: I / II						
SCIENTIFIC FOUNDATIONS OF HEALTH: YOGA PRACTICE **Category: Humanities & Social Sciences (Common to all the Programs)** **(Practice)**						
Course Code	**:**	HS115YL/HS125YL		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	0:0:1		**SEE**	**:**	50 Marks
Total Hours	**:**	30		**SEE Duration**	**:**	2 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.	
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 – II	**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: After completing the course, the students will be able to	
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	**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:** One Demonstration Test will be conducted for 30 Marks	**30**

3	**ACTIVITY BOOK:** Students are asked to maintain an Activity Book, **THE TOTAL MARKS FOR THE COMPILATION OF THE BOOK (05 Marks) AND STUDENT'S INVOLVEMENT IN THE ACTIVITY (05 Marks) WILL BE THE FINAL MARKS.**	**10**
	MAXIMUM MARKS FOR THE CIE THEORY	**50**

RUBRIC FOR SEMESTER END EXAMINATION (PRACTICE)		
Q. NO.	**CONTENTS**	**MARKS**
1	Demonstration of Asanas and Pranayama **SEE** for 50 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of only objective type questions for 40 marks covering the complete syllabus. Part – B consists of essay type questions for 10 marks.	50
	MAXIMUM MARKS FOR THE SEE THEORY	**50**

Skill Labs

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

BASIC FABRICATION AND SERVICE

SKILL LAB

For First Year Students

Organized by
Departments of Mechanical, Aerospace Engineering & Industrial Engineering

9980480001

8th Mail, Mysure Road
Bengaluru

krishnam@rvce.edu.in

SUMMARY

Improving the skills of engineering students is critical for the nation's economic development. Engineering students' adequate skills can help businesses to transform themselves structurally in the ways that are necessary to adapt to the emerging technologies. The future of skilled jobs requires attention to the labour market and to the employer needs for developing newer technologies. Training policies as per NEP 2020 for the skill development are addressed in this program.

Use of Hand tools

Pliers and Locking Devices, Clamps and Vices, Locking Nut Devices, Mallets and Non-Threaded Fasteners, Key Fasteners, Press Fit Assembly, Torque Wrench, Torque-Controlled Portable Power Tools,Drill/Drivers, etc

Welding and Fabrication: Welding standards Design consideration, Mathematical calculation, Safety & checklist, cutting, joining, rebuilding, Filler material consumption, Arc welding, TiG welding and Gas welding, Fabrication, Design considerations, fabrication materials, Metal fabricator's toolbox, Occupation hazards and workplace

Sheet Metal Work: Basic hand tools for sheet metal works, Design of Basics, CADD basics, Sheet metal equipment, Material selection, Patterns and layouts, Metal shaping, Hammer-forming, Riveting , brazing, Restoration, Occupational hazards

Plumbing work : Plumbing standards, Piping materials, Valve type, Common Sanitary Fixture, Fittings, Plumber chart, Fountain system, Garden water irrigation, Water management system, Drain Waste vent

Tyre repair Identification of tyre repair tools, Disassemble and assemble wheel from vehicles (only tubed wheels). Type of tyre damages, Examines and probes tyre with awl to determine extent of defect; Apply the puncher, replaces treads by cutting defective tread from plies,

Terms and Condition

Only students who have paid a special lab fee to the institution
The students must maintain 90 % attendance for obtaining the skill lab certificate
Students must attend training as per scheduled time

Acceptance

In order to accept and start the training of the program, students are required to sign in the provided space. Please remember that after signatures, the proposal will be set into action by RVCE/ For any queries, it is advised to discuss with the appointed representatives before the signing and making it

Coordinators:

Dr. S K Harisha, Dept of Mech Engg, Phone: 9538300040, e-mail: harishsk@rvce.edu.in ,

Prof. Pranesh Kumar S R, Dept of Aerospace Egg. Phone: 8904484360, e-mail: praneshkumarsr@rvce.edu.in

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Student Details

Name {_____
USN:_____
Branch: _____
Phone: _____
e-mail: _____

Signature of Student

Job Opportunity

After training, the student Careers in Welding may include Automotive, Maintenance, Construction, Fabrication and Designing sectors. Despite limited employment growth, about 13,100 openings for sheet metal workers are projected each year on an average, over the decade. Plumbers, pipefitters, and steamfitters work in factories, homes, businesses, and other places where there are pipes and related systems

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

IT ESSENTIALS
SKILL LAB

Organized by

Departments of Information Science and Engineering

Exploring visualization tools - 5 Hrs For First Year Students

9886332226

8th Mail, Mysuru Road
Bengaluru

sagarbm@rvce.edu.in

SUMMARY

Improving the skills of engineering students is critical for the nation's economic development. Engineering students' adequate skills can help businesses to transform themselves structurally in the ways that are necessary to adapt to the emerging technologies. The future of skilled jobs requires attention to the labour market and to the employer needs for developing newer technologies. Training policies as per NEP 2020 for the skill development are addressed in this program.

Exploring visualization tools - 5 Hrs

- Google data Studio
- M S Excel
- Tableau
- Power BI

Data Processing Essentials - 5 Hrs

- Poster Design Using Canva
- Video Editing
- Advanced features of MS word, MS Excel and MS Power Point

Basics of Operating System and Configuration - 5 Hrs

- OS Installation and Basics of Networking
- Dual OS Installation
- Virtual Box
- Antivirus installation and Scheduling
- Remote Login

Terms and Condition

Only students who have paid a special lab fee to the institution. The students must maintain 90 % attendance for obtaining the skill lab certificate

Acceptance

In order to accept and start the training of the program, students are required to sign in the provided space. Please remember that after signatures, the proposal will be set into action by RVCE/ For any queries, it is advised to discuss with the appointed representatives before the signing and making it officially

Coordinators:

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,
Dr. Padmashree T, Dept of ISE. Phone: 9632076605,
e-mail: padmashreet@rvce.edu.in

Prof. Priya D, Dept of ISE, Phone:9986997603
e-mail: priyad@rvce.edu.in

Student Details

Name _____
USN:_____
Branch: _____
Phone: _____
e-mail: _____

Signature of Student

Job Opportunity

After training, the student will be able to take up roles such as IT Assistant, Computer Operator, Programmer, Assistant Engineer, Network Administrator and Data Analyst.

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

IT ESSENTIALS (IT SKILSS FOR ALL)

SKILL LAB

For First Year Students

Organized by:
Department of
Computer Science & Engineering

080-68188199

8th Mail, Mysore Road,
Bengaluru-59

Hod.cse@rvce.edu.in

Course Overview:

What you learn here Students apply skills and procedures to install, configure, and troubleshoot computers, mobile devices, and software.

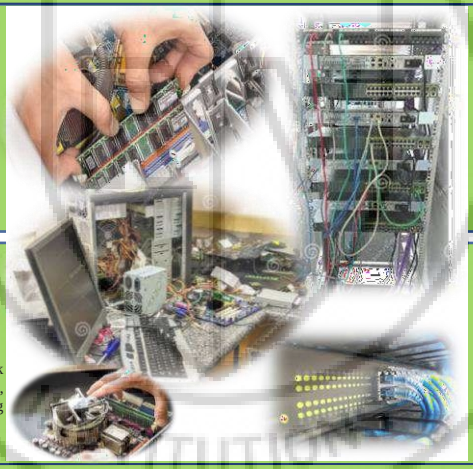
Benefits Learn the fundamentals of connecting computers to networks. Plus, you'll enjoy working with advanced simulation tools with hands-on labs to hone your troubleshooting skills and immediately practice what you learn!

Mode of Conduction of each Module:

2 Hours Theory, 2 Hours Demo, 3 Lab Sessions of 2.5 Hours each
Prepare for Careers / Employability options.
Develop skills for entry-level technical support roles (IT Support Jobs, Level1 and Level2,Voice support Executive Jobs, IT service Engineer Jobs, Network Engineer Jobs, Cloud support Executive Jobs), Prepare for Certification exams like CompTIA A+ and CCNA-level courses.

Module 1: Basics of PC, Laptops & Components

Introduction to PC Hardware: PC Components - CPUs and cooling system, Memory , Adapter cards and extension slots, Hard disk drives and SSDs, Optical storage devices ,ports , cables and adapters, Input devices and output devices. Computer disassembly & Assembly, Preventive maintenance and trouble shooting. Advanced computer Hardware: Advanced computer Functionality ports, Configuration for specialized computers. Laptops and other Mobile Devices: Laptop hardware and component installation and configuration, Preventive Maintenance and troubleshooting process.



Module 3: Basics of OS with Installations & Configurations

Windows Installation & Upgrades (Disk cloning, other installation methods, Remote network installation), Disk Management (storage device types, Hard drive partitioning, Partitions and logical drives), Windows Configuration - Configure Windows with Control Panels, System Administration
Linux OS tools and features, Linux OS best practices, BASIC CLI commands, Basic troubleshooting solutions for Linux operating systems.

Module 2: Networking Concepts and Components

Network components and types, Internet connection types, Networking protocols & standards, Network services & Network Devices (Basic network devices like Network interface cards, repeaters, bridges and hubs, switches, wireless Access points, Routers).
Applied Networking: Device to network connection (network addressing, configure a NIC, configure a wired and wireless networks, firewall settings, IoT device configuration), Basic trouble shooting process for networks, network problems and solutions

Module 4: Basics of Virtualization, Cloud Computing & Security

Virtualization and Cloud Computing: Introduction to Virtualization, client side virtualization, type1, Type2 hypervisors, Virtual Machine Requirements, Cloud computing Applications: How we use clouds, cloud services, cloud Models.
Security: Security threats, Security Procedures (security Policy, Protecting Physical Equipment, Protecting Data, Data Destruction, Securing Devices and Data), Securing Windows Work station, Windows local security Policy, Managing users and groups, Windows Firewalls, Web security, Security Maintenance.

Terms and Condition

Only students who have paid a special lab fee to the institution.
The students must maintain 90% attendance for obtaining the skill lab certificate.
Students must attend training as per scheduled time.

Acceptance

In order to accept and start the training of the program, students are required to sign in the provided space. Please remember that after signatures, the proposal will be set into action by RVCE/for any queries, it is advised to discuss with the appointed representatives before the signing and making it officially.

Coordinators:

Dr. Vinay V Hegde,
Associate Professor, Department of CSE, RVCE
Mobile: 9449782211, E-mail: vinayvhegde@rvce.edu.in
Dr. K Badari Nath,
Assistant Professor, Department of CSE, RVCE
Mobile: 9945124747, E-mail: badarinath.kb@rvce.edu.in
Prof. Pavithra H,
Assistant Professor, Department of CSE, RVCE
Mobile: 9591830273, E-mail: pavithrah@rvce.edu.in

Student Details

Name: _____
USN: _____
Branch: _____
Phone: _____
e-mail: _____

Signature of Student

Job Opportunity:

IT Support Jobs, Level 1 and Level2, Voice support Executive Jobs, IT service Engineer Jobs, Network Engineer Jobs, Cloud support Executive Jobs.

Course Delivery:

- 18 Interactive Lectures with demos followed by practice labs.
- Hands on PC Hardware, Laptops, OS Installations (Windows & Linux Installations), virtual laptop, and virtual desktop learning tools, IT Preventive Maintenance & Troubleshooting.

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

BASIC HARDWARE AND SERVICE

SKILL LAB

For First Year Students

Organized by
Departments of
Electrical and Electronics
Electronics and Communication
Electronics and Instrumentation
Electronics and Telecommunication

SUMMARY

Skills are most demanded and perishable resource in all sectors of life. Engineering skills encompass the ability to use the insights, to conceive, model and scale an appropriate solution to a problem. In the era of rapid changes and fierce competition, efforts to learn new things and acquire certain skills not only make students confident and self-assured, but also give them an advantage in the career building. Laboratory courses are essential in skills and knowledge for all engineering programs. Training policies as per NEP 2020 for the skill development are addressed in this program.

Electrical ratings, wiring, and controlling of lamps: Wiring skills and multi way control of lamps, Selection of lamp ratings, Relation between current, voltage and power.

Measurement of Solar cell parameters: Measurement of current and voltage due to varying radiation and temperature levels, shading, and tilt angle.

Measuring Instruments : Multi meter: AC Measurements, DC Measurement, Component Testing, Continuity Testing. **CRO:** Blocks Identification, Signal Display, Measurements and Lissajous Figures.

Regulated Power Supply(RPS) : RPS Blocks Identification, Signal measurement and troubleshooting at different stages.

Circuit rig up and testing on PCB: Identification of Circuits and components. Component placement rules: Placement and Soldering of components on the board, Wiring of components, Circuit testing and De soldering

Installation of Home appliances: Assembling and Dis-assembling of parts, Circuit testing, Testing the working condition of appliance.

Basics of Computer Networking: Identification of network components, CAT6 cable color code and crimping, RJ-45 connectors, Network cable testing.

Basics of Optical Fiber Communication
Identification of different types of optical cables, Transmission and receptions of analog and digitals signals via optical cable, Optical cable testing.

Terms and Condition

Only students who have paid a special lab fee to the institution
The students must maintain 90 % attendance for obtaining the skill lab certificate
Students must attend training as per scheduled time

Acceptance

In order to accept and start the training of the program, students are required to sign in the provided space. Please remember that after signatures, the proposal will be set into action by RVCE/ For any queries, it is advised to discuss with the appointed representatives before the signing and making it officially

Coordinators:

Dr. Kariyappa B S, Prof., ECE Dept., RVCE
E-mail: kariyappabs@rvce.edu.in, *M: 9449223582*
Dr. Chayapathy V, Asso. Prof., EEE Dept., RVCE
E-mail: chayapathiv@rvce.edu.in, *M: 7899638568*
Dr. Ramesh K B, Asso. Prof., EIE Dept., RVCE
E-mail: rameshkb@rvce.edu.in, *M: 9342522399*
Dr. Premananda B S, Asso. Prof., ETE Dept., RVCE
E-mail: premanandabs@rvce.edu.in, *M: 9844531730*

Student Details

Name _____
USN: _____
Branch: _____
Phone: _____
e-mail: _____

Signature of Student

Job Opportunity

After the completion of Skill Lab training, the candidate may:

- Enter into Electrical, Electronics and Solar energy power generation industries.
- Start their own service centres for servicing and installation of Home appliances.
- Become IT technicians and networking support staff.

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

DATA VISUALIZATION TOOLS
SKILL LAB
For First Year Students

Organized by
Department of Artificial Intelligence and Machine Learning

9844488329

8th Mile, Mysuru Road
Bengaluru

hod.ai@rvce.edu.in

SUMMARY

Improving the skills of engineering students is critical for the nation's economic development. Engineering students' adequate skills can help businesses to transform themselves structurally in the ways that are necessary to adapt to the emerging technologies. The future of skilled jobs requires attention to the labour market and to the employer needs for developing newer technologies. Training policies as per NEP 2020 for the skill development are addressed in this program.

Business Intelligence
Introduction to Business Intelligence, Understanding dataset, Introduction to Data Visualization

Excel
Overview of Excel features, Excel Plots, Introduction to VBA, Anatomy of Macros, Creating Personal macro-Workbook, Introduction to Visual Basic Editor

Power BI
Overview of Power BI, setting up the Power BI Environment, Data Sources and Visual Types, Constructing Bar, Column, and Pie, Charts, Building Line and Scatter Charts, Creating the Map-based Visualization, Creating the dashboard

Tableau
Overview of Tableau, Setting up the Tableau Environment
Live Data Connection, Filtering and sorting the data
Creating Basic Visualization, Creating dashboard

Terms and Condition

Only students who have paid a special lab fee to the institution. The students must maintain 90 % attendance for obtaining the skill lab certificate. Students must attend training as per scheduled time

Coordinators

Dr. Vijayalakshmi M N
Dept of AIML
Phone: 9986551776
e-mail: vijayalakshmi@rvce.edu.in

Prof. Narasimha Swamy S
Dept of AIML
Phone: 9986232400
e-mail: narasimhaswamys@rvce.edu.in

Acceptance

In order to accept and start the training of the program, students are required to sign in the provided space. Please remember that after signatures, the proposal will be set into action by RVCE. For any queries, it is advised to discuss with the appointed representatives before the signing and making it official

NAME:
USN:
BRANCH:
PHONE:
EMAIL: SIGNATURE

Job Opportunity

After training, the student Careers in Data Visualization may include Data Visualization Analyst, BI Designer, Data Visualization Engineer, Business Intelligence Developer. There are about 14,000+ Data Visualization Jobs in India.

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

WATER TESTING AND SKILL BASED LAB

For First Year Students

Organized by
Departments of BIOTECHNOLOGY

9945465657

8th Mail, Mysure Road
Bengaluru

vidya.n@rvce.edu.in

SUMMARY

Improving the skills of engineering students is critical for the nation's economic development. Engineering students' adequate skills can help businesses to transform themselves structurally in the ways that are necessary to adapt to the emerging technologies. The future of skilled jobs requires attention to the labour market and to the employer needs for developing newer technologies. Training policies as per NEP 2020 for the skill development are addressed in this program.

Biological Characterisation and assay: ***Escherichia coli, Coliform Bacteria, Coliform Bacteria, Staphylococcus aureus, Sulphite Reducing Anaerobes, Pseudomonas aeruginosa, Aerobic Microbial Count, Yeast &Mould, Salmonella and Shigella, Vibrio cholera***

Details about water filter and its components: Types of water filters, advancements in water filters, conventional and advanced water filters, candles, cartridges, columns, types of membranes, membrane materials, structural and other allied components, radiation-sources

Maintenance of filters: Types of filters, Mechanical Filters, Absorption Filters, Sequestration Filters, Ion Exchange Filters, Reverse Osmosis Filters. Durability, common problems and trouble shoots, nature of filters, columns and cartridges, filtration, softening, desalination, coagulation, flocculation, and clarification, durability of filters

Tools for accessing various parameters for water testing: conductivity, odor, sediment, and turbidity, PH Meter, Conductivity Meter, Turbidity Meter, Dissolved Oxygen Meter, Flame Photo Meter, Spectrophotometer (UV and Vis), Colorimeter, portable digital meters, colorimeters, and photometers

Analysis of Physical, Organoleptic properties and toxic substances: Taste, Colour , Odour, Turbidity, Total dissolved solids. Temperature testing, pH testing, Chloride test, Salinity testing, Dissolved Oxygen Test, Turbidity test, Nitrate and Phosphate, Pesticides, Heavy metals; Arsenic, Fluorine, Cadmium, mercury, lead. Iron, Barium, and other heavy and toxic metals

Terms and Condition

Only students who have paid a special lab fee to the institution
The students must maintain 90 % attendance for obtaining the skill lab certificate
Students must attend training as per scheduled

Acceptance

In order to accept and start the training of the program, students are required to sign in the provided space. Please remember that after signatures, the proposal will be set into action by RVCE/ For any queries, it is advised to discuss with the appointed representatives before the signing and making it

Coordinator:

Dr, Nagashree N Rao,
Associate Professor,
Department of Biotechnology
nagashreenrao@rvce.edu.in
6360962828

Student Details

Name {_____
USN:_____
Branch: _____
Phone: _____
e-mail: _____

Signature of Student

Job Prospects

Water and its manifestations in any form for the survival of the living being is the demand of the day. Water to be supplied in its purest form that to be consumed needs a master plan, After the completion of the course, students finds the avenues in Water treatment plant operator, Microbiologist for any of the industries, Water quality specialist or analyst, Start-ups and Social Enterprises, Food and allied industries, Water packaging and sampling Industries, Pharmaceutical and cosmetics industry,

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

BASIC SKILLS OF ENGINEERING

SKILL LAB

For First Year Students

Organized by
Departments of Civil & Chemical Engineering

9886127398

8th Mail, Mysore Road
Bengaluru

radhakrishna@rvce.edu.in

SUMMARY

Improving the skills of engineering students is critical for the nation's economic development. Engineering students' adequate skills can help businesses to transform themselves structurally in the ways that are necessary to adapt to the emerging technologies. The future of skilled jobs requires attention to the labor market and to the employer needs for developing newer technologies. Training policies as per NEP 2020 for the skill development are addressed in this program.

Paint & Accessories Handling

Painter tapes, Rollers, Brush, Putty Knife and Taping Knife, Color Mixing Combinations

Applying

Surface preparation, wall putty, primer coat, Paint mixing and applying

Tools Handling

Plumb Bob, Sprit Level, Bubble Tube, Hand Saw (Wood, PVC, CPVC and Steel), Spanners, Allen key & Wrench (Flat, Ring, Adjustable)

Area and Measurements

Plinth Area, Carpet area, Floor area, Floor Space Index, Built up area, Deductions in area calculations

Fire Safety

Fire Safety and Fire Extinguishers, General Safety and Personal Protective Equipments (PPE)
Safety Wares & First Aid, Material Safety data sheets
Chemicals/Acid spills and handling

Terms and Condition

- Only students who have paid a special lab fee to the Institution
- The students must maintain 90 % attendancefor obtaining the skill lab certificate
- Students must attend training as per scheduled time

Acceptance

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Coordinators:

Anand Kumar B.G of Civil Engg, Phone:9844755956,
e-mail: anandkumarbg@rvce.edu.in
,

Dr. Vidya C, Dept of Chemical Engg, Phone:9620166222,
e-mail:vidyac@rvce.edu.in

Student Details

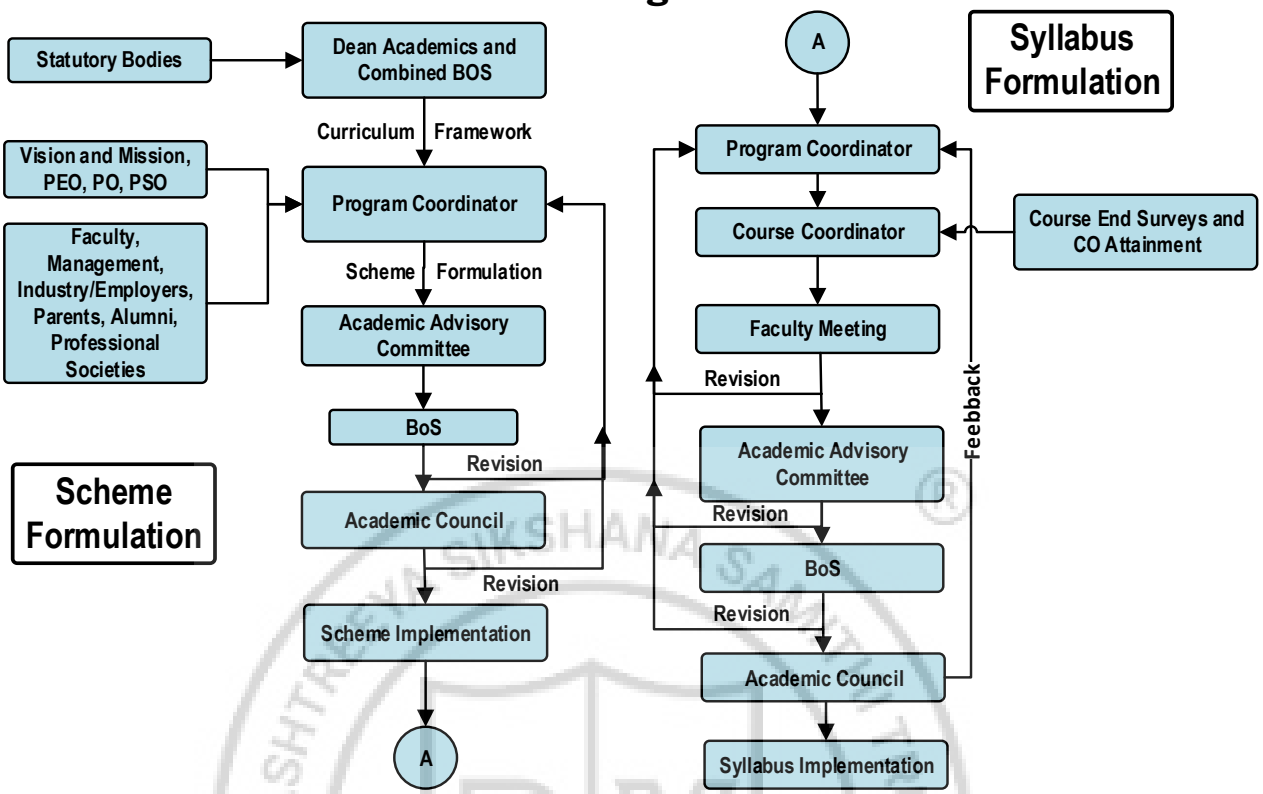
Name {_____
USN:_____
Branch:_____
Phone:_____
e-mail: _____

Signature of Student

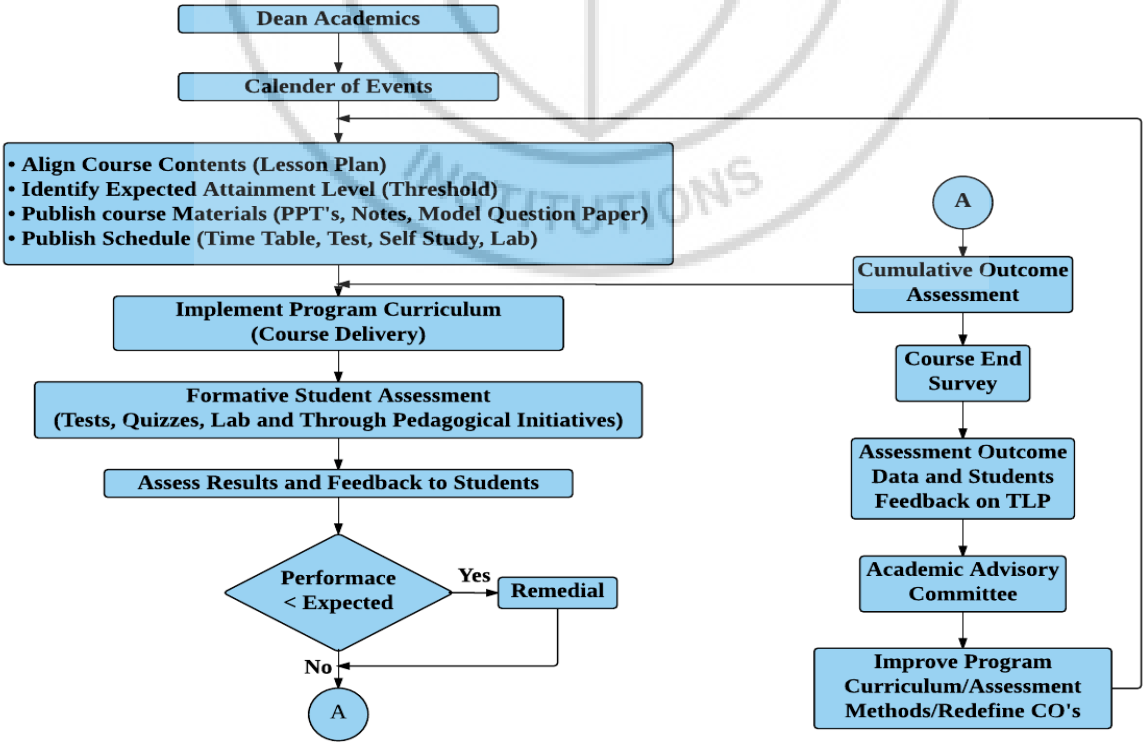
Job Opportunity

After training, the student can find employment in the area of building services, area calculations and property tax calculations. Supervision based employment in building repair/services civil and chemical laboratories.

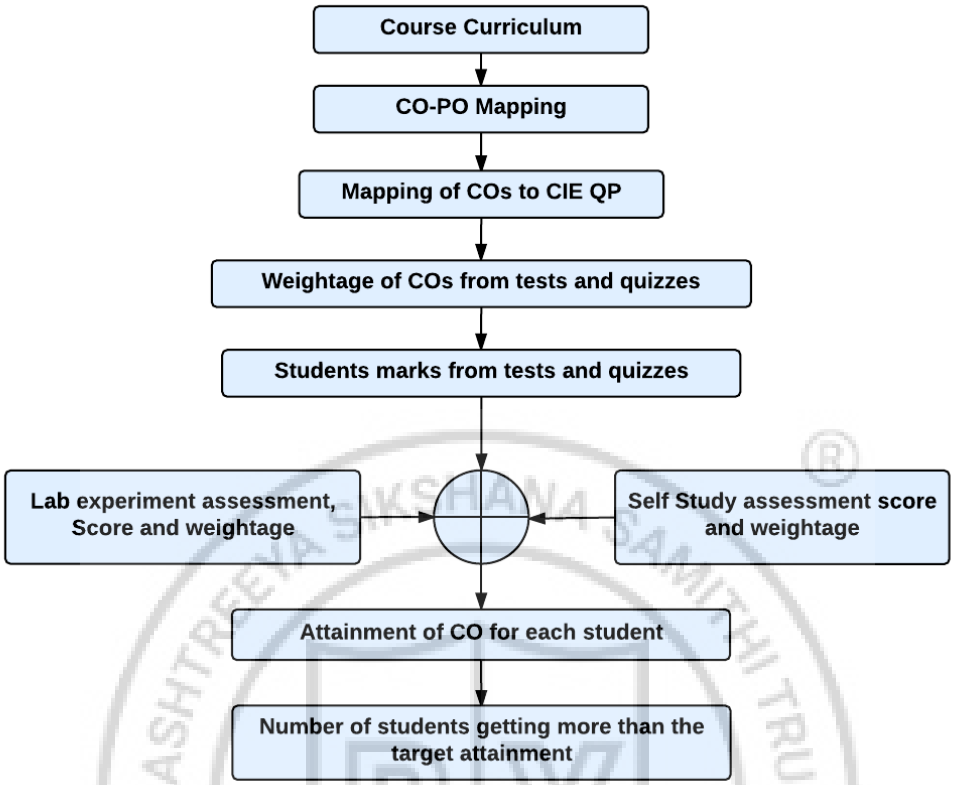
Curriculum Design Process



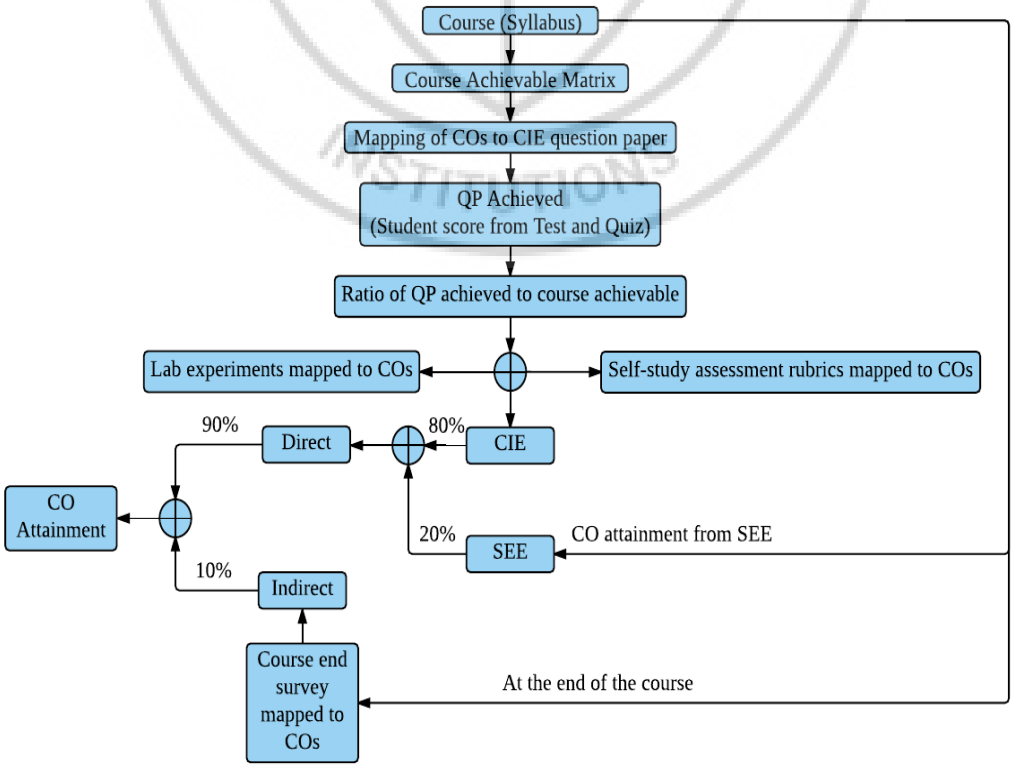
Academic Planning and Implementation



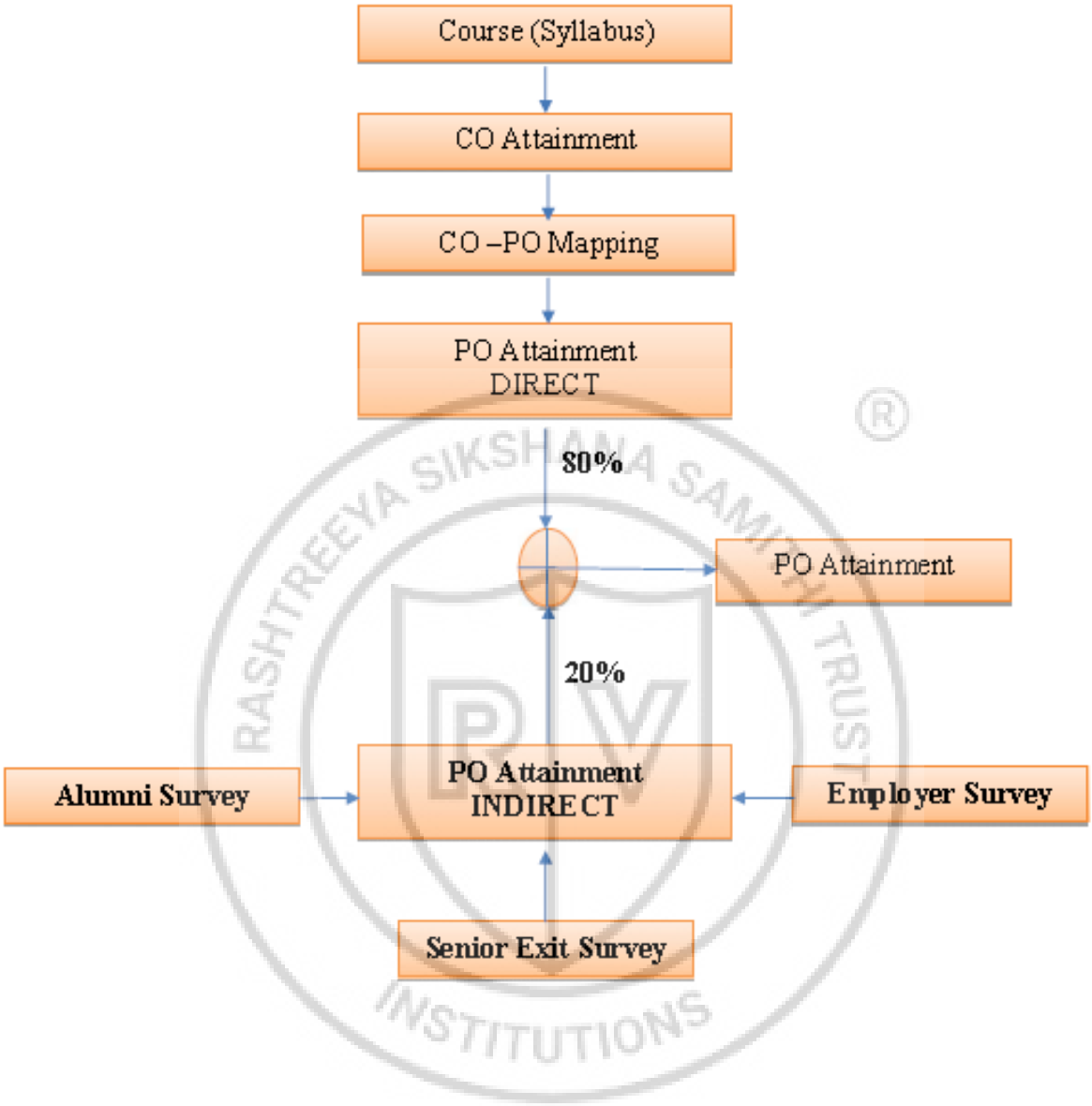
Process For Course Outcome Attainment



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.

Entrepreneurship Development Cell (E-Cell): Promotes entrepreneurship through workshops, speaker sessions, and mentoring for startups.

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.

Solar Car Team: Aims to create a solar electric vehicle for sustainable transportation.

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 Hydra: Develops autonomous underwater vehicles for tasks like water purification.

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.

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