MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru–560074

Bachelor of Engineering

CHEMISTRY GROUP

Scheme and Syllabus of I Semester for UG
(2025 Scheme)

VISION

To empower young minds through technology, research and innovation, to produce technically competent and socially responsible professionals in higher education.

MISSION

1. To deliver excellence in education through innovative teaching, impactful research, and continuous skill development, preparing students to meet global challenges with technical expertise and ethical responsibility.
2. To foster a transformative learning environment that integrates technology, research and practical experience, empowering students to become skilled professionals and socially conscious leaders.
3. To cultivate a culture of lifelong learning and professional excellence by encouraging creativity, research, and community engagement, equipping students with the skills to thrive in a dynamic world.
4. To provide a holistic educational experience that combines advanced technology, hands-on research, and community-focused learning, shaping students into competent, ethical professionals who contribute positively to society.

QUALITY POLICY

Rajarajeswari College of Engineering is committed to imparting quality technical education that nurtures competent, ethical professionals with global relevance. We ensure academic excellence through a dynamic, outcome-based curriculum, experienced faculty, and cutting-edge infrastructure. Continuous improvement is driven by innovation, research and strong industry collaboration. We foster holistic development and a progressive environment that supports lifelong learning, teamwork, and professional growth.

CORE VALUES

Academic Excellence, Integrity, Innovation, Global Competence, Continuous Improvement.

PROGRAM OUTCOMES (POs)

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, modeling, 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 modeling 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, 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)

INDEX

Dept: CSD & ISE

Dept: ECE & EEE

Dept: CV & R&A

I semester Chemistry Group Common Courses

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Scheme of Teaching and Examinations – 2025

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26)

I Semester — Chemistry Group: CSD — Academic Year: 2025-26

Sl. No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	SAAE	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks	
					L	T	P	S					
1.	ASC	B25MCS101	Calculus and Linear Algebra	Maths	3	2	0		50	3	50	100	4
2.	ASC(IC)	B25CCS102	Chemistry for Smart Systems	CHE	3	0	2		50	3	50	100	4
3.	ETC	B25AAK103	Introduction to AI and Applications	AIML	3	0	0		50	3	50	100	3
4.	ESC	B25ESB104	Introduction to Electrical Engineering	EEE	3	0	0		50	3	50	100	3
5.	PLC(IC)	B25PLB105	Python Programming	ISE	3	0	2		50	3	50	100	4
6.	AEC	B25CSK106	Communication Skills	Humanities	1	0	0		50	2	50	100	1
7.	NCMC	B25ICK107	Indian Constitution and Engineering Ethics	Humanities	1	0	0		100	--	--	100	PI
8.	AEC/ SDC	B25IDL108	Innovation and Design Thinking Lab (Project Based Learning)	Any Dept.	0	0	2		100	--	--	100	1
								TOTAL	450		350	800	2(

S-(SAAE) Students Academic Activity Engagement Hours, **ASC** – Applied Science Course, **ESC -** Engineering Science Courses, **IC -** Integrated Course (Practical Cour with Theory Course), **PLC (IC) –** Programming Language Course (Integrated Course), **AEC -** Ability Enhancement Course, **AEC/SDC -** Ability Enhanceme Course/Skill Development course, **ETC -**Emerging Technology Course, **TD/PSB -** Teaching Department/ Paper Setting Board, **HSMC -** Humanity, Social Science ar management Course, **CIE -** Continuous Internal Evaluation, **SEE -**Semester End Examination, **NCMC -** Non Credit Mandatory Course, **PP/NP -** (Pass/Not Pass).

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26)

I Semester — Chemistry Group– ISE (A&B) — Academic Year: 2025-26

Sl. No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	SAAE	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks	
					L	T	P	S					
1.	ASC	B25MCS101	Calculus and Linear Algebra	Maths	3	2	0		50	3	50	100	4
2.	ASC(IC)	B25CCS102	Chemistry for Smart Systems	CHE	3	0	2		50	3	50	100	4
3.	ETC	B25AAK103	Introduction to AI and Applications	AIML	3	0	0		50	3	50	100	3
4.	ESC	B25ESC104	Introduction to Electronics and Communication	ECE	3	0	0		50	3	50	100	3
5.	PLC(IC)	B25PLB105	Python Programming	ISE	3	0	2		50	3	50	100	4
6.	AEC	B25CSK106	Communication Skills	Humanities	1	0	0		50	2	50	100	1
7.	NCMC	B25ICK107	Indian Constitution and Engineering Ethics	Humanities	1	0	0		100	--	--	100	PP
8.	AEC/ SDC	B25IDL108	Innovation and Design Thinking Lab (Project Based Learning)	Any Dept.	0	0	2		100	--	--	100	1
								TOTAL	450		350	800	20

S-(SAAE) Students Academic Activity Engagement Hours, **ASC** – Applied Science Course, **ESC -** Engineering Science Courses, **IC -** Integrated Course (Practica Course Integrated with Theory Course), **PLC (IC) –** Programming Language Course (Integrated Course), **AEC -** Ability Enhancement Course, **AEC/SDC -** Ability Enhancement Course/Skill Development course, **ETC -**Emerging Technology Course, **TD/PSB -** Teaching Department/ Paper Setting Board, **HSMC -** Humanity, Socia Science and management Course, **CIE -** Continuous Internal Evaluation, **SEE -**Semester End Examination, **NCMC -** Non Credit Mandatory Course, **PP/NP -** (Pass/No Pass).

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(Effective from the Academic Year 2025-26)

I Semester — Chemistry Group: ECE — Academic Year: 2025-26

Sl. No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	SAAE	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks	
					L	T	P	S					
1.	ASC	B25MEE101	Differential Calculus and Linear Algebra	Maths	3	2	0		50	3	50	100	4
2.	ASC(IC)	B25CEE102	Chemistry for Emerging Electronics and Futuristic Devices	CHE	3	0	2		50	3	50	100	4
3.	ETC	B25AAK103	Introduction to AI and Applications	AIML	3	0	0		50	3	50	100	3
4.	ESC	B25ESB104	Introduction to Electrical Engineering	EEE	3	0	0		50	3	50	100	3
5.	PLC(IC)	B25PLA105	Introduction to C Programming	CSE	3	0	2		50	3	50	100	4
6.	AEC	B25CSK106	Communication Skills	Humanities	1	0	0		50	2	50	100	1
7.	NCMC	B25ICK107	Indian Constitution and Engineering Ethics	Humanities	1	0	0		100	--	--	100	PP
8.	AEC/ SDC	B25IDL108	Innovation and Design Thinking Lab (Project Based Learning)	Any Dept.	0	0	2		100	--	--	100	1
				TOTAL					450		350	800	20

S-(SAAE) Students Academic Activity Engagement Hours, **ASC** – Applied Science Course, **ESC -** Engineering Science Courses, **IC -** Integrated Course (Practica Course Integrated with Theory Course), **PLC (IC) –** Programming Language Course (Integrated Course), **AEC -** Ability Enhancement Course, **AEC/SDC -** Ability Enhancement Course/Skill Development course, **ETC -**Emerging Technology Course, **TD/PSB -** Teaching Department/ Paper Setting Board, **HSMC -** Humanity, Socia Science and management Course, **CIE -** Continuous Internal Evaluation, **SEE -**Semester End Examination, **NCMC -** Non Credit Mandatory Course, **PP/NP -** (Pass/No Pass).

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(Effective from the Academic Year 2025-26)

I Semester — Chemistry Group: EEE — Academic Year: 2025-26

Sl. No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	SAAE	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks	
					L	T	P	S					
1.	ASC	B25MEE101	Differential Calculus and Linear Algebra	Maths	**3**	**2**	**0**		**50**	**3**	**50**	**100**	**4**
2.	ASC(IC)	B25CEE102	Chemistry for Emerging Electronics and Futuristic Devices	CHE	**3**	**0**	**2**		**50**	**3**	**50**	**100**	**4**
3.	ETC	B25AAK103	Introduction to AI and Applications	AIML	**3**	**0**	**0**		**50**	**3**	**50**	**100**	**3**
4.	ESC	B25ESC104	Introduction to Electronics and Communication	ECE	**3**	**0**	**0**		**50**	**3**	**50**	**100**	**3**
5.	PLC(IC)	B25PLA105	Introduction to C Programming	CSE	**3**	**0**	**2**		**50**	**3**	**50**	**100**	**4**
6.	AEC	B25CSK106	Communication Skills	Humanities	**1**	**0**	**0**		**50**	**2**	**50**	**100**	**1**
7.	NCMC	B25ICK107	Indian Constitution and Engineering Ethics	Humanities	**1**	**0**	**0**		**100**	**--**	**--**	**100**	**PP**
8.	AEC/ SDC	B25IDL108	Innovation and Design Thinking Lab (Project Based Learning)	Any Dept.	**0**	**0**	**2**		**100**	**--**	**--**	**100**	**1**
				TOTAL					**450**		**350**	**800**	**20**

S-(SAAE) Students Academic Activity Engagement Hours, **ASC** – Applied Science Course, **ESC -** Engineering Science Courses, **IC -** Integrated Course (Practica Course Integrated with Theory Course), **PLC (IC) –** Programming Language Course (Integrated Course), **AEC -** Ability Enhancement Course, **AEC/SDC -** Ability Enhancement Course/Skill Development course, **ETC -**Emerging Technology Course, **TD/PSB -** Teaching Department/ Paper Setting Board, **HSMC -** Humanity, Socia Science and management Course, **CIE -** Continuous Internal Evaluation, **SEE -**Semester End Examination, **NCMC -** Non Credit Mandatory Course, **PP/NP -** (Pass/No Pass).

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(Effective from the Academic Year 2025-26)

I Semester — Chemistry Group: CV — Academic Year: 2025-26

Sl. No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	SAAE	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks	
					L	T	P	S					
1.	ASC	B25MME101	Multivariable Calculus	Maths	3	2	0		50	3	50	100	4
2.	ASC(IC)	B25CCV102	Chemistry for Sustainable Structure and Material Design	CHE	3	0	2		50	3	50	100	4
3.	ETC	B25AAK103	Introduction to AI and Applications	AIML	3	0	0		50	3	50	100	3
4.	ESC	B25ESD104	Introduction to Mechanical Engineering	ME	3	0	0		50	3	50	100	3
5.	PLC(IC)	B25PLA105	Introduction to C Programming	ISE	3	0	2		50	3	50	100	4
6.	AEC	B25CSK106	Communication Skills	Humanities	1	0	0		50	2	50	100	1
7.	NCMC	B25ICK107	Indian Constitution and Engineering Ethics	Humanities	1	0	0		100	--	--	100	PP
8.	AEC/ SDC	B25IDL108	Innovation and Design Thinking Lab (Project Based Learning)	Any Dept.	0	0	2		100	--	--	100	1
								TOTAL	450		350	800	20

S-(SAAE) Students Academic Activity Engagement Hours, **ASC** – Applied Science Course, **ESC -** Engineering Science Courses, **IC -** Integrated Course (Practica Course Integrated with Theory Course), **PLC (IC) –** Programming Language Course (Integrated Course), **AEC -** Ability Enhancement Course, **AEC/SDC -** Ability Enhancement Course/Skill Development course, **ETC -**Emerging Technology Course, **TD/PSB -** Teaching Department/ Paper Setting Board, **HSMC -** Humanity, Socia Science and management Course, **CIE -** Continuous Internal Evaluation, **SEE -**Semester End Examination, **NCMC -** Non Credit Mandatory Course, **PP/NP -** (Pass/No Pass).

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26)

I Semester — Chemistry Group: R&A — Academic Year: 2025-26

Sl. No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	SAAE	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks	
					L	T	P	S					
1.	ASC	B25MME101	Multivariable Calculus	Maths	3	2	0		50	3	50	100	4
2.	ASC(IC)	B25CME102	Chemistry for Advanced Metal Protection and Sustainable Energy Systems	CHE	3	0	2		50	3	50	100	4
3.	ETC	B25AAK103	Introduction to AI and Applications	AIML	3	0	0		50	3	50	100	3
4.	ESC	B25ESC104	Introduction to Electronics and Communication	ECE	3	0	0		50	3	50	100	3
5.	PLC(IC)	B25PLA105	Introduction to C Programming	CSE	3	0	2		50	3	50	100	4
6.	AEC	B25CSK106	Communication Skills	Humanities	1	0	0		50	2	50	100	1
7.	NCMC	B25ICK107	Indian Constitution and Engineering Ethics	Humanities	1	0	0		100	--	--	100	PP
8.	AEC/ SDC	B25IDL108	Innovation and Design Thinking Lab (Project Based Learning)	Any Dept.	0	0	2		100	--	--	100	1
				TOTAL					450		350	800	20

S-(SAAE) Students Academic Activity Engagement Hours, **ASC** – Applied Science Course, **ESC -** Engineering Science Courses, **IC -** Integrated Course (Practica Course Integrated with Theory Course), **PLC (IC) –** Programming Language Course (Integrated Course), **AEC -** Ability Enhancement Course, **AEC/SDC -** Ability Enhancement Course/Skill Development course, **ETC -**Emerging Technology Course, **TD/PSB -** Teaching Department/ Paper Setting Board, **HSMC -** Humanity, Socia Science and management Course, **CIE -** Continuous Internal Evaluation, **SEE -**Semester End Examination, **NCMC -** Non Credit Mandatory Course, **PP/NP -** (Pass/No Pass).

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(Effective from the Academic Year 2025-26)

Applied Mathematics-I					**Applied Chemistry**				
Course Code	**Title**	**L**	**T**	**P**	**Course Code**	**Title**	**L**	**T**	**P**
B25MME101	Multivariable Calculus: CV & ME Stream	3	2	0	B25CCV102/ 202	Chemistry for Sustainable Structure and Material Design: CV Stream	3	0	2
B25MEE101	Differential Calculus and Linear Algebra: EEE Stream	3	2	0	B25CME102/ 202	Chemistry for Advanced Metal Protection and Sustainable Energy systems: ME Stream	3	0	2
B25MCS101	Calculus and Linear Algebra : CSE Stream	3	2	0	B25CEE102/ 202	Chemistry for Emerging Electronics and Futuristic Devices : EEE, ECE Stream	3	0	2
					B25CCS102/ 202	Chemistry for Smart Systems :CSE Stream	3	0	2
Engineering Science Courses-I (ESC-I)					**Programming Language Courses (PLC)**				
B25ESA104/ 204	Building Sciences and Mechanics	3	0	0	B25PLA105/ 205	Introduction to C Programming (for Non-IT programmes)	3	0	2
B25ESB104/ 204	Introduction to Electrical Engineering	3	0	0	B25PLB105/205	Python Programming (CSE & Allied programmes)	3	0	2
B25ESC104/ 204	Introduction to Electronics and Communication	3	0	0					
B25ESD104/ 204	Introduction to Mechanical Engineering	3	0	0					
B25ESE104/ 204	Essentials of Information Technology	3	0	0					

Dean-Academics **Principal**

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Computer Science and Design

Information Science and Engineering

(2025 Scheme)

SEMESTER-I					
CALCULUS AND LINEAR ALGEBRA **Category: ASC(IC)**					
Course Code	:	B25MCS101	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:2:0	SEE	:	50 Marks
Total Hours	:	45(L)+30(T)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3Hrs

Course Objectives	
1.	Analyze engineering problems by applying Partial derivatives.
2.	Familiarize the fundamentals of Vector calculus.
3.	Understanding the importance of linear algebra.
4.	To provide unified framework for linear equations, vector spaces.
5.	To ensure a comprehensive understanding of linear transformations fundamental properties and applications.

Module– 1: Calculus	**No. of Hours**
Partial differentiation, total derivative, differentiation of composite functions, Jacobian, Statement of Taylor's and Maclaurin's series expansion for two variables. Maxima and minima for the function of two variables.	9
Module– 2: Vector Calculus	**No. of Hours**
Scalar and vector fields, Gradient, directional derivatives, divergence and curl - physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential. Introduction to polar coordinates and polar curves. Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality.	9
Module– 3: System of Linear Equations, Eigenvalues and Eigenvectors	**No. of Hours**
Elementary row transformation of a matrix, Echelon form, rank of a matrix. Consistency, solution of system of linear equations: Gauss elimination method. Applications: Traffic flow. Eigenvalues and Eigenvectors, modal matrix, diagonalization of the matrix.	9
Module– 4:Vector Space	**No. of Hours**
Vector spaces: definition and examples, subspace: definition and examples. Linear Combinations, linear span, linearly independent and dependent sets, basis and dimension, row space and column space of a matrix, Coordinate vector, inner products and orthogonality.	9
Module– 5: Linear Transformation	**No. of Hours**
Definition and examples, algebra of linear transformations, matrix of a linear transformation. Singular, non singular linear transformations and invertible linear transformations. Rank and nullity of linear transformations, Rank-Nullity theorem.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply the concepts of multivariable calculus and vector calculus to compute derivatives, optimize functions, and analyze vector fields for applications in computer science engineering.
CO2	Solve system of linear equations and determine eigenvalues and eigenvectors using direct and iterative methods.
CO3	Apply the concepts of vector spaces and linear transformations to problems in computer science engineering.
CO4	Demonstrate the applications of computer science and allied engineering Science using modern ICT tools.

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

Reference Text Books	
1.	V. Ramana, Higher Engineering Mathematics" McGraw-Hill Education, 11thEd., 2017
2.	James Stewart, Calculus, Cengage Publications, 7thEd., 2019.
3.	David Poole, Linear Algebra, a modern introduction, Cengage publishers, 4thEd., 2014.

Web links and Video lectures (e-Resources)
• https://nptel.ac.in/courses/111106135 • https://nptel.ac.in/courses/111105160 • https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments / practicing the problems**	**10**	**05**	
	Lab activity	**10**	**05**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	-	-	-	-	-	2
CO2	3	2	1	2	1	-	-	-	-	-	2
CO3	3	2	1	2	1	-	-	-	-	-	2
CO4	3	2	1	2	1	-	-	-	-	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom instruction (CI) in hours / semester		Lab instruction (LI) in hours / semester	Term work (TW) and self learning (SL) in hours /sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25MCS101 (L:T:P:S 3:2:0:3)	Calculus and Linear Algebra	**45**	**30**	**0**	**45**	**120**	**4**

SEMESTER-I					
CHEMISTRY FOR SMART SYSTEMS **Category: ASC(IC)**					
Course Code	:	B25CCS102	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:2	SEE	:	50 Marks
Total Hours	:	45(T)+26(P)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3Hrs

Course Objectives	
1.	To study about electrochemical studies, corrosion science for engineering applications.
2.	To studies of basic understanding about Batteries for various energy devices for engineering applications.
3.	To study the properties, engineering applications of polymeric materials for brain computer devise.
4.	To study the functional materials for memory devices and display systems
5.	To study the synthesis of green materials for IT industry applications and E waste manage mental studies

Module– 1: Electro Chemical Sensors and Corrosion Control	**No. of Hours**
Electrochemistry: Introduction, electrode potential, concentration cell, numerical problems. Reference electrode-Calomel electrode-construction, working. Ion selective electrode – pH electrode- construction, working. **Sensors**: Introduction, terminologies- Transducer, Actuators and Sensors, working principle and applications of electrochemical sensor, electrochemical gas sensors for the detection of NOx, Biosensor-principle and working mechanism for detection of glucose in biofluids. **Corrosion**: Introduction, electrochemical theory of corrosion, types-differential metal and differential aeration corrosion, Corrosion control**:** Galvanization and anodization, Corrosion Protection: cathodic protection methods and corrosion penetration rate (CPR)- definition, importance and numerical problems. **Self-study:** corrosion inhibitors for computer circuit boards,	9
Module– 2:Sustainable Chemistry for Energy Devices	**No. of Hours**
Batteries: Introduction, classification of batteries, construction, working and applications of Li-Ion battery. **Next-Generation Energy Systems:** Introduction, construction and working of sodium ion battery and redox flow battery for EV applications. Construction and working of ultra-small asymmetric super capacitor and its applications in IoT/wearable devices. **Clean Energy Chemistry:** Introduction, fuel cell, difference between fuel cell and battery, construction, working principle, applications and limitations of solid-oxide fuel cell (SOFCs) and solar photovoltaic cell (PV cell), Quantum dot sensitized solar cells (QDSSC's) construction working principle and applications. Production of green hydrogen by photocatalytic water splitting processes and its advantages.	9
Module-3: Polymers for Advanced Systems	**No. of Hours**
Polymer: Introduction, terminology, molecular weight of polymers - number and weight average molecular weight of polymers, numerical problems, structure-property relationship of polymers, synthesis and properties of nylon-12, advantages in 3D printing applications, synthesis and properties of CPVC and PMMA for device applications. Conducting polymers- Introduction, synthesis of polyaniline, conductions mechanism and its engineering applications. **Biomaterials**: Introduction, synthesis and properties of polylactic acid (PLA) and polyethylene glycol (PEG) for touch screen applications. Properties and applications of alginate hydrogel for Brain-Computer Interfaces (BCIs) applications. **Self-study:** Definition and significance of glass transition temperature	9
Module-4: Functional Materials for Memory and Display Systems	**No. of Hours**
Memory Devices: Introduction, organic semiconductors; types of organic semiconductors used in memory devices, p-type semiconductor-pentacene and n- type semiconductor -perfluoropentacene, difference between organic and inorganic memory devices, construction, working and advantages of pentacene semiconductor chip. **Resistive RAM (ReRAM) Materials:** Introduction, synthesis of TiO_2-RAM nanomaterial by sol-gel method, properties and its applications. **Display Systems:** Introduction, liquid crystals (LCs)- classification, properties and its applications in Liquid Crystal Displays (LCDs), construction, working principle and applications of LEDs, OLEDs,	9

and Quantum Light Emitting Diodes (QLEDs). Quantum Dot Light emitting Diode (QDLED) **Self-study:** Active-Matrix Organic Light Emitting Diodes (AMOLEDs)	
Module-5: Green Materials and E-Waste Management	**No. of Hours**
Green Materials: 12 principles of green chemistry (numericals on atom economy), Introduction, properties and applications of green solvents for server heat management, biosynthesis and properties of glycerol trioleate ester for server and IT infrastructure applications. Green synthesis of ZnO nanoparticles for magnetic radio frequency identification (RFID) & Internet of Nano Things (IONT) system applications. E-waste: Introduction, sources, composition of e-waste, effects of e-waste on environment and human health, extraction of gold from e-waste by bioleaching method, extraction of copper from e-waste by hydrometallurgical method, direct recycling method of lithium-ion batteries. **Self-study:** Role of artificial intelligence in e-waste management and its applications	9

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	List of experiments
1.	Estimation of acid mixture using Standard NaOH by conductometric sensor
2.	Estimation of iron in FAS using $K_2Cr_2O_7$bypotentiometric sensor
3.	Determination of pKa value of acetic acid using pH sensor
4.	Estimation of Copper in CuSO4usingoptical sensor
5.	Determination of viscosity coefficient of organic liquid using Ostwald's viscometer.
6.	Estimation of total hardness of given water sample by EDTA method.
7.	Estimation of percentage of CaO in cement by EDTA method.
8.	Determination of chemical oxygen demand (COD) of industrial effluents.
9.	Determination of alkalinity of water using standard NaOH solution.
10.	Demonstration of ZnO nanomaterial by Solution combustion method.
11.	Demonstration of Estimation of iron in TMT bar by diphenyl amine indicator method.
12.	Chemical structure drawing using software: ChemDraw/ChemSketch.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the concept of sensors, corrosion control towards real time application
CO2	Evaluate next-generation energy systems, fuel cells, green hydrogen technologies and Apply concepts of quantum materials.
CO3	Apply concepts of conducting polymers in modern electronics systems
CO4	Explain role of Functional Materials for Memory and Display Systems in energy and electronic systems.
CO5	Analyze Green Materials and E-Waste Management in sustainable electronics

Text Books	
1.	Engineering Chemistry, Suba Ramesh, Vairam, Ananda Murthy, 2011, Wiley India, ISBN: 9788126519880.
2.	Engineering Chemistry, Shubha Ramesh et.al., Wiley India, 1st Edition, 2011, ISBN: 9788126519880.
3.	Chemistry For Engineering Students by Dr B S Jai Prakash , Prof R Venugopal, DrShivakumaraiah.

Reference Text Books	
1.	Semiconducting Materials and Devices-Deepak Verma, ISBN: 978 9394777712,
2.	Organic Thin Film Transistor Applications: Materials to Circuits-Brajesh K. Kaushik et al. ISBN 10: 9781498736534
3.	High Quality Liquid Crystal Displays and Smart Devices – Ishihara, Kobayashi &Ukai (2019,IET), ISBN: 9781785619397

Web links and Video lectures (e-Resources)
• https://youtu.be/1TGTVQbMlIc • https://www.youtube.com/watch?v=IzWONUYlQ5E&t=56s • https://youtu.be/3j0jLuOs0v4 • https://youtu.be/CeZxn8CyM6Q

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	Internal Assessment1	50	Average of Best two Assessments, scale down to 40	50/2 = 25
	Internal Assessment2	50		
	Internal Assessment3	50		
CCA	Two Assignments	20	10	
Laboratory	Record &Observation	Evaluating each expt. for 10 marks	10	25
	Lab Internal Test	50	15	
SEE	Semester End Examination	100	50	50
Grand Total				100

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	1	-	1	-	1	1
CO2	3	2	1	2	1	1	-	1	-	1	1
CO3	3	2	1	2	1	1	-	1	-	1	1
CO4	3	2	1	2	1	1	-	1	-	1	1
CO5	3	2	1	2	1	1	-	1	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 – Low

Course Code	Course Title	Teaching and Learning Structure					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / semester	Term Work (TW) and Self Learning (SL) in hours / Sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25CCS202 (L:T:P:S 3:0:2:3)	Applied Chemistry for Smart Systems	**45**	**00**	**26**	**50**	**120**	**4**

SEMESTER-I					
INTRODUCTION TO AI AND APPLICATIONS **Category: ETC**					
Course Code	:	B25AAK103	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To study the concepts and types of artificial intelligence.
2.	To Demonstrate basic machine learning methods for regression, classification and clustering.
3.	To understand real-world applications across different disciplines.
4.	To make use of prompt engineering techniques to interact with generative AI tools.
5.	To study recent trends in artificial intelligence and machine learning.

Module– 1	**No. of Hours**
Introduction to Artificial Intelligence: Artificial Intelligence, How Does AI Work?, Advantages and Disadvantages of Artificial Intelligence, History of Artificial Intelligence, Types of Artificial Intelligence, Weak AI, Strong AI, Reactive Machines, Limited Memory, Theory of Mind, Self-Awareness, Is Artificial Intelligence Same as Augmented Intelligence and Cognitive Computing, Machine Learning and Deep Learning. **Machine Intelligence:** Defining Intelligence, Components of Intelligence, Differences Between Human and Machine Intelligence, Agent and Environment, Search, Uninformed Search Algorithms, Informed Search Algorithms: Pure Heuristic Search, Best-First Search Algorithm (Greedy Search). **Knowledge Representation:** Introduction, Knowledge Representation, Knowledge-Based Agent, Types of Knowledge.	9
Module– 2	**No. of Hours**
Introduction to Prompt Engineering, Introduction to Prompt Engineering, The Evolution of Prompt Engineering, Types of Prompts, How Does Prompt Engineering Work?, Comprehending Prompt Engineering's Function in Communication, The Advantages of Prompt Engineering, The Future of LLM Communication. **Prompt Engineering Techniques for ChatGPT,** Introduction to Prompt Engineering Techniques, Instructions Prompt Technique, Zero, One, and Few Shot Prompting, Self-Consistency Prompt. **Prompts for Creative Thinking:** Introduction, Unlocking Imagination and Innovation. **Prompts for Effective Writing:** Introduction, Igniting the Writing Process with Prompts.	9
Module– 3	**No. of Hours**
Machine Learning: Techniques in AI, Machine Learning Model, Regression Analysis in Machine Learning, Classification Techniques, Clustering Techniques, Naïve Bayes Classification, Neural Network, Support Vector Machine (SVM).	9
Module– 4	**No. of Hours**
Trends in AI: AI and Ethical Concerns, AI as a Service (AIaaS), Recent trends in AI, Expert System, Internet of Things, Artificial Intelligence of Things (AIoT).	9
Module– 5	**No. of Hours**
Robotics, Robotics-an Application of AI, Drones Using AI, No Code AI, Low Code AI. ***Textbook 1: Chapter 8 (8.3), Chapter 1 (1.7, 1.8, 1.10, 1.11)*** **Industrial Applications of AI:** Application of AI in Healthcare, Application of AI in Finance, Application of AI in Retail, Application of AI in Agriculture, Application of AI in Education, Application of AI in Transportation, AI in Experimentation and Multi-disciplinary research.	9

Sl. No.	**Activity on Creating Effective Prompts**
Note: To conduct the activity students can use any of the AI tools such as ChatGPT.	
1.	Basic Prompt writing: Create two different prompts to ask an AI about the topic "Electricity." The first prompt should be vague, and the second prompt should be clear and specific. Compare the responses you get and describe which prompt gave a better answer and why.
2.	Zero-Shot Prompting: Create a prompt that asks an AI to explain Ohm's Law without giving any example or background. Evaluate how well the AI explains the concept based on your prompt alone.
3.	One-Shot and Few-Shot Prompting: Provide the AI with a single example of how to calculate the resistance in a simple circuit. Then write your own prompt asking the AI to solve a similar resistance calculation. After

	that, add two more examples to your prompt and observe any changes in the AI's response quality.
4.	Chain-of-Thought Prompting: Develop a prompt that guides the AI step-by-step through calculating current flow in a circuit using Ohm's Law with resistors in series. Then, ask a final question for the AI to solve. Analyze how breaking down the reasoning steps impacts the accuracy of the answer.
5.	Prompt Refinement: Start with an ambiguous prompt related to the "Water Cycle." Test the AI's response, note the confusion or errors, and then refine your prompt to make it clearer and more specific. Repeat this process twice and record how the AI's responses improve with each refinement. Role-Based Prompting: Create three prompts asking the AI to explain "Newton's Laws of Motion," each with a different role instruction: (a) as an expert engineer, (b) as a high school teacher, (c) as a beginner. Compare the tone, detail, and style of the responses.
6.	Creative Engineering Problem Prompts: Craft a prompt that asks the AI to brainstorm ideas for designing a low-cost water purification system suitable for rural areas. Encourage creativity by adding phrases like "limited resources" and "sustainability".
7.	PCC-PEC-OEC (3 Credits) template 4 Ethical Prompt Design Discussion: Identify a biased prompt related to job descriptions (e.g. language with respect to a gender). Rewrite the prompt to remove bias and create a neutral, inclusive version. Explain why this revision is more ethical.
8.	Simulated Customer Support Chatbot: Develop a prompt that instructs the AI to play the role of a technical support agent helping a customer troubleshoot a failure in an electronic circuit. Include instructions to keep the tone friendly and professional and to ask diagnostic questions.
9.	Multi-Language Prompting: Develop a prompt that asks the AI to translate a simple engineering glossary (5 technical terms) from English to your native language. Then modify the prompt to request additional explanations of these terms in the translated language.
10.	Review a curated set of different prompt types (e.g., for summarization, information extraction, paraphrasing, question answering) from a "Prompt Gallery." For each prompt type, match it with a real world task (e.g., summarizing a lecture note, extracting names from a project report). Test at least three prompt templates on an AI tool or by role-play (students simulate being the AI), with varied wording. Record the outcomes and discuss which prompt (or template) was most effective for each task, and explain why you think it worked best. Reflect on how changing small parts of a prompt can alter model response quality, completeness, or accuracy.
11.	Choose a real engineering challenge or societal problem relevant to your field (e.g., "Reducing plastic waste in campus cafeterias" or "Optimizing solar panel placement on campus rooftops"). Draft an initial prompt that asks an AI to propose practical solutions. Share the AI's (or peer's) answer in small groups and identify aspects that are missing, vague, or not actionable. Refine your prompt based on feedback (e.g., specify constraints, ask for step-by-step solutions, or require a list of pros and cons). Repeat the process one more time, refining again for further clarity or specificity. Document the entire prompt-refinement process and share the best solution generated, along with a brief analysis of how prompt improvements led to better responses.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the concepts and types of artificial intelligence.
CO2	Illustrate basic machine learning methods for regression, classification and clustering.
CO3	Identify real-world applications across different disciplines.
CO4	Make use of prompt engineering techniques to interact with generative AI tools.
CO5	Outline recent trends in artificial intelligence and machine learning.

Text Books	
1.	ReemaThareja, Artificial Intelligence: Beyond Classical AI, Pearson Education, 2023.
2.	Ajantha Devi Vairamani and AnandNayyar, Prompt Engineering: Empowering Communication, 1st Edition, CRC Press, Taylor & Francis Group, 2024. (DOI: https://doi.org/10.1201/9781032692319).
3.	SaptarsiGoswami, Amit Kumar Das and AmlanChakrabarti, "AI for Everyone – A Beginner's Handbook for Artificial Intelligence", Pearson, 2024.

Reference Text Books	
1.	Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach (4th Edition), Pearson Education, 2023.
2.	Elaine Rich, Kevin Knight, and Shivashankar B. Nair, Artificial Intelligence, McGraw Hill Education.
3.	Tom Taulli, Prompt Engineering for Generative AI: ChatGPT, LLMs, and Beyond, Apress, Springer Nature.
4.	Nilakshi Jain, Artificial Intelligence: Making A System Intelligent, 1st Edition, Wiley.

Web links and Video lectures (e-Resources)
• https://cs50.harvard.edu/ai/ • https://developers.google.com/machine-learning/crash-course • https://learnprompting.org • https://ai.google/education/ • https://www.coursera.org/learn/machine-learning

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments /Lab activity**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	-	-	1	-	-	-	1	-	1
CO2	1	1			1				1	-	1
CO3	1	1			1				1	-	1
CO4	1	1			1				1	-	1
CO5	1	1			1				1	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / Semester	Term work (TW) and self learning (SL) in hours / sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25AAK203 (L:T:P:S 3:0:0:3)	Introduction to AI and Applications	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-I					
INTRODUCTION TO ELECTRICAL ENGINEERING **Category: ESC**					
Course Code	:	B25ESB104	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To explain the power generation concepts and laws used in the analysis of DC circuits.
2.	To explain the behavior of circuit elements in single-phase and three phase circuits.
3.	To describe the construction and operation DC machines and Transformers.
4.	To describe the application of renewable energy and introduction to EV.
5.	To describe domestic wiring and safety measures.

Module– 1	**No. of Hours**
Introduction: Conventional and non-conventional energy resources; General structure of electrical power systems using single line diagram approach. **Power Generation:** Hydel, Nuclear, Solar & Wind power generation (Block Diagram approach). **DC Circuits:** Ohm's Law and its limitations, KCL & KVL, Series, Parallel, Series- Parallel circuits. Simple Numerical.	9
Module– 2	**No. of Hours**
Single Phase Circuits: Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Analysis of R-L, R-C, R-L-C Series circuits, Active power, Reactive power and Apparent power, Concept of power factor. **Three Phase Circuits:** Generation of Three phase AC quantity, Advantages and limitations; Star and Delta connection, Relationship between line and phase quantities	9
Module– 3	**No. of Hours**
DC Machines: DC Generator: Principle of operation, Constructional details, Induced EMF expression, Types of generators, Relation between induced EMF and terminal voltage, simple numericals on EMF equation, DC Motor: Principle of operation, Back EMF and its significance, Types of motors, characteristics and speed control (armature & field) of DC motors (series & shunt only), Torque equation, Applications of DC motors **Transformers:** Necessity of transformer, Principle of operation, Types and construction of single phase transformers, EMF equation, Losses of transformer, Efficiency, Simple numerical on Losses and Efficiency	9
Module– 4	**No. of Hours**
Applications of Renewable energy: Photovoltaic Systems, Solar distillation; Solar Pond electric power plant, Off grid solar inverter, Urban waste to energy conversion, Hydrogen based transportation system **Introduction to EV:** History, General block diagram, Application and Benefits	9
Module– 5	**No. of Hours**
Domestic Wiring: Requirements, Types of wiring: casing, capping. Two way and three way control of load. **Domestic Safety:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits, Electric Shock, Earthing and its types, Safety Precautions to avoid shock **Electricity bill:** Power consumption of electrical energy, Two-part electricity tariff, Case study on calculation of electricity bill for domestic consumers.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the concepts of power generation and solve DC circuit problems.
CO2	Analyze single-phase circuits, solve R-L,R-C, and R-L-C circuits and comprehend three-phase circuit principles.
CO3	Understand DC machines, transformers and their characteristics.
CO4	Understand the application of renewable energy and basics of EV.
CO5	Understand domestic wiring and safety measures.

Text Books	
1.	D C Kulshreshtha, Basic Electrical Engineering, Tata McGraw Hill, 1st Edition2019

Reference Text Books	
1.	B.L. Theraja, A text book of Electrical Technology, S Chand and Company, reprint edition 2014.
2.	G D Rai, Nonconventional Energy sources, , Khanna Publication, 4th Edition, 1988
3.	D. P. Kothari and I. J. Nagrath, Basic Electrical Engineering, , Tata McGraw Hill 4th edition, 2019.
4.	V. K. Mehta, Rohit Mehta, Principles of Electrical Engineering & Electronics, S. Chand and Company Publications, 2nd edition, 2015.
5.	Rajendra Prasad, Fundamentals of Electrical Engineering, PHI, 3rd edition, 2014.

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	**Type of Assessment**	**Max. Marks**	**weightage**	**Total Marks**
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments / Project**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	2	2	1	-	-	-	1	-	1
CO2	1	2	2	2	1	-	-	-	1	-	1
CO3	1	3	3	2	1	-	-	-	2	-	1
CO4	1	3	3	2	1	-	-	-	2	-	1
CO5	1	3	3	2	1	-	-	-	2	-	1

Level 3 - High, Level 2 – Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / Semester	Term work (TW) and self learning (SL) in hours / sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25ESB104 (L:T:P:S 3:0:0:3)	Introduction to Electrical Engineering	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-I					
INTRODUCTION TO ELECTRONICS AND COMMUNICATION **Category: ESC**					
Course Code	:	B25ESC104	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To study the operation of Semiconductor diode, Zener diode and their applications.
2.	To study the operation of linear Op-amps and its applications
3.	To study the Basic Logic gates, circuits and their optimization.
4.	To study the Principles of Communication system.
5.	To study the operation of embedded system and its classification.

Module– 1	**No. of Hours**
Diode Theory: PN Junction Diode, Load line analysis, Series- diode configuration. Sinusoidal inputs - half wave rectification, Full wave Rectification, voltage multiplier Circuits, Zener Diodes. **Bipolar Junction Transistor:** Introduction, Common Base Configuration, Common Emitter Configuration. ***Text book: 1***	9
Module– 2	**No. of Hours**
Operational amplifier –Operational amplifier basics, practical Op-Amp circuits, Op-Amp specification –DC offset parameter, frequency parameter, Differential and common mode operation. Practical Op-Amp circuits– Inverting amplifier, non-inverting amplifier, Unity follower, Summing amplifier, Integrator, Differentiator. ***Text book: 1***	9
Module– 3	**No. of Hours**
Number Systems: Binary numbers, Number Base Conversion, Octal & Hexadecimal Numbers, Complements (1's & 2's Complements). **Boolean Algebra and Logic Circuits:** Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates. Combinational logic: Introduction, Design procedure, Adders- Half adder, Full adder. ***Text book: 2***	9
Module– 4	**No. of Hours**
Communication scheme: Elements of a Communication System, Need for Modulation, Amplitude Modulation, Frequency Modulation, Phase modulation, Comparison of FM& PM, Comparison of FM and AM. ***Text book: 3***	9
Module– 5	**No. of Hours**
Embedded systems: Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, Purpose of Embedded System, Core of the Embedded System: Microprocessors, GPP Vs ASIP, Microcontrollers, Microprocessor Vs Microcontroller, DSP, RISC Vs CISC, Memory: ROM, Sensors, Actuators, LED, 7-Segment LED display. ***Text book: 4***	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyze basic electronic circuits using the principles of rectifiers, voltage regulators.
CO2	Apply the knowledge on working principle of Operational amplifier.
CO3	Apply the concepts of Boolean Algebra and Logic Circuits.
CO4	Apply the concepts of embedded systems, sensors and interfacing.
CO5	Apply the concepts of analog and digital communication schemes.

Text Books	
1.	Electronic Devices and Circuit Theory, Robert L Boylestad and Louis Nashelsky, 11th Edition, Pearson Education, 2013, ISBN: 978-93-325-4260-0.
2.	Digital Design, M Moris Mano, 5th Edition, Prentice Hall of India
3.	Electronics communication systems, George Kennedy, 5thEdition, TataMcGraw hill.
4.	Introduction to embedded systems, Shibu K V,2nd Edition, Mc Graw Hill

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in/courses/122106025 2. https://nptel.ac.in/courses/108105132 3. https://nptel.ac.in/courses/117104072

ASSESSMENT STRUCTURE:

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CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments / Project**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	-	-	2	-	-	1	-	1
CO2	3	2	3	2	-	1	-	-	1	-	1
CO3	3	2	3	1	-	-	-	-	1	-	1
CO4	2	1	1	1	2	1	-	-	1	-	1
CO5	2	1	1		1	1	-	-	1	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / Semester	Term work (TW) and self learning (SL) in hours / sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25ESC104 (L:T:P:S 3:0:0:3)	Introduction to Electronics and Communication	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-I					
PYTHON PROGRAMMING **Category: PLC(IC)**					
Course Code	:	B25PLB105	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:2	SEE	:	50 Marks
Total Hours	:	45(T)+26(P)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3Hrs

Course Objectives	
1.	To develop scripts using primitive language constructs of python.
2.	To identify the methods to manipulate primitive python data structures.
3.	To make use of Python standard libraries for programming.
4.	To build scripts for performing file operations.
5.	To illustrate the concepts of Object-Oriented Programming as used in Python.

Module– 1	**No. of Hours**
The way of the program: The Python programming language, what is a program? What is debugging? Syntax errors, Runtime errors, Semantic errors, Experimental debugging. **Variables, Expressions and Statements:** Values and data types, Variables, Variable names and keywords, Statements, Evaluating expressions, Operators and operands, Type converter functions, Order of operations, Operations on strings, Input, Composition, The modulus operator. **Iteration:** Assignment, Updating variables, the for loop, the while statement, The Collatz 3n + 1 sequence, tables, two-dimensional tables, break statement, continue statement, paired data, Nested Loops for Nested Data. **Functions:** Functions with arguments and return values.	9
Module– 2	**No. of Hours**
Strings: Working with strings as single things, working with the parts of a string, Length, Traversal and the for loop, Slices, String comparison, Strings are immutable, the in and not in operators, A find function, Looping and counting, Optional parameters, The built-in find method, The split method, Cleaning up your strings, The string format method. **Tuples:** Tuples are used for grouping data, Tuple assignment, Tuples as return values, Composability of Data Structures. **Lists:** List values, accessing elements, List length, List membership, List operations, List slices, Lists are mutable, List deletion, Objects and references, Aliasing, cloning lists, Lists and for loops, List parameters, List methods, Pure functions and modifiers, Functions that produce lists, Strings and lists, list and range, Nested lists, Matrices.	9
Module– 3	**No. of Hours**
Dictionaries: Dictionary operations, dictionary methods, aliasing and copying. **Numpy:** About, Shape, Slicing, masking, Broadcasting, dtype. **Files:** About files, writing our first file, reading a file line-at-a-time, turning a file into a list of lines, Reading the whole file at once, working with binary files, Directories, fetching something from the Web.	9
Module– 4	**No. of Hours**
Modules: Random numbers, the time module, the math module, creating your own modules, Namespaces, Scope and lookup rules, Attributes and the dot Operator, Three import statement variants. **Mutable versus immutable and aliasing Object oriented programming:** Classes and Objects — The Basics, Attributes, Adding methods to our class, Instances as arguments and parameters, Converting an instance to a string, Instances as return values.	9
Module– 5	**No. of Hours**
Object oriented programming: Objects are mutable, Sameness, Copying. **Inheritance:** Pure functions, Modifiers, Generalization, Operator Overloading, Polymorphism. **Exceptions:** Catching Exceptions, Raising your own exceptions.	9

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	Name of the experiments
1.	a) Develop a python program to read 2 numbers from the keyboard and perform the basic arithmetic operations based on the choice. (1-Add, 2-Subtract, 3-Multiply, 4-Divide). b) Develop a program to read the name and year of birth of a person. Display whether the person is a senior citizen or not.
2.	a) Develop a program to generate Fibonacci sequence of length (N). Read N from the console. b) Write a python program to create a list and perform the following operations • Inserting an element • Removing an element • Appending an element • Displaying the length of the list • Popping an element • Clearing the list
3.	a) Read N numbers from the console and create a list. Develop a program to print mean, variance and standard deviation with suitable messages. b) Read a multi-digit number (as chars) from the console. Develop a program to print the frequency of each digit with a suitable message.
4.	Develop a program to print 10 most frequently appearing words in a text file. [Hint: Use a dictionary with distinct words and their frequency of occurrences. Sort the dictionary in the reverse order of frequency and display the dictionary slice of the first 10 items.
5.	Develop a program to read 6 subject marks from the keyboard for a student. Generate a report that displays the marks from the highest to the lowest score attained by the student. [Read the marks into a 1-Dimesional array and sort using the Bubble Sort technique].
6.	Develop a program to sort the contents of a text file and write the sorted contents into a separate text file. [Hint: Use string methods strip(), len(), list methods sort(), append(), and file methods open(), readlines(), and write()].
7.	Develop a function named DivExp which takes TWO parameters a, b, and returns a value c (c=a/b). Write a suitable assertion for a>0 in the function DivExp and raise an exception for when b=0. Develop a suitable program that reads two console values and calls the function DivExp.
8.	Define a function that takes TWO objects representing complex numbers and returns a new complex number with the sum of two complex numbers. Define a suitable class 'Complex' to represent the complex number. Develop a program to read N (N >=2) complex numbers and to compute the addition of N complex numbers.
9.	Text Analysis Tool: Build a tool that analyses a paragraph: frequency of each word, longest word, number of sentences, etc.
10.	Develop Data Summary Generator: Read a CSV file (like COVID data or weather stats), convert to dictionary form, and allow the user to run summary queries: max, min, average by column.
11.	Develop Student Grade Tracker: Accept multiple students' names and marks. Store them in a list of tuples or dictionaries. Display summary reports (average, topper, etc.).
12.	Develop a program to display contents of a folder recursively (Directory) having sub-folders and files (name and type).

Course Outcomes: At the end of the course, the students will be able to	
CO1	Develop scripts using primitive language constructs of python.
CO2	Identify the methods to manipulate primitive python data structures.
CO3	Make use of Python standard libraries for programming.
CO4	Build scripts for performing file operations.
CO5	Illustrate the concepts of Object-Oriented Programming as used in Python.

Text Books	
1.	Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers- How to think like a computer scientist: learning with python 3. Green Tea Press, Wellesley, Massachusetts,2020 https://media.readthedocs.org/pdf/howtothink/latest/howtothink.pdf

Reference Text Books	
1.	Al Sweigart," Automate the Boring Stuff with Python, 2nd Edition: Practical Programming for Total Beginners",2nd Edition, No Starch Press, 2022. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
2.	Kyla McMullen, Elizabeth Matthews and June Jamrich Parsons, Programming with Python, Cengage, 2023.

Web links and Video lectures (e-Resources)
• https://www.learnbyexample.org/python/ • https://www.learnpython.org/ • https://pythontutor.com/visualize.html#mode=edit

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50/2 = 25**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments**	**20**	**10**	
Laboratory	**Record & Observation**	**Evaluating each expt. For 10 marks**	**10**	**25**
	Lab Internal Test	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	1	-	-	2	1	-	-	1	-	-
CO2	-	1	-	-	2	1	-	-	1	-	-
CO3	-	2	-	-	2	2	-	-	1	-	1
CO4	-	2	-	-	2	2	-	-	1	-	1
CO5	-	2	-	-	2	2	-	-	1	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	Teaching and Learning Structure					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / semester	Term Work (TW) and Self Learning (SL) in hours / Sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25PLB105 **(L:T:P:S 3:0:2:3)**	Python programming	**45**	**00**	**26**	**50**	**120**	**4**

MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru–560074

Electronics and Communication Engineering

Electrical and Electronics Engineering

(2025 Scheme)

SEMESTER-I					
DIFFERENTIAL CALCULUS AND LINEAR ALGEBRA **Category: ASC**					
Course Code	:	B25MEE101	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:2:0	SEE	:	50 Marks
Total Hours	:	45(L)+30(T)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3Hrs

Course Objectives	
1.	Understand the angle of intersection between two curves and the radius of curvature.
2.	Familiarize the importance of calculus associated with one variable and multivariables.
3.	Analyze engineering problems applying Ordinary Differential Equations.
4.	Develop the knowledge of Linear Algebra referring to matrices.

Module– 1: Differential Calculus	**No. of Hours**
Polar curves, angle between the radius vector and the tangent, angle between the polar curves, pedal equations. Curvature and radius of curvature in cartesian, polar, parametric and pedal forms.	9
Module– 2: Power Series Expansions, Indeterminate Forms and Multivariable Calculus	**No. of Hours**
Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms - L'Hospital's rule. Partial Differentiation: Partial differentiation, total derivative - differentiation of composite functions. Jacobian. Maxima and minima for a function of two variables.	9
Module– 3: Ordinary Differential Equations (ODE) of First Order and First Degree and Nonlinear ODE	**No. of Hours**
Exact and reducible to exact differential equations- Integrating factors $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{-1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$on only Linear and Bernoulli's differential equations. Orthogonal trajectories, L-R and C-R circuits.. Non-linear differential equations: Introduction to general and singular solutions, solvable for p only, Clairaut's equations, reducible to Clairaut's equations.	9
Module– 4:Ordinary Differential Equations of Higher Order	**No. of Hours**
Higher-order linear ODEs with constant coefficients, homogeneous and non-homogeneous equations $-e^{ax}, \sin(ax+b), \cos(ax+b), x^n$only. Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. L-C-R circuits.	9
Module– 5: Linear Algebra	**No. of Hours**
Elementary transformations on a matrix, Echelon form, rank of a matrix, consistency of system of linear equations. Gauss elimination, Gauss –Seidel method to solve system of linear equations. Eigen values and eigen vectors of a matrix, Rayleigh power method to determine the dominant eigen value of a matrix.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply foundational concepts of calculus and differential equations to analyze geometric properties of curves, solve first and higher-order ordinary differential equations, and model physical phenomena in science and engineering.
CO2	Apply the principles of linear algebra to solve systems of linear equations, determine eigenvalues and eigenvectors, and analyze real-world problems such as traffic flow.
CO3	Demonstrate the applications of electrical engineering and allied engineering science using modern ICT tools.
CO4	Apply the knowledge of Linear Algebra referring to matrices.

Text Books	
1.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2021.
2.	E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10thEdition, 2018.
3.	Gilbert Strang, Linear Algebra and its Applications, Cengage Publications, 4th Edition, 2022.
Reference Text Books	
1.	B.V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education, 11thEdition, 2017
2.	Srimanta Pal &SubodhC.Bhunia, Engineering Mathematics, Oxford University Press, 3rdEdition, 2016.
3.	N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10thEdition, 2022.

Web links and Video lectures (e-Resources)
• https://nptel.ac.in/courses/111106135 • https://nptel.ac.in/courses/111105160 • https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/ • https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments / practicing the problems**	**10**	**05**	
	Lab activity	**10**	**05**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	-	-	-	-	-	2
CO2	3	2	1	2	1	-	-	-	-	-	2
CO3	3	2	1	2	1	-	-	-	-	-	2
CO4	3	2	1	2	1	-	-	-	-	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom instruction (CI) in hours / semester		Lab instruction (LI) in hours / semester	Term work (TW) and self learning (SL) in hours /sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25MEE101 (L:T:P:S 3:2:0:3)	Differential Calculus and Linear Algebra	**45**	**30**	**0**	**45**	**120**	**4**

SEMESTER-I					
CHEMISTRY FOR EMERGING ELECTRONICS AND FUTURISTIC DEVICES **Category: ASC(IC)**					
Course Code	:	B25CEE102	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:2	SEE	:	50 Marks
Total Hours	:	45(T)+26(P)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3Hrs

Course Objectives	
1.	To study about electrochemical studies, corrosion science and protection of materials using different plating techniques.
2.	To enable students to acquire knowledge on chemical Fuels and studies of various energy storage devices for engineering applications.
3.	To Study the properties, engineering applications of polymeric materials for smart electronic devise.
4.	To Study the properties, Nanomaterials, quantum dot materials for engineering applications.
5.	To study the advanced electronic materials and E waste manage mental studies.

Module-1: Electrode Systems and Corrosion Science	**No. of Hours**
Electrochemistry: Introduction, types of electrodes, concentration cell, numerical problems. Reference electrode-Calomel electrode-construction, working. Ion selective electrode – pH electrode- construction, working, determination of pH using glass electrode. **Corrosion:** Introduction, electrochemical theory of corrosion, types of corrosion differential metal corrosion in electronic circuits and differential aeration corrosion, corrosion control-cathodic protection - impressed current method, corrosion penetration rate (CPR)- definition, importance and numerical problems. **Metal Finishing:** Introduction, difference between electroplating &electroless plating, electroplating of gold, Electroless plating of copper on PCBs. **Self-study:** galvanization and anodization	9
Module-2: Energy – Sources, Conversion and Storage	**No. of Hours**
Chemical fuel: Calorific values, determination of calorific values by Bomb calorimeter, numericals. Petroleum cracking- Definition with an example, Reformation of petrol- Definition with an example. **Energy Storage Devices:** Introduction, classification of batteries-primary, secondary and reserve battery, characteristics (capacity, power density, energy efficiency & cycle life), construction and working of lithium-ion battery - advantages in EV applications. Introduction to super capacitors, construction and working of ultra-small asymmetric super capacitor in IoT/wearable device applications. **Energy Conversion Devices:** Introduction, construction, working, advantages and applications of photovoltaic cell of (PV cell), Introduction to MEMS-Based Energy Harvesters, working principle and applications. **Self-study:** Introduction, construction and working of sodium ion battery	9
Module-3: Functional Polymers in Flexible Electronics	**No. of Hours**
Polymer: Introduction, terminology, molecular weight of polymers - number and weight average molecular weight of polymers, numerical problems, Conducting Polymers: Introduction, synthesis, conduction mechanism and applications of polyaniline in electronic devices. **Polymeric semiconductors:** Introduction, n-type and p-type polymeric semiconductor materials, organic photovoltaic's – Poly (3-hexylthiophene) (P3HT) as a donor and Phenyl C61-butyric acid methyl ester (PCBM) as an acceptor, construction, working and applications. **Polymer Composites:** Introduction, synthesis and properties of epoxy resin- Fe_3O_4 composite for sensors applications, synthesis of Kevlar Fiber Reinforced Polymer (KFRP)-properties and smart electronic devices applications. **Self-study:** Difference between organic and inorganic semiconductors	9
Module-4 :Quantum Dot Materials for Electronics Applications	**No. of Hours**
Nanomaterials: Introduction, size dependent properties of nanomaterials -Surface area, Catalytic, optical and electrical. **Quantum Dot Materials:** introduction, quantum confinement effect, band gap. Inorganic Quantum Dot Materials (IQDMs): Introduction, synthesis and properties of silicon based QDs by Sol-Gel method and CdSe Quantum Dots by hot injection method and applications in optoelectronic devices	9

(QLED).Wet chemical synthesis, properties and applications of quantum dot-based copper conductive ink. **Quantum dot sensitized solar cells (QDSSCs)**-construction, working principle and applications. **Organic Quantum Dot Materials (OQDMs):** Introduction, synthesis and properties of chitosan-carbon quantum dots hydrogel applications in next-generation flexible and wearable electronics. Synthesis, properties and applications of Graphene Quantum Dots (using citric acid method) in emerging electronics. **Self-study:** Construction and working of OLEDs	
Module-5: Advanced Electronic Materials and E-waste Management	**No. of Hours**
Stretchable and Wearable Microelectronics: Introduction, basic principle and working of Lithography for micro-patterned copper deposition. Applications of PDMS (Polydimethyl siloxane) in e-skin (electronic skin) applications **Sensing Methods:** Introduction, principle and instrumentation of colorimetric sensors, application in the estimation of copper in PCB industry. Principle and working of potentiometric sensors, applications in the estimation of iron in steel. Conductometric sensors. Application in the estimation of acid mixture in a sample. **E-waste:** Introduction, need of e-waste management, sources & effects of e-waste on environment and human health, extraction of gold from e-waste from bioleaching method. **Self-study:** Extraction of lithium from spent lithium-ion batteries	9

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	List of experiments
1.	Estimation of total hardness of water by EDTA method.
2.	Determination of chemical oxygen demand (COD)of industrial effluent sample.
3.	Estimation of iron in TMT bar by diphenyl amine indicator method.
4.	Determination of alkalinity of given boiler water sample.
5.	Green synthesis of copper nanoparticles for conductive ink applications.
6.	Estimation of acid mixture by conductometric sensor(Conductometry)
7.	Estimation of iron in rust sample by Potentiometric sensor(Potentiometry)
8.	Determination of pKa of vinegar using pH sensor(Glass electrode)
9.	Estimation of copper present in e-waste by optical sensor (Colorimetry).
10.	Smartphone-Basedcolorimetricestimationoftotalphenoliccontentincoffeeproducts.
11.	Data analysis of pKa of a week acid and its inter pretation using origin software.
12.	Chemical structure drawing using software: ChemDraw/ChemSketch.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply the principles of chemistry involved in corrosion, energy systems, materials, quantum dots, sensors for emerging electronics and futuristic devices
CO2	Analyze the engineering problems and draw meaningful inferences through concepts of chemistry
CO3	Implement sustainable solutions through concepts of applied chemistry in the field of materials, energy and electronic devices
CO4	Engage in self-study and make an effective presentation on contribution of chemistry to society
CO5	Apply the knowledge of chemistry to investigate engineering materials by analytical techniques

Text Books	
1.	Engineering Chemistry, Suba Ramesh, Vairam, Ananda Murthy, 2011, Wiley India, ISBN: 9788126519880.
2.	Engineering chemistry, Shubha Ramesh et.al., Wiley India, 1st Edition, 2011, ISBN: 9788126519880.
3.	Chemistry for Engineering Students by Dr B S Jai Prakash, Prof R Venugopal, DrShivakumaraiah.

Reference Text Books	
1.	Electrochemical Energy System:Dr. K. K. Rajeshwar (IIT Madras), Publisher: IIT Madras Open Courseware (Free PDF & videos), ISBN: N/A (Open Educational Resource).
2.	Advances in corrosion science and technology, M.G. Fontana, R.W. Staettle, Springer publications, 2012, ISBN: 9781461590620.
3.	Engineering Chemistry: Jain & Jain, Publisher: Dhanpat Rai Publishing Company, ISBN: 978 9353161181.

Web links and Video lectures (e-Resources)
• https://youtu.be/HT21wrGl6oM • https://youtu.be/aG2F-fd2drM • https://youtu.be/ivWXuOd5SrI

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50/2 = 25**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments**	**20**	**10**	
Laboratory	**Record & Observation**	**Evaluating each expt. For 10 marks**	**10**	**25**
	Lab Internal Test	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	1	-	1	-	1	1
CO2	3	2	1	2	1	1	-	1	-	1	1
CO3	3	2	1	2	1	1	-	1	-	1	1
CO4	3	2	1	2	1	1	-	1	-	1	1
CO5	3	2	1	2	1	1	-	1	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 – Low

Course Code	Course Title	Teaching and Learning Structure					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / semester	Term Work (TW) and Self Learning (SL) in hours / Sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25CEE102 (L:T:P:S 3:0:2:3)	Applied Chemistry for Emerging Electronics And Futuristic Devices	**45**	**00**	**26**	**50**	**120**	**4**

SEMESTER-I					
INTRODUCTION TO AI AND APPLICATIONS **Category: ETC**					
Course Code	:	B25AAK103	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To study the concepts and types of artificial intelligence.
2.	To Demonstrate basic machine learning methods for regression, classification and clustering.
3.	To understand real-world applications across different disciplines.
4.	To make use of prompt engineering techniques to interact with generative AI tools.
5.	To study recent trends in artificial intelligence and machine learning.

Module– 1	**No. of Hours**
Introduction to Artificial Intelligence: Artificial Intelligence, How Does AI Work?, Advantages and Disadvantages of Artificial Intelligence, History of Artificial Intelligence, Types of Artificial Intelligence, Weak AI, Strong AI, Reactive Machines, Limited Memory, Theory of Mind, Self-Awareness, Is Artificial Intelligence Same as Augmented Intelligence and Cognitive Computing, Machine Learning and Deep Learning. **Machine Intelligence:** Defining Intelligence, Components of Intelligence, Differences Between Human and Machine Intelligence, Agent and Environment, Search, Uninformed Search Algorithms, Informed Search Algorithms: Pure Heuristic Search, Best-First Search Algorithm (Greedy Search). **Knowledge Representation:** Introduction, Knowledge Representation, Knowledge-Based Agent, Types of Knowledge.	9
Module– 2	**No. of Hours**
Introduction to Prompt Engineering, Introduction to Prompt Engineering, The Evolution of Prompt Engineering, Types of Prompts, How Does Prompt Engineering Work?, Comprehending Prompt Engineering's Function in Communication, The Advantages of Prompt Engineering, The Future of LLM Communication. **Prompt Engineering Techniques for ChatGPT,** Introduction to Prompt Engineering Techniques, Instructions Prompt Technique, Zero, One, and Few Shot Prompting, Self-Consistency Prompt. **Prompts for Creative Thinking:** Introduction, Unlocking Imagination and Innovation. **Prompts for Effective Writing:** Introduction, Igniting the Writing Process with Prompts.	9
Module– 3	**No. of Hours**
Machine Learning: Techniques in AI, Machine Learning Model, Regression Analysis in Machine Learning, Classification Techniques, Clustering Techniques, Naïve Bayes Classification, Neural Network, Support Vector Machine (SVM).	9
Module– 4	**No. of Hours**
Trends in AI: AI and Ethical Concerns, AI as a Service (AIaaS), Recent trends in AI, Expert System, Internet of Things, Artificial Intelligence of Things (AIoT).	9
Module– 5	**No. of Hours**
Robotics, Robotics-an Application of AI, Drones Using AI, No Code AI, Low Code AI. ***Textbook 1: Chapter 8 (8.3), Chapter 1 (1.7, 1.8, 1.10, 1.11)*** **Industrial Applications of AI:** Application of AI in Healthcare, Application of AI in Finance, Application of AI in Retail, Application of AI in Agriculture, Application of AI in Education, Application of AI in Transportation, AI in Experimentation and Multi-disciplinary research.	9

Sl. No.	**Activity on Creating Effective Prompts**
Note: To conduct the activity students can use any of the AI tools such as ChatGPT.	
1.	Basic Prompt writing: Create two different prompts to ask an AI about the topic "Electricity." The first prompt should be vague, and the second prompt should be clear and specific. Compare the responses you get and describe which prompt gave a better answer and why.
2.	Zero-Shot Prompting: Create a prompt that asks an AI to explain Ohm's Law without giving any example or background. Evaluate how well the AI explains the concept based on your prompt alone.
3.	One-Shot and Few-Shot Prompting: Provide the AI with a single example of how to calculate the resistance in a simple circuit. Then write your own prompt asking the AI to solve a similar resistance calculation. After

	that, add two more examples to your prompt and observe any changes in the AI's response quality.
4.	Chain-of-Thought Prompting: Develop a prompt that guides the AI step-by-step through calculating current flow in a circuit using Ohm's Law with resistors in series. Then, ask a final question for the AI to solve. Analyze how breaking down the reasoning steps impacts the accuracy of the answer.
5.	Prompt Refinement: Start with an ambiguous prompt related to the "Water Cycle." Test the AI's response, note the confusion or errors, and then refine your prompt to make it clearer and more specific. Repeat this process twice and record how the AI's responses improve with each refinement. Role-Based Prompting: Create three prompts asking the AI to explain "Newton's Laws of Motion," each with a different role instruction: (a) as an expert engineer, (b) as a high school teacher, (c) as a beginner. Compare the tone, detail, and style of the responses.
6.	Creative Engineering Problem Prompts: Craft a prompt that asks the AI to brainstorm ideas for designing a low-cost water purification system suitable for rural areas. Encourage creativity by adding phrases like "limited resources" and "sustainability".
7.	PCC-PEC-OEC (3 Credits) template 4 Ethical Prompt Design Discussion: Identify a biased prompt related to job descriptions (e.g. language with respect to a gender). Rewrite the prompt to remove bias and create a neutral, inclusive version. Explain why this revision is more ethical.
8.	Simulated Customer Support Chatbot: Develop a prompt that instructs the AI to play the role of a technical support agent helping a customer troubleshoot a failure in an electronic circuit. Include instructions to keep the tone friendly and professional and to ask diagnostic questions.
9.	Multi-Language Prompting: Develop a prompt that asks the AI to translate a simple engineering glossary (5 technical terms) from English to your native language. Then modify the prompt to request additional explanations of these terms in the translated language.
10.	Review a curated set of different prompt types (e.g., for summarization, information extraction, paraphrasing, question answering) from a "Prompt Gallery." For each prompt type, match it with a real world task (e.g., summarizing a lecture note, extracting names from a project report). Test at least three prompt templates on an AI tool or by role-play (students simulate being the AI), with varied wording. Record the outcomes and discuss which prompt (or template) was most effective for each task, and explain why you think it worked best. Reflect on how changing small parts of a prompt can alter model response quality, completeness, or accuracy.
11.	Choose a real engineering challenge or societal problem relevant to your field (e.g., "Reducing plastic waste in campus cafeterias" or "Optimizing solar panel placement on campus rooftops"). Draft an initial prompt that asks an AI to propose practical solutions. Share the AI's (or peer's) answer in small groups and identify aspects that are missing, vague, or not actionable. Refine your prompt based on feedback (e.g., specify constraints, ask for step-by-step solutions, or require a list of pros and cons). Repeat the process one more time, refining again for further clarity or specificity. Document the entire prompt-refinement process and share the best solution generated, along with a brief analysis of how prompt improvements led to better responses.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the concepts and types of artificial intelligence.
CO2	Illustrate basic machine learning methods for regression, classification and clustering.
CO3	Identify real-world applications across different disciplines.
CO4	Make use of prompt engineering techniques to interact with generative AI tools.
CO5	Outline recent trends in artificial intelligence and machine learning.

Text Books	
1.	ReemaThareja, Artificial Intelligence: Beyond Classical AI, Pearson Education, 2023.
2.	Ajantha Devi Vairamani and AnandNayyar, Prompt Engineering: Empowering Communication, 1st Edition, CRC Press, Taylor & Francis Group, 2024. (DOI: https://doi.org/10.1201/9781032692319).
3.	SaptarsiGoswami, Amit Kumar Das and AmlanChakrabarti, "AI for Everyone – A Beginner's Handbook for Artificial Intelligence", Pearson, 2024.

Reference Text Books	
1.	Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach (4th Edition), Pearson Education, 2023.
2.	Elaine Rich, Kevin Knight, and Shivashankar B. Nair, Artificial Intelligence, McGraw Hill Education.
3.	Tom Taulli, Prompt Engineering for Generative AI: ChatGPT, LLMs, and Beyond, Apress, Springer Nature.
4.	Nilakshi Jain, Artificial Intelligence: Making A System Intelligent, 1st Edition, Wiley.

Web links and Video lectures (e-Resources)
• https://cs50.harvard.edu/ai/ • https://developers.google.com/machine-learning/crash-course • https://learnprompting.org • https://ai.google/education/ • https://www.coursera.org/learn/machine-learning

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments /Lab activity**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	-	-	1	-	-	-	1	-	1
CO2	1	1			1				1	-	1
CO3	1	1			1				1	-	1
CO4	1	1			1				1	-	1
CO5	1	1			1				1	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / Semester	Term work (TW) and self learning (SL) in hours / sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25AAK203 (L:T:P:S 3:0:0:3)	Introduction to AI and Applications	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-I					
INTRODUCTION TO ELECTRICAL ENGINEERING **Category: ESC**					
Course Code	:	B25ESB104	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To explain the power generation concepts and laws used in the analysis of DC circuits.
2.	To explain the behavior of circuit elements in single-phase and three phase circuits.
3.	To describe the construction and operation DC machines and Transformers.
4.	To describe the application of renewable energy and introduction to EV.
5.	To describe domestic wiring and safety measures.

Module– 1	**No. of Hours**
Introduction: Conventional and non-conventional energy resources; General structure of electrical power systems using single line diagram approach. **Power Generation:** Hydel, Nuclear, Solar & Wind power generation (Block Diagram approach). **DC Circuits:** Ohm's Law and its limitations, KCL & KVL, Series, Parallel, Series- Parallel circuits. Simple Numerical.	9
Module– 2	**No. of Hours**
Single Phase Circuits: Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Analysis of R-L, R-C, R-L-C Series circuits, Active power, Reactive power and Apparent power, Concept of power factor. **Three Phase Circuits:** Generation of Three phase AC quantity, Advantages and limitations; Star and Delta connection, Relationship between line and phase quantities	9
Module– 3	**No. of Hours**
DC Machines: DC Generator: Principle of operation, Constructional details, Induced EMF expression, Types of generators, Relation between induced EMF and terminal voltage, simple numericals on EMF equation, DC Motor: Principle of operation, Back EMF and its significance, Types of motors, characteristics and speed control (armature & field) of DC motors (series & shunt only), Torque equation, Applications of DC motors **Transformers:** Necessity of transformer, Principle of operation, Types and construction of single phase transformers, EMF equation, Losses of transformer, Efficiency, Simple numerical on Losses and Efficiency	9
Module– 4	**No. of Hours**
Applications of Renewable energy: Photovoltaic Systems, Solar distillation; Solar Pond electric power plant, Off grid solar inverter, Urban waste to energy conversion, Hydrogen based transportation system **Introduction to EV:** History, General block diagram, Application and Benefits	9
Module– 5	**No. of Hours**
Domestic Wiring: Requirements, Types of wiring: casing, capping. Two way and three way control of load. **Domestic Safety:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits, Electric Shock, Earthing and its types, Safety Precautions to avoid shock **Electricity bill:** Power consumption of electrical energy, Two-part electricity tariff, Case study on calculation of electricity bill for domestic consumers.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the concepts of power generation and solve DC circuit problems.
CO2	Analyze single-phase circuits, solve R-L,R-C, and R-L-C circuits and comprehend three-phase circuit principles.
CO3	Understand DC machines, transformers and their characteristics.
CO4	Understand the application of renewable energy and basics of EV.
CO5	Understand domestic wiring and safety measures.

Text Books	
1.	D C Kulshreshtha, Basic Electrical Engineering, Tata McGraw Hill, 1st Edition2019

Reference Text Books	
1.	B.L. Theraja, A text book of Electrical Technology, S Chand and Company, reprint edition 2014.
2.	G D Rai, Nonconventional Energy sources, , Khanna Publication, 4th Edition, 1988
3.	D. P. Kothari and I. J. Nagrath, Basic Electrical Engineering, , Tata McGraw Hill 4th edition, 2019.
4.	V. K. Mehta, Rohit Mehta, Principles of Electrical Engineering & Electronics, S. Chand and Company Publications, 2nd edition, 2015.
5.	Rajendra Prasad, Fundamentals of Electrical Engineering, PHI, 3rd edition, 2014.

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	**Type of Assessment**	**Max. Marks**	**weightage**	**Total Marks**
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments / Project**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	2	2	1	-	-	-	1	-	1
CO2	1	2	2	2	1	-	-	-	1	-	1
CO3	1	3	3	2	1	-	-	-	2	-	1
CO4	1	3	3	2	1	-	-	-	2	-	1
CO5	1	3	3	2	1	-	-	-	2	-	1

Level 3 - High, Level 2 – Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / Semester	Term work (TW) and self learning (SL) in hours / sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25ESB104 (L:T:P:S 3:0:0:3)	Introduction to Electrical Engineering	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-I					
INTRODUCTION TO ELECTRONICS AND COMMUNICATION **Category: ESC**					
Course Code	:	B25ESC104	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To study the operation of Semiconductor diode, Zener diode and their applications.
2.	To study the operation of linear Op-amps and its applications
3.	To study the Basic Logic gates, circuits and their optimization.
4.	To study the Principles of Communication system.
5.	To study the operation of embedded system and its classification.

Module– 1	**No. of Hours**
Diode Theory: PN Junction Diode, Load line analysis, Series- diode configuration. Sinusoidal inputs - half wave rectification, Full wave Rectification, voltage multiplier Circuits, Zener Diodes. **Bipolar Junction Transistor:** Introduction, Common Base Configuration, Common Emitter Configuration. ***Text book: 1***	9
Module– 2	**No. of Hours**
Operational amplifier –Operational amplifier basics, practical Op-Amp circuits, Op-Amp specification –DC offset parameter, frequency parameter, Differential and common mode operation. Practical Op-Amp circuits– Inverting amplifier, non-inverting amplifier, Unity follower, Summing amplifier, Integrator, Differentiator. ***Text book: 1***	9
Module– 3	**No. of Hours**
Number Systems: Binary numbers, Number Base Conversion, Octal & Hexadecimal Numbers, Complements (1's & 2's Complements). **Boolean Algebra and Logic Circuits:** Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates. Combinational logic: Introduction, Design procedure, Adders- Half adder, Full adder. ***Text book: 2***	9
Module– 4	**No. of Hours**
Communication scheme: Elements of a Communication System, Need for Modulation, Amplitude Modulation, Frequency Modulation, Phase modulation, Comparison of FM& PM, Comparison of FM and AM. ***Text book: 3***	9
Module– 5	**No. of Hours**
Embedded systems: Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, Purpose of Embedded System, Core of the Embedded System: Microprocessors, GPP Vs ASIP, Microcontrollers, Microprocessor Vs Microcontroller, DSP, RISC Vs CISC, Memory: ROM, Sensors, Actuators, LED, 7-Segment LED display. ***Text book: 4***	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyze basic electronic circuits using the principles of rectifiers, voltage regulators.
CO2	Apply the knowledge on working principle of Operational amplifier.
CO3	Apply the concepts of Boolean Algebra and Logic Circuits.
CO4	Apply the concepts of embedded systems, sensors and interfacing.
CO5	Apply the concepts of analog and digital communication schemes.

Text Books	
1.	Electronic Devices and Circuit Theory, Robert L Boylestad and Louis Nashelsky, 11th Edition, Pearson Education, 2013, ISBN: 978-93-325-4260-0.
2.	Digital Design, M Moris Mano, 5th Edition, Prentice Hall of India
3.	Electronics communication systems, George Kennedy, 5thEdition, TataMcGraw hill.
4.	Introduction to embedded systems, Shibu K V,2nd Edition, Mc Graw Hill

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in/courses/122106025 2. https://nptel.ac.in/courses/108105132 3. https://nptel.ac.in/courses/117104072

ASSESSMENT STRUCTURE:

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CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments / Project**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2			2			1		1
CO2	3	2	3	2		1			1		1
CO3	3	2	3	1					1		1
CO4	2	1	1	1	2	1			1		1
CO5	2	1	1		1	1			1		1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / Semester	Term work (TW) and self learning (SL) in hours / sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25ESC104 (L:T:P:S 3:0:0:3)	Introduction to Electronics and Communication	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-I					
INTRODUCTION TO C PROGRAMMING **Category: PLC(IC)**					
Course Code	:	B25PLA105	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:2	SEE	:	50 Marks
Total Hours	:	45(T)+26(P)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3Hrs

Course Objectives	
1.	To understand the fundamental structure of a C program and primitive constructs.
2.	To apply decision-making and iterative control structures to solve simple computational problems.
3.	To demonstrate programs using arrays and string operations to solve real-world problems.
4.	To construct user-defined functions to modularize the solution to the given problems.
5.	To write a programs using structures and pointers for complex data representation and access.

Module– 1	**No. of Hours**
Flowchart and Algorithms: Art of Programming through Algorithms & Flowcharts. **Overview of C:** History of C, Importance of C, Basic Structure of C Programs, Programming Style, Compiling and Executing a 'C' Program. **Constants, Variables and Data Types:** Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Assigning Values to Variables, Defining Symbolic Constants, Declaring a Variables as Constants and Volatile, Input/output Statements in C.	9
Module– 2	**No. of Hours**
Operators: Introduction to Operators, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Precedence of Arithmetic Operators. **Decision Making, Branching, Looping:** Introduction, Decision Making with IF Statement, Simple IF Statement, The IF..ELSE Statement, Nesting of IF..ELSE Statements, The ELSE IF Ladder, The Switch Statement, The ?: Operator, The GOTO Statement, WHILE, DO, FOR, Jumps in LOOPS.	9
Module– 3	**No. of Hours**
Arrays and Strings: Introduction, Declaration and Initialization of One-dimensional and Two-Dimensional Arrays, Declaring and Initializing String Variables, Example programs using arrays ,Reading Strings from Terminal, Writing Strings to Screen, Arithmetic Operations on Characters, Comparison of Two Strings, String-handling Functions.	9
Module– 4	**No. of Hours**
User-defined Functions: Introduction, Need for User-defined Functions, A Multi-functional Program, Elements of User-defined Functions, Definition of Function, Return Values and their Types, Function Calls, Function Declaration, No Arguments and no Return Values, Arguments but no Return Values, Nesting of Functions.	9
Module– 5	**No. of Hours**
Structures and Pointers: Introduction, Defining a Structure, Declaring and Accessing Structure Variables and Members, Structure Initialization, Copying and Comparing Structure Variables, Array of Structures, Arrays within Structures. **Pointers:** Introduction, Understanding Pointers, Accessing the Address of Variable, Declaring pointer variables, initialization of pointers, accessing variables through its pointer.	9

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	**List of experiments**
1.	Develop a program to calculate the temperature converter from degree to Fahrenheit
2.	Develop a program to find the roots of quadratic equations.
3.	Develop a program to find whether a given number is prime or not.
4.	Develop a program to find key elements in an array using linear search.
5.	Given age and gender of a person, develop a program to categorise senior citizen (male & female).

6.	Generate Floyd's triangle for given rows.
7.	Develop a program to find the transpose of a matrix.
8.	Develop a program to concatenate two strings, find length of a string and copy one string to other using string operations.
9.	Develop a modular program to find GCD and LCM of given numbers.
10.	Develop a program to declare the structure of employees and display the employee records with higher salary among two employees.
11.	Develop a program to add two numbers using the pointers to the variables.
12.	Develop a program to find the sum of digits of a given number.
13.	Develop a program to perform Matrix Multiplication.
14.	Develop a program to create an array of structures to store book details and check whether a specific book, as requested by the user, is available or not.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the fundamental structure of a C program and primitive constructs.
CO2	Apply decision-making and iterative control structures to solve simple computational problems.
CO3	Develop programs using arrays and string operations to solve real-world problems.
CO4	Construct user-defined functions to modularize the solution to the given problems.
CO5	Build programs using structures and pointers for complex data representation and access.

Text Books	
1.	Programming in ANSI C, 9th edition, E Balaguruswamy, Tata McGraw Hill Education.

Reference Text Books	
1.	Programming in C, ReemaThareja, Oxford University, 3rdEdition, 2023.
2.	The 'C' Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2ndEdition, Prentice Hall of India, 2015

Web links and Video lectures (e-Resources)

1. elearning.vtu.ac.in/econtent/courses/video/BS/15PCD23.html
2. https://nptel.ac.in/courses/106/105/106105171/ MOOC

Courses can be adopted for more clarity in understanding the topics and verities of problem-solving methods.

- https://www.tutorialspoint.com/what-is-an-algorithm-and-flowchart-in-c-language
- https://www.tutorialspoint.com/cprogramming/c_data_types.htm
- https://www.tutorialspoint.com/cprogramming/c_operators.htm
- https://www.ccbp.in/blog/articles/decision-making-statements-in-c
- https://www.tutorialspoint.com/cprogramming/c_arrays.htm

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CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50/2 = 25**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments**	**20**	**10**	
Laboratory	**Record & Observation**	**Evaluating each expt. for 10 marks**	**10**	**25**
	Lab Internal Test	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

- The Question paper for each course contains two parts, Part – A and Part – B.
- Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
- Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	1	-	-	2	1	-	-	1	-	-
CO2	-	1	-	-	2	1	-	-	1	-	-
CO3	-	2	-	-	2	2	-	-	1	-	1
CO4	-	2	-	-	2	2	-	-	1	-	1
CO5	-	2	-	-	2	2	-	-	1	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	Teaching and Learning Structure					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / semester	Term Work (TW) and Self Learning (SL) in hours / Sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25CEE102 (L:T:P:S 3:0:2:3)	Applied Chemistry for Emerging Electronics And Futuristic Devices	**45**	**00**	**26**	**50**	**120**	**4**

MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru–560074

Civil Engineering

Robotics and Automation

(2025 Scheme)

SEMESTER-I					
MULTIVARIABLE CALCULUS **Category: ASC**					
Course Code	:	B25MME101	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:2:0	SEE	:	50 Marks
Total Hours	:	45(L)+30(T)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3Hrs

Course Objectives	
1.	Understand the angle of intersection between two curves and the radius of curvature.
2.	Familiarize the importance of calculus associated with one variable and multivariable.
3.	Analyze engineering problems applying Ordinary Differential Equations.
4.	Develop the knowledge of Linear Algebra referring to matrices.

Module– 1: Polar Curves and Curvature	**No. of Hours**
Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and radius of curvature - Cartesian, parametric, polar and pedal forms.	9
Module– 2: Series Expansion, Indeterminate Forms and Multivariable Calculus	**No. of Hours**
Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms - L'Hospital's rule. Partial differentiation, total derivative - differentiation of composite functions. Jacobian. Maxima and minima for the function of two variables.	9
Module– 3: Ordinary Differential Equations of First Order	**No. of Hours**
Linear and Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factor: $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$. Orthogonal trajectories, Law of natural growth and decay.	9
Module– 4:Ordinary Differential Equations of Higher Order	**No. of Hours**
Higher-order linear ordinary differential equations with constant coefficients, homogeneous and non-homogeneous equations-e^{ax}, $sin(ax+b), cos(ax+b)$, x^n only, Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Applications: Solving governing differential equations of deflection of a beam.	9
Module– 5: Linear Algebra	**No. of Hours**
Elementary row transformation of a matrix, Rank of a matrix. Consistency, Solution of system of linear equations - Gauss-elimination method and approximate solution by Gauss-Seidel method. Eigenvalues and Eigenvectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Applications: Traffic flow.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply foundational concepts of calculus and differential equations to analyze geometric properties of curves, solve first and higher-order ordinary differential equations, and model physical phenomena in science and engineering.
CO2	Apply the principles of linear algebra to solve systems of linear equations, determine eigenvalues and eigenvectors, and analyze real-world problems such as traffic flow.
CO3	Analyze engineering problems applying Ordinary Differential Equations.
CO4	Apply the knowledge of Linear Algebra.

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

Reference Text Books	
1.	B.V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education, 11thEdition, 2017
2.	Srimanta Pal &SubodhC.Bhunia, Engineering Mathematics, Oxford University Press, 3rdEdition, 2016.
3.	N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10thEdition, 2022.

Web links and Video lectures (e-Resources)
• http://academicearth.org/ • https://nptel.ac.in/courses/111106135 • https://nptel.ac.in/courses/111105160 • https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/ • https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks.To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
C C A	**Two Assignments / Practicing the problems**	**10**	**05**	
	Lab activity	**10**	**05**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

- The Question paper for each course contains two parts, Part – A and Part – B.
- Part – A consists of **Short Answer Questions**(2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
- Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	-	-	-	-	-	1
CO2	3	2	1	2	1	-	-	-	-	-	1
CO3	3	2	1	2	1	-	-	-	-	-	1
CO4	3	2	1	2	1	-	-	-	-	-	1

Level 3 - High, Level 2 - Moderate, Level 1 – Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom instruction (CI) in hours / semester		Lab instruction (LI) in hours / semester	Term work (TW) and self learning (SL) in hours /sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25MME101	Differential Calculus and Linear Algebra **(L:T:P:S 3:2:0:3)**	**45**	**30**	**0**	**45**	**120**	**4**

SEMESTER-I					
CHEMISTRY FOR SUSTAINABLE STRUCTURES & MATERIAL DESIGN **Category: ASC(IC)**					
Course Code	:	B25CCV102	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:2	SEE	:	50 Marks
Total Hours	:	45(T)+26(P)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3Hrs

Course Objectives	
1.	To enable students to acquire knowledge on Electro chemistry, Battery Technology and Green Fuels.
2.	To Study the properties, engineering applications of polymeric materials and Nanomaterials for Structural Integrity.
3.	To study the composition & manufacturing processes of Conventional and sustainable construction materials.
4.	To understand about corrosion science and protection of materials from corrosion.
5.	To study about water technology and sensor applications relevant to civil engineering.

Module– 1: Energy Systems and Green Fuels	**No. of Hours**
Electrochemistry: Introduction, electrode potential, overview of Nernst equation, concentration cell, numerical problems. **Energy systems:** Introduction, classification of batteries, characteristics of capacity-power density, cell balancing & cycle life, construction & working of Lithium-ion battery, redox flow battery and its applications, fuel cell-definition, difference between battery and fuel cell, construction and working of solid oxide fuel, silicon solar cell-advantages, applications and limitations. **Green Fuels:** Introduction, green hydrogen production by TiO2-Photocatalytical method and applications.	9
Module– 2:Materials for Structural Integrity	**No. of Hours**
Polymer: Introduction, polymerization, types, synthesis, properties and engineering applications of PVC, PMMA, Kevlar fiber and epoxy resins, molecular weight of polymers: number average and weight average molecular weight of polymers, numericals, properties and industrial applications of carbon-based reinforced composites-graphene/carbon nanotubes as fillers. **Nanomaterials:** Introduction, size dependent properties viz; surface area, water absorption, permeability, thermal properties and antimicrobial activity, concrete as composite material, composition of nano-concrete, synthesis of TiO2 nanoparticles by sol-gel method for sensor applications.	9
Module– 3: Conventional and Sustainable Construction Materials	**No. of Hours**
Cement: Introduction, composition, manufacturing process of cement-wet process, process of setting and hardening of cement, special cements-composition, properties and applications. **Geopolymer Concrete:** Introduction, mechanism of geopolymerization and manufacturing process of geopolymer concrete. **Biopolymers:**Polylactic Acid (PLA)-synthesis, properties and applications. **Photochromic Coatings:** Introduction, spiropyran as photochromic coating, working principle with chemical reactions and applications in construction activities. **Piezoelectric Cement Composites:** Introduction, piezoelectric materials in cement composites and its applications in civil engineering.	9
Module– 4: Corrosion Science and Surface Protection	**No. of Hours**
Metals and Alloys: Introduction, classification of metals: ferrous and non-ferrous, composition, properties, applications of iron and its alloys-wrought iron, cast iron, pig iron and steel, aluminium and its alloys-Duralumin and Magnalium. **Corrosion:** Introduction, electrochemical corrosion of steel in concrete, types- differential metal corrosion and differential aeration corrosion, stress corrosion in civil structures. Corrosion control by galvanization and anodization, corrosion penetration rate (CPR) - definition, importance and numerical problems. **Metal Finishing:** Introduction, technological importance of metal finishing, electroplating of Chromium-decorative and hard coating.	9
Module– 5: Water Chemistry and Analytical Techniques	**No. of Hours**
Water Chemistry: Introduction, significance of water quality parameters-pH, turbidity, chlorides, dissolved oxygen and alkalinity for environmental and construction applications. Hard water; types, determination of total hardness by EDTA method. Waste water-definition of domestic and industrial	9

effluents. **Analytical Techniques:** Introduction, potentiometric sensors: principle, instrumentation and application in estimation of iron in industrial effluents, conductometric sensors: principle, instrumentation and application in determination of acid mixture in water and industrial effluents: colorimetric sensor- principle, instrumentation and estimation of copper in brass alloy, determination of dissolved oxygen by Winkler's method, COD and numericals.	

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	List of experiments
1.	Estimation of acid mixture using conductometric sensor
2.	Estimation of iron in rust sample using potentiometric sensor
3.	Determination of pKa value of vinegar solution using pH sensor
4.	Estimation of iron in TMT bar using optical sensor
5.	Determination of viscosity coefficient of polycarboxylate ether (PCE) based admixture using Ostwald's viscometer.
6.	Colorimetric determination of phenolic content in wastewater using smartphone.
7.	Estimation of total hardness of given water sample by EDTA method
8.	Determination of chemical oxygen demand (COD) of industrial effluents
9.	Estimation of iron in TMT bar by diphenyl amine indicator method
10.	Determination of alkalinity of water using standard NaOH solution
11.	Estimation of percentage of CaO in cement by EDTA method
12.	Determination of pka of a week acid and its interpretation using origin software.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand electrochemical principles, energy storage systems and green hydrogen production for sustainable energy applications.
CO2	Analyze polymers, nanomaterials and composite materials for structural integrity and sensor applications.
CO3	Evaluate sustainable construction materials like geopolymer concrete, biopolymers and smart coatings including photochromic and piezoelectric composites.
CO4	Explain corrosion mechanisms in metals and alloys, types of corrosion in civil structures and apply metal finishing techniques for surface protection.
CO5	Apply water chemistry principles and analytical techniques like potentiometry, conductometry and colorimetry for environmental and industrial water quality assessment.

Text Books	
1.	Textbook of Engineering Chemistry: S. S. Dara & S. S. Umare, S. Chand Publishing, ISBN: 9788121903593
2.	Engineering Chemistry, Satyaprakash& Manisha Agrawal, Khanna Book Publishing, Delhi, 1st edition, 2012.
3.	Engineering Chemistry: Jain & Jain, Publisher: Dhanpat Rai Publishing Company, ISBN: 978-935316118.

Reference Text Books	
1.	Materials Science: S. K. Malik, Publisher: New Age International Publishers, ISBN: 978 8122418713
2.	Electrochemical Energy System: Dr. K. K. Rajeshwar (IIT Madras), Publisher: IIT Madras Open Courseware (Free PDF & videos), ISBN: N/A (Open Educational Resource).
3.	Materials Science: S. K. Malik, Publisher: New Age International Publishers, ISBN: 978 8122418713.

Web links and Video lectures (e-Resources)
• https://nptel.ac.in/courses/113/104/113104021/ • https://nptel.ac.in/courses/103/102/103102103/

- https://www.youtube.com/watch?v=JvzH4QQOfSw
- https://www.youtube.com/watch?v=1F9Vjae7k60
- https://www.youtube.com/watch?v=xrsK9FUdvRE

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Not with standing the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	Internal Assessment1	50	Average of Best two Assessments, scale down to 40	50/2 = 25
	Internal Assessment2	50		
	Internal Assessment3	50		
CCA	Two Assignments	20	10	
Laboratory	Record & Observation	12X10 = 120	10	25
	Lab Internal Test	50	15	
SEE	Semester End Examination	100	50	50
Grand Total				100

SEMESTER END EXAMINATION (SEE):

- The Question paper for each course contains two parts, Part – A and Part – B.
- Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed .
- Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	1	-	1	-	1	1
CO2	3	2	1	2	1	1	-	1	-	1	1
CO3	3	2	1	2	1	1	-	1	-	1	1
CO4	3	2	1	2	1	1	-	1	-	1	1
CO5	3	2	1	2	1	1	-	1	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	Teaching and Learning Structure					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / semester	Term Work (TW) and Self Learning (SL) in hours / Sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25CCV102 (L:T:P:S 3:0:2:3)	Applied Chemistry for Sustainable Structures and Material Design	**45**	**00**	**26**	**50**	**120**	**4**

SEMESTER-I					
CHEMISTRY FOR ADVANCED METAL PROTECTION AND SUSTAINABLE ENERGY SYSTEMS **Category: ASC(IC)**					
Course Code	:	B25CME102	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:2	SEE	:	50 Marks
Total Hours	:	45(T)+26(P)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3Hrs

Course Objectives	
1.	To understand about corrosion science and protection of materials from corrosion.
2.	To enable students to acquire knowledge on Fuels, production process of green fuel and applications.
3.	To Study the properties, Nanomaterials, Battery Technology and fuel cells for engineering applications.
4.	To Study the properties, engineering applications of polymeric materials like composites and 3d Printing materials.
5.	To understand fluid technology and sensor applications for mechanical engineering field.

Module– 1: Corrosion Science and Coating Technologies	No. of Hours
Corrosion: Introduction, electrochemical theory of corrosion, types of corrosion-differential metal and differential aeration corrosion, corrosion control-metal coating; galvanization, surface conversion coating; anodization and cathodic protection; sacrificial anode method, corrosion penetration rate (CPR) - Introduction and numerical problems. **Coating Technologies:** Introduction, technological importance, electroplating - electroplating of chromium; hard and decorative, electro-less plating - electroless plating of Nickel, difference between electroplating and electroless plating.	9
Module– 2:Sustainable Green Fuels	**No. of Hours**
Fuels: Introduction, calorific value, determination of calorific value using bomb calorimeter, numerical problems on GCV and NCV. Knocking in internal combustion engines - knocking mechanism and anti-knocking agents - methyl tertiary butyl ether (MTBE) and ethyl tert-butyl ether (ETBE), importance of octane and cetane rating of fuel. **Green Fuels:** Introduction, power alcohol – properties, applications and its limitations, biodiesel - synthesis by trans-esterification method, advantages and its applications. Production of green hydrogen by photocatalytic water splitting and its advantages, hydrogen storage – introduction, advantages and limitations of metal hydride and ammonia as chemical hydrogen carriers.	9
Module– 3: Materials for Energy Systems	**No. of Hours**
Nanomaterials: Introduction, synthesis of TiO2 nanoparticles by sol-gel method for catalytic converter applications, size-dependent properties of nanomaterial-surface area, catalytical, electrical and thermal conductivity. Graphene - Synthesis by chemical vapor deposition method, properties and engineering applications, role of carbon nanotubes (CNTs) in energy devices. **Energy Systems:** Batteries - Introduction, classification of batteries, characteristics-capacity, power density, cell balancing and cycle life, construction, working and applications of Li-ion battery. Fuel cells - Introduction, construction and working of solid oxide fuel (SOFCs) for auxiliary power units (APUs) applications, difference between fuel cell and battery, photovoltaic cells (PV cells) - construction, working, advantages and limitations.	9
Module– 4: Materials for Engineering Applications	**No. of Hours**
Engineering Polymers: Introduction, molecular weight of polymers - numerical problems, synthesis, properties and engineering applications of polyvinyl chloride (PVC), and polymethyl methacrylate (PMMA), structure and property relationship of polymers. Glass transition temperature (Tg), factor affecting Tg and its significance. **Polymer Composites:** Introduction, fiber-reinforced polymers (FRPs); Kevlar – Synthesis, properties and industrial applications. Carbon-fiber - Preparation from Polyacrylonitrile (PAN), properties and industrial applications. **3D Printing materials:** Introduction, synthesis, properties and applications of polylactic acid (PLA) resin.	9
Module– 5: Fluid Technology and Smart Sensors	**No. of Hours**
Lubricants: Introduction, classification, ideal properties and applications. Lubricant testing; experimental determination of viscosity. **Industrial Coolants:** Introduction, types-water and oil-based coolants, properties and industrial applications.	9

Industrial effluents: Introduction, determination of COD and numerical problems. **Sensors:** Introduction, potentiometric sensor - principle and its application in the estimation of iron in steel industry effluent, conductometric sensor - principle and its application in the estimation of acids in electrochemical bath effluent. pH sensor - principle and its application in the estimation of pKa of acid electrolyte.	

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	List of experiments
1.	Estimation of total hardness of water by EDTA method
2.	Determination of chemical oxygen demand (COD) of industrial wastewater
3.	Estimation of iron in steel industry effluent by diphenyl amine indicator method
4.	Determination of alkalinity of water using standard NaOH solution
5.	Estimation of acid mixture in electrochemical bath effluent using conductometric sensor (Conductometry)
6.	Estimation of iron in rust sample by Potentiometric sensor (Potentiometry)
7.	Determination of pKa of acid electrolyte using pH sensor (Glass electrode)
8.	Estimation of copper present in e-waste by optical sensor (Colorimetry)
9.	Determination of viscosity coefficient of lubricant using Ostwald's viscometer
10.	Determination of acid value of biofuel
11.	Green synthesis of copper nanoparticles for conductive inks
12.	Synthesis of polylactic acid (PLA)

Course Outcomes: At the end of the course, the students will be able to	
CO1	Interpret the terms and processes involved in scientific and engineering applications
CO2	Apply the knowledge of chemistry to solve the problems in chemistry that are pertinent in engineering applications
CO3	Analyze the appropriate chemical techniques suitable for engineering applications to reach the substantiated conclusions
CO4	Apply the synthetic methods and techniques of quantitative chemical analysis for engineering problems through experimental skills

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

Reference Text Books	
1.	Engineering Chemistry, Satyaprakash& Manisha Agrawal, Khanna Book Publishing, Delhi
2.	Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin& A.C. Arsenault, RSC Publishing, 2005.
3.	Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.

Web links and Video lectures (e-Resources)

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

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50/2 = 25**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments**	**20**	**10**	
Laboratory	**Record &Observation**	**Evaluating each expt. for 10 marks**	**10**	**25**
	Lab Internal Test	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	1	-	1	-	1	1
CO2	3	2	1	2	1	1	-	1	-	1	1
CO3	3	2	1	2	1	1	-	1	-	1	1
CO4	3	2	1	2	1	1	-	1	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	Teaching and Learning Structure					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / semester	Term Work (TW) and Self Learning (SL) in hours / Sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25CME102 (L:T:P:S 3:0:2:3)	Chemistry for Advanced Metal Protection And Sustainable Energy Systems	**45**	**00**	**26**	**50**	**120**	**4**

SEMESTER-I					
INTRODUCTION TO AI AND APPLICATIONS **Category: ETC**					
Course Code	:	B25AAK103	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To study the concepts and types of artificial intelligence.
2.	To Demonstrate basic machine learning methods for regression, classification and clustering.
3.	To understand real-world applications across different disciplines.
4.	To make use of prompt engineering techniques to interact with generative AI tools.
5.	To study recent trends in artificial intelligence and machine learning.

Module– 1	**No. of Hours**
Introduction to Artificial Intelligence: Artificial Intelligence, How Does AI Work?, Advantages and Disadvantages of Artificial Intelligence, History of Artificial Intelligence, Types of Artificial Intelligence, Weak AI, Strong AI, Reactive Machines, Limited Memory, Theory of Mind, Self-Awareness, Is Artificial Intelligence Same as Augmented Intelligence and Cognitive Computing, Machine Learning and Deep Learning. **Machine Intelligence:** Defining Intelligence, Components of Intelligence, Differences Between Human and Machine Intelligence, Agent and Environment, Search, Uninformed Search Algorithms, Informed Search Algorithms: Pure Heuristic Search, Best-First Search Algorithm (Greedy Search). **Knowledge Representation:** Introduction, Knowledge Representation, Knowledge-Based Agent, Types of Knowledge.	9
Module– 2	**No. of Hours**
Introduction to Prompt Engineering, Introduction to Prompt Engineering, The Evolution of Prompt Engineering, Types of Prompts, How Does Prompt Engineering Work?, Comprehending Prompt Engineering's Function in Communication, The Advantages of Prompt Engineering, The Future of LLM Communication. **Prompt Engineering Techniques for ChatGPT,** Introduction to Prompt Engineering Techniques, Instructions Prompt Technique, Zero, One, and Few Shot Prompting, Self-Consistency Prompt. **Prompts for Creative Thinking:** Introduction, Unlocking Imagination and Innovation. **Prompts for Effective Writing:** Introduction, Igniting the Writing Process with Prompts.	9
Module– 3	**No. of Hours**
Machine Learning: Techniques in AI, Machine Learning Model, Regression Analysis in Machine Learning, Classification Techniques, Clustering Techniques, Naïve Bayes Classification, Neural Network, Support Vector Machine (SVM).	9
Module– 4	**No. of Hours**
Trends in AI: AI and Ethical Concerns, AI as a Service (AIaaS), Recent trends in AI, Expert System, Internet of Things, Artificial Intelligence of Things (AIoT).	9
Module– 5	**No. of Hours**
Robotics, Robotics-an Application of AI, Drones Using AI, No Code AI, Low Code AI. ***Textbook 1: Chapter 8 (8.3), Chapter 1 (1.7, 1.8, 1.10, 1.11)*** **Industrial Applications of AI:** Application of AI in Healthcare, Application of AI in Finance, Application of AI in Retail, Application of AI in Agriculture, Application of AI in Education, Application of AI in Transportation, AI in Experimentation and Multi-disciplinary research.	9

Sl. No.	**Activity on Creating Effective Prompts**
Note: To conduct the activity students can use any of the AI tools such as ChatGPT.	
1.	Basic Prompt writing: Create two different prompts to ask an AI about the topic "Electricity." The first prompt should be vague, and the second prompt should be clear and specific. Compare the responses you get and describe which prompt gave a better answer and why.
2.	Zero-Shot Prompting: Create a prompt that asks an AI to explain Ohm's Law without giving any example or background. Evaluate how well the AI explains the concept based on your prompt alone.
3.	One-Shot and Few-Shot Prompting: Provide the AI with a single example of how to calculate the resistance in a simple circuit. Then write your own prompt asking the AI to solve a similar resistance calculation. After

	that, add two more examples to your prompt and observe any changes in the AI's response quality.
4.	Chain-of-Thought Prompting: Develop a prompt that guides the AI step-by-step through calculating current flow in a circuit using Ohm's Law with resistors in series. Then, ask a final question for the AI to solve. Analyze how breaking down the reasoning steps impacts the accuracy of the answer.
5.	Prompt Refinement: Start with an ambiguous prompt related to the "Water Cycle." Test the AI's response, note the confusion or errors, and then refine your prompt to make it clearer and more specific. Repeat this process twice and record how the AI's responses improve with each refinement. Role-Based Prompting: Create three prompts asking the AI to explain "Newton's Laws of Motion," each with a different role instruction: (a) as an expert engineer, (b) as a high school teacher, (c) as a beginner. Compare the tone, detail, and style of the responses.
6.	Creative Engineering Problem Prompts: Craft a prompt that asks the AI to brainstorm ideas for designing a low-cost water purification system suitable for rural areas. Encourage creativity by adding phrases like "limited resources" and "sustainability".
7.	PCC-PEC-OEC (3 Credits) template 4 Ethical Prompt Design Discussion: Identify a biased prompt related to job descriptions (e.g. language with respect to a gender). Rewrite the prompt to remove bias and create a neutral, inclusive version. Explain why this revision is more ethical.
8.	Simulated Customer Support Chatbot: Develop a prompt that instructs the AI to play the role of a technical support agent helping a customer troubleshoot a failure in an electronic circuit. Include instructions to keep the tone friendly and professional and to ask diagnostic questions.
9.	Multi-Language Prompting: Develop a prompt that asks the AI to translate a simple engineering glossary (5 technical terms) from English to your native language. Then modify the prompt to request additional explanations of these terms in the translated language.
10.	Review a curated set of different prompt types (e.g., for summarization, information extraction, paraphrasing, question answering) from a "Prompt Gallery." For each prompt type, match it with a real world task (e.g., summarizing a lecture note, extracting names from a project report). Test at least three prompt templates on an AI tool or by role-play (students simulate being the AI), with varied wording. Record the outcomes and discuss which prompt (or template) was most effective for each task, and explain why you think it worked best. Reflect on how changing small parts of a prompt can alter model response quality, completeness, or accuracy.
11.	Choose a real engineering challenge or societal problem relevant to your field (e.g., "Reducing plastic waste in campus cafeterias" or "Optimizing solar panel placement on campus rooftops"). Draft an initial prompt that asks an AI to propose practical solutions. Share the AI's (or peer's) answer in small groups and identify aspects that are missing, vague, or not actionable. Refine your prompt based on feedback (e.g., specify constraints, ask for step-by-step solutions, or require a list of pros and cons). Repeat the process one more time, refining again for further clarity or specificity. Document the entire prompt-refinement process and share the best solution generated, along with a brief analysis of how prompt improvements led to better responses.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the concepts and types of artificial intelligence.
CO2	Illustrate basic machine learning methods for regression, classification and clustering.
CO3	Identify real-world applications across different disciplines.
CO4	Make use of prompt engineering techniques to interact with generative AI tools.
CO5	Outline recent trends in artificial intelligence and machine learning.

Text Books	
1.	ReemaThareja, Artificial Intelligence: Beyond Classical AI, Pearson Education, 2023.
2.	Ajantha Devi Vairamani and AnandNayyar, Prompt Engineering: Empowering Communication, 1st Edition, CRC Press, Taylor & Francis Group, 2024. (DOI: https://doi.org/10.1201/9781032692319).
3.	SaptarsiGoswami, Amit Kumar Das and AmlanChakrabarti, "AI for Everyone – A Beginner's Handbook for Artificial Intelligence", Pearson, 2024.

Reference Text Books	
1.	Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach (4th Edition), Pearson Education, 2023.
2.	Elaine Rich, Kevin Knight, and Shivashankar B. Nair, Artificial Intelligence, McGraw Hill Education.
3.	Tom Taulli, Prompt Engineering for Generative AI: ChatGPT, LLMs, and Beyond, Apress, Springer Nature.
4.	Nilakshi Jain, Artificial Intelligence: Making A System Intelligent, 1st Edition, Wiley.

Web links and Video lectures (e-Resources)
• https://cs50.harvard.edu/ai/ • https://developers.google.com/machine-learning/crash-course • https://learnprompting.org • https://ai.google/education/ • https://www.coursera.org/learn/machine-learning

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments /Lab activity**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	-	-	1	-	-	-	1	-	1
CO2	1	1	-	-	1	-	-	-	1	-	1
CO3	1	1	-	-	1	-	-	-	1	-	1
CO4	1	1	-	-	1	-	-	-	1	-	1
CO5	1	1	-	-	1	-	-	-	1	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / Semester	Term work (TW) and self learning (SL) in hours / sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25AAK203 (L:T:P:S 3:0:0:3)	Introduction to AI and Applications	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-I					
INTRODUCTION TO ELECTRONICS AND COMMUNICATION **Category: ESC**					
Course Code	:	B25ESC104	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To study the operation of Semiconductor diode, Zener diode and their applications.
2.	To study the operation of linear Op-amps and its applications
3.	To study the Basic Logic gates, circuits and their optimization.
4.	To study the Principles of Communication system.
5.	To study the operation of embedded system and its classification.

Module– 1	**No. of Hours**
Diode Theory: PN Junction Diode, Load line analysis, Series- diode configuration. Sinusoidal inputs - half wave rectification, Full wave Rectification, voltage multiplier Circuits, Zener Diodes. **Bipolar Junction Transistor:** Introduction, Common Base Configuration, Common Emitter Configuration. ***Text book: 1***	9
Module– 2	**No. of Hours**
Operational amplifier –Operational amplifier basics, practical Op-Amp circuits, Op-Amp specification –DC offset parameter, frequency parameter, Differential and common mode operation. Practical Op-Amp circuits– Inverting amplifier, non-inverting amplifier, Unity follower, Summing amplifier, Integrator, Differentiator. ***Text book: 1***	9
Module– 3	**No. of Hours**
Number Systems: Binary numbers, Number Base Conversion, Octal & Hexadecimal Numbers, Complements (1's & 2's Complements). **Boolean Algebra and Logic Circuits:** Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates. Combinational logic: Introduction, Design procedure, Adders- Half adder, Full adder. ***Text book: 2***	9
Module– 4	**No. of Hours**
Communication scheme: Elements of a Communication System, Need for Modulation, Amplitude Modulation, Frequency Modulation, Phase modulation, Comparison of FM& PM, Comparison of FM and AM. ***Text book: 3***	9
Module– 5	**No. of Hours**
Embedded systems: Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, Purpose of Embedded System, Core of the Embedded System: Microprocessors, GPP Vs ASIP, Microcontrollers, Microprocessor Vs Microcontroller, DSP, RISC Vs CISC, Memory: ROM, Sensors, Actuators, LED, 7-Segment LED display. ***Text book: 4***	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyze basic electronic circuits using the principles of rectifiers, voltage regulators.
CO2	Apply the knowledge on working principle of Operational amplifier.
CO3	Apply the concepts of Boolean Algebra and Logic Circuits.
CO4	Apply the concepts of embedded systems, sensors and interfacing.
CO5	Apply the concepts of analog and digital communication schemes.

Text Books	
1.	Electronic Devices and Circuit Theory, Robert L Boylestad and Louis Nashelsky, 11th Edition, Pearson Education, 2013, ISBN: 978-93-325-4260-0.
2.	Digital Design, M Moris Mano, 5th Edition, Prentice Hall of India
3.	Electronics communication systems, George Kennedy, 5thEdition, TataMcGraw hill.
4.	Introduction to embedded systems, Shibu K V,2nd Edition, Mc Graw Hill

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in/courses/122106025 2. https://nptel.ac.in/courses/108105132 3. https://nptel.ac.in/courses/117104072

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments / Project**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2			2			1		1
CO2	3	2	3	2		1			1		1
CO3	3	2	3	1					1		1
CO4	2	1	1	1	2	1			1		1
CO5	2	1	1		1	1			1		1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / Semester	Term work (TW) and self learning (SL) in hours / sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25ESC104 (L:T:P:S 3:0:0:3)	Introduction to Electronics and Communication	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-I					
INTRODUCTION TO MECHANICAL ENGINEERING **Category: PSC**					
Course Code	:	B25ESD104	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To enable students to apply mechanical engineering principles for solving socially relevant problems
2.	To understand the working of I.C. engines, power transmission elements, and future mobility vehicles.
3.	To discuss the properties and applications of engineering materials, composite materials, and smart materials.
4.	To describe the working principles and applications of various manufacturing processes.
5.	To explain the advances in mechanical engineering.

Module– 1	**No. of Hours**
Introduction: Streams in mechanical engineering and their relevance/significance, role of mechanical engineers in solving the real case problems (with examples), careers in mechanical engineering. Realization of some of the engineering solutions through principles of mechanical engineering (with a schematic diagram) **Concepts of Thermodynamics:** Work, Energy, Heat, Modes of Heat transfer: Conduction, Convection and Radiation. Steam: Formation of steam, Properties of Steam. **Energy Conversion:** Introduction and basic working principles of Pelton Turbine and Centrifugal pump.	9
Module– 2	**No. of Hours**
Engines: Introduction, petrol engine, diesel engines, Working of four Stroke engines, applications. **Insight into Future Mobility:** Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of EVs and Hybrid vehicles. **Power Transmission systems**: Classification of gears, simple & compound gear trains, concepts of automatic and CVT transmission.	9
Module– 3	**No. of Hours**
Engineering materials: Introduction, Classification, Ferrous and Non-Ferrous metals: Types, Properties and their applications. **Composite materials**: Introduction, Constituents of a composite, Classification, Types of Matrix and Reinforcement materials, Advantages, Disadvantages and Applications of composite materials. **Smart materials**: Introduction, Types - Piezoelectric materials, MR fluids, Shape memory alloys and Advantages, Disadvantages and Applications.	9
Module– 4	**No. of Hours**
Manufacturing Overview, classification of manufacturing processes, process selection criterion. Principles of Welding, soldering, brazing.**Introduction to machine tools** – lathe, drilling and milling machine. **Lathe operations:** Turning, facing, knurling, **Drilling machine operations:** Drilling, reaming, tapping. **Milling machine operations:** End milling, face milling. Introduction to CNC, components, advantages and applications.Basic principles of 3D printing.	9
Module– 5	**No. of Hours**
Advances in mechanical engineering **Automation technology:** Definition of automation, types of automation, basic elements of automation. **Mechatronic systems:** Definition of mechatronics, elements of mechatronics systems, examples. **Elementary sensors:** Working principle and applications of Potentiometer, capacitive sensor and optical encoders. **Integrated system:** Need for integration of technologies, ADAS (Advanced Driver Assistance System).	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Recognize the significance of mechanical engineering principles to solve the problems of social relevance.
CO2	Understand the working of I.C. engines, power transmission elements and future mobility vehicles.
CO3	Discuss the properties and applications of engineering materials, composite materials and smart materials.
CO4	Describe the working principles and applications of various manufacturing processes.
CO5	Explain the advances in mechanical engineering.

Text Books	
1.	Elements of Mechanical Engineering, K R Gopala Krishna, Subhash Publications, 2008
2.	An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, 3rdEdition, 2012

Reference Text Books	
1.	Manufacturing Technology- Foundry, Forming and Welding, P.N.Rao Tata McGraw Hill 3rdEdition, 2003.
2.	William D. Callister, Materials Science & Engineering, An Introduction, John Wiley & Sons Inc, 2010.
3.	V. Ganesan, Internal Combustion Engines, Tata McGraw Hill Education; 4thedition, 2017.

Web links and Video lectures (e-Resources)
• https://nptel.ac.in/courses/112104526
• https://nptel.ac.in/courses/112104616
• https://nptel.ac.in/courses/112104769

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments / Project / Lab activity**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	1	2	-	-	-	-	-	-	1
CO2	1	2	1	2	-	-	-	-	-	-	1
CO3	2	2	1	2	-	-	-	-	-	-	1
CO4	2	2	1	2	-	-	-	-	-	-	1
CO5	2	2	1	2	-	-	-	-	-	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	Teaching and Learning Structure					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / Semester	Term work (TW) and self learning (SL) in hours / sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25ESD104 (L:T:P:S 3:0:0:3)	Introduction to Mechanical Engineering	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-I					
INTRODUCTION TO C PROGRAMMING **Category: PLC(IC)**					
Course Code	:	B25PLA105	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:2	SEE	:	50 Marks
Total Hours	:	45(T)+26(P)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3Hrs

Course Objectives	
1.	To understand the fundamental structure of a C program and primitive constructs.
2.	To apply decision-making and iterative control structures to solve simple computational problems.
3.	To demonstrate programs using arrays and string operations to solve real-world problems.
4.	To construct user-defined functions to modularize the solution to the given problems.
5.	To write a programs using structures and pointers for complex data representation and access.

Module– 1	**No. of Hours**
Flowchart and Algorithms: Art of Programming through Algorithms & Flowcharts. **Overview of C:** History of C, Importance of C, Basic Structure of C Programs, Programming Style, Compiling and Executing a 'C' Program. **Constants, Variables and Data Types:** Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Assigning Values to Variables, Defining Symbolic Constants, Declaring a Variables as Constants and Volatile, Input/output Statements in C.	9
Module– 2	**No. of Hours**
Operators: Introduction to Operators, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Precedence of Arithmetic Operators. **Decision Making, Branching, Looping:** Introduction, Decision Making with IF Statement, Simple IF Statement, The IF..ELSE Statement, Nesting of IF..ELSE Statements, The ELSE IF Ladder, The Switch Statement, The ?: Operator, The GOTO Statement, WHILE, DO, FOR, Jumps in LOOPS.	9
Module– 3	**No. of Hours**
Arrays and Strings: Introduction, Declaration and Initialization of One-dimensional and Two-Dimensional Arrays, Declaring and Initializing String Variables, Example programs using arrays ,Reading Strings from Terminal, Writing Strings to Screen, Arithmetic Operations on Characters, Comparison of Two Strings, String-handling Functions.	9
Module– 4	**No. of Hours**
User-defined Functions: Introduction, Need for User-defined Functions, A Multi-functional Program, Elements of User-defined Functions, Definition of Function, Return Values and their Types, Function Calls, Function Declaration, No Arguments and no Return Values, Arguments but no Return Values, Nesting of Functions.	9
Module– 5	**No. of Hours**
Structures and Pointers: Introduction, Defining a Structure, Declaring and Accessing Structure Variables and Members, Structure Initialization, Copying and Comparing Structure Variables, Array of Structures, Arrays within Structures. **Pointers:** Introduction, Understanding Pointers, Accessing the Address of Variable, Declaring pointer variables, initialization of pointers, accessing variables through its pointer.	9

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	List of experiments
1.	Develop a program to calculate the temperature converter from degree to Fahrenheit
2.	Develop a program to find the roots of quadratic equations.
3.	Develop a program to find whether a given number is prime or not.
4.	Develop a program to find key elements in an array using linear search.
5.	Given age and gender of a person, develop a program to categorise senior citizen (male & female).

6.	Generate Floyd's triangle for given rows.
7.	Develop a program to find the transpose of a matrix.
8.	Develop a program to concatenate two strings, find length of a string and copy one string to other using string operations.
9.	Develop a modular program to find GCD and LCM of given numbers.
10.	Develop a program to declare the structure of employees and display the employee records with higher salary among two employees.
11.	Develop a program to add two numbers using the pointers to the variables.
12.	Develop a program to find the sum of digits of a given number.
13.	Develop a program to perform Matrix Multiplication.
14.	Develop a program to create an array of structures to store book details and check whether a specific book, as requested by the user, is available or not.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the fundamental structure of a C program and primitive constructs.
CO2	Apply decision-making and iterative control structures to solve simple computational problems.
CO3	Develop programs using arrays and string operations to solve real-world problems.
CO4	Construct user-defined functions to modularize the solution to the given problems.
CO5	Build programs using structures and pointers for complex data representation and access.

Text Books	
1.	Programming in ANSI C, 9th edition, E Balaguruswamy, Tata McGraw Hill Education.

Reference Text Books	
1.	Programming in C, ReemaThareja, Oxford University, 3rdEdition, 2023.
2.	The 'C' Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2ndEdition, Prentice Hall of India, 2015

Web links and Video lectures (e-Resources)

1. elearning.vtu.ac.in/econtent/courses/video/BS/15PCD23.html
2. https://nptel.ac.in/courses/106/105/106105171/ MOOC

Courses can be adopted for more clarity in understanding the topics and verities of problem-solving methods.

- https://www.tutorialspoint.com/what-is-an-algorithm-and-flowchart-in-c-language
- https://www.tutorialspoint.com/cprogramming/c_data_types.htm
- https://www.tutorialspoint.com/cprogramming/c_operators.htm
- https://www.ccbp.in/blog/articles/decision-making-statements-in-c
- https://www.tutorialspoint.com/cprogramming/c_arrays.htm

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1**	**50**	**Average of Best two Assessments, scale down to 40**	**50/2 = 25**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
CCA	**Two Assignments**	**20**	**10**	
Laboratory	**Record & Observation**	**Evaluating each expt. for 10 marks**	**10**	**25**
	Lab Internal Test	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

- The Question paper for each course contains two parts, Part – A and Part – B.
- Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
- Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	1	-	-	2	1	-	-	1	-	-
CO2	-	1	-	-	2	1	-	-	1	-	-
CO3	-	2	-	-	2	2	-	-	1	-	1
CO4	-	2	-	-	2	2	-	-	1	-	1
CO5	-	2	-	-	2	2	-	-	1	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	Teaching and Learning Structure					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / semester	Term Work (TW) and Self Learning (SL) in hours / Sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25CEE102 (L:T:P:S 3:0:2:3)	Applied Chemistry for Emerging Electronics And Futuristic Devices	**45**	**00**	**26**	**50**	**120**	**4**

MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru–560074

Common Courses
Chemistry Group-I

Bachelor of Engineering

(2025 Scheme)

SEMESTER-I					
COMMUNICATION SKILLS **Category: AEC**					
Course Code	:	B25CSK106	CIE	:	50 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	50 Marks
Total Hours	:	15(T)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	2Hrs

Module– 1: Communication Skills	**No. of Hours**
Glimpses of Essential English for Engineers (General Overview). Communication Skills: Process, Verbal and Non-Verbal, Proxemics, Chronemics and Barriers. **Writing:** Word Classification – Parts of Speech, Sentence structures. **Speaking & Listening:** Listening to English Pronunciation – English Phonemes – Intelligible Accent – Speech Organs- Syllable Structures, Stress, Intonation, and Practice.	3
Module– 2: Interpersonal Skills	**No. of Hours**
Speaking: Role Play Exercises Based on Workplace Contexts, Introducing Oneself - PEP Talks- Personal Empowerment, Participating in Group Discussion and Debates, Giving Technical Presentation. **Reading:** Reading the Interview of an Achiever (Skimming and Scanning) (Case Studies). **Writing:** Writing a Short Biography of an Achiever Based on given reflections, **Grammar:** Sentence patterns. **Vocabulary Development:** Idioms and Phrases.	3
Module– 3: English for Employabilty	**No. of Hours**
Writing: Formal Letter writing (Enquiry, Order, and Complaint). Tenses – Reported Speech Voice - Email Etiquettes, Structure, Writing and Responding to Emails. Paragraph Writing (Descriptive, Argumentative, Expository, Short Story, and Narrative), Blog Writing. **Reading:** Proof Reading (Spelling, Punctuation, Grammar). Error Identification Exercises. **Speaking:** Questions & Requests (non-Wh questions and Question tags).	3
Module– 4: English in Digital World	**No. of Hours**
Writing: Framing of search terms / keywords in search engines/ Commands for search on open AIs - Tools to support synchronous communication such as webinar platforms, and asynchronous communication such as forums and social media - Online communication - Types – pros and cons of online communication. Acceptable online roles and behaviours – Netiquettes - Etiquettes of social media. Problems and opportunities in handling digital resources -Tools to check grammar. **Writing:** Citing information accurately from source material - Plagiarism – Infringement, Importance of academic integrity.	3
Module– 5: Applying for Jobs	**No. of Hours**
Listening: TED Talks. **Speaking:** Mock Interview, Telephone Interviews. **Reading:** Reading a Job Interview- language used in formal professional settings, formal vs. informal tone, non verbal communication cues, Statement of Purpose, Company Profile and Completing Comprehension Exercises **Writing:** Job Applications and Resumes **Grammar:** Conditional Clauses, Modal verbs **Vocabulary Development:** Technical Vocabulary, Purpose Statement.	3

Course Outcomes: At the end of the course, the students will be able to	
CO1	Build essential verbal, non-verbal, and phonetic communication skills for clarity and effectiveness.
CO2	Use interpersonal skills in group discussions, presentations, and professional interactions.
CO3	Apply formal writing, email etiquette, and creative content development for employability.
CO4	Communicate effectively in digital platforms, following netiquette and academic integrity.
CO5	Prepare job applications, resumes, and perform confidently in interviews.

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

Web links and Video lectures (e-Resources)

- Google Docs + Voice Typing - https://docs.google.com
- LearnEnglish – https://learnenglish.britishcouncil.org/
- TakeIELTS - https://www.britishcouncil.in/exam/ielts

ASSESSMENT STRUCTURE:

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than35% (18 Marks out of 50) in the Semester-End Examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	Internal Assessment1	50	Average of Best Two Assessments, scale down to 40	50
	Internal Assessment2	50		
	Internal Assessment3	50		
C C A	Two Assignments	05	10	
	Laboratory / Seminar	05		
SEE	Semester End Exam	50	50	50
Grand Total				100

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of Multiple Choice **Questions** for 20 marks covering the complete syllabus and it is compulsory.
3. Part – B consists of **10 questions**, two questions of **06 marks** from each module with internal choice. Students shall answer five full questions, selecting one full question from each module. Total marks is 50.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	1	1	-	-	2	-	2
CO2	-	-	-	-	1	1	-	-	2	-	2
CO3	-	-	-	-	1	1	-	-	2	-	2
CO4	-	-	-	-	1	1	-	-	2	-	2
CO5	-	-	-	-	1	1	-	-	2	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Course Code	Course Title	**Teaching and Learning Structure**					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / semester	Term Work (TW) and Self Learning (SL) in hours / Sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25CSK106/206 **(L:T:P:S 1:0:0:1)**	Communication Skills	**15**	**00**	**00**	**15**	**30**	**1**

SEMESTER-I					
INDIAN CONSTITUTION AND ENGINEERING ETHICS **Category:NCMC**					
Course Code	:	B25ICK107	CIE	:	100 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	--
Total Hours	:	15	Total	:	100 Marks
Credits	:	PP	SEE Duration	:	--

Course Objectives	
1.	To know about the basic structure of the Indian Constitution.
2.	To know the Fundamental Rights (FRs), DPSP's, and Fundamental Duties (FD's) of our constitution.
3.	To know about our Union Government, political structure & codes, and procedures.
4.	To know the State Executive & Elections system of India.
5.	To learn the Amendments and Emergency Provisions, other important provisions given by the constitution.

Module– 1	**No. of Hours**
Introduction to Indian Constitution: The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly. The Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of India Constitution.	3
Module– 2	**No. of Hours**
FR's, FD's and DPSP's: Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.	3
Module– 3	**No. of Hours**
Union Executive: Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.	3
Module– 4	**No. of Hours**
State Executive & Elections, Amendments and Emergency Provisions: State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (How and Why) and Important Constitutional Amendments till today. Emergency Provisions.	3
Module– 5	**No. of Hours**
Professional Ethics: Ethics & Values. Types of Ethics. Scope & Aims of Professional & Engineering Ethics. Positive and Negative Faces of Engineering Ethics. Clash of Ethics, Conflicts of Interest. The impediments to Responsibility. Trust & Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.	3

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyze the basic structure of Indian Constitution.
CO2	Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution.
CO3	Know about our Union Government, political structure & codes, procedures.
CO4	Understand our State Executive & Elections system of India.
CO5	Remember the Amendments and Emergency Provisions, other important provisions given by the constitution.

Text Books	
1.	"Constitution of India" (for Competitive Exams) - Published by NaidhruvaEdutech Learning Solutions, Bengaluru. – 2022.
2.	"Engineering Ethics", M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Prentice –Hall, 2004.

Reference Text Book	
1.	"SamvidhanaOdu" - for Students & Youths by Justice HN NagamohanDhas, Sahayana, kerekon.
2.	"Constitution of India, Professional Ethics and Human Rights" by Shubham Singles, Charles E. Haries, and et al: published by Cengage Learning India, Latest Edition – 2019.
3.	"Introduction to the Constitution of India", (Students Edition.) by Durga Das Basu (DD Basu): Prentice – Hall, 2008.
4.	"The Constitution of India" by Merunandan K B: published by Merugu Publication, 2nd Edition, Bengaluru.

ASSESSMENT STRUCTURE:

- The assessment of this course is Continuous Internal Evaluation (CIE) only.
- The three tests are conducted for 50 marks each and the average of best two tests marks scored from three tests is scaled down to 50 marks. The question paper contains the MCQs only.
- CCA – Activity 1 (25 marks): Two assignments given and each assignment is evaluated for 10 marks. The assignment should be in BL3, BL4, BL5 level.
- Activity 2 (25 Marks): All the students have to give the Seminar Presentation and it will be evaluated for 25 marks.
- Minimum marks to pass to get 40% of maximum marks ie,.100.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	weightage	Total Marks
Theory	**Internal Assessment1 (MCQs)**	**50**	**Average of Best two Assessments, scale down to 50**	**100**
	Internal Assessment2 (MCQs)	**50**		
	Internal Assessment3 (MCQs)	**50**		
C C A	**Two Assignments**	**25**	**50**	
	Seminar	**25**		
Grand Total				**100**

Course Code	Course Title	Teaching and Learning Structure					
		Classroom Instruction (CI) in hours / Semester		Lab Instruction (LI) in hours / semester	Term Work (TW) and Self Learning (SL) in hours / Sem	Total no. of hours/sem	Total Credits
		L	**T**	**P**	**SAAE**		
B25ICK107/207 **(L:T:P:S 1:0:0:1)**	Indian Constitution and Engineering Ethics	**15**	**00**	**00**	**15**	**30**	**1**

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	1	-	-	3	3	1	1	-	1
CO2	1	1	1	-	-	3	3	1	1	-	1
CO3	1	1	1	-	-	2	3	1	1	-	1
CO4	1	1	1	-	-	2	3	1	1	-	1
CO5	1	1	1	-	-	2	3	1	1	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-I					
INNOVATION AND DESIGN THINKING **Category: AEC/SDC**					
Course Code	:	B25IDL108	CIE	:	100 Marks
Teaching Hours: L:T: P	:	0 : 0 : 2	SEE	:	--
Total Hours	:	15 (P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	--
Semester running period : 15-16 weeks					
Examination type (Only CIE - Internals) divided into 4 reviews with each of 25 marks: Practical/ PPT Presentation/Seminar/Demonstration/Poster Presentation/Exhibition/Weekly/Project Report/Project Exhibition/Reviews/Observation/Case-Study/Simulation Study/Prototype Development/Model Making.					

Course Objectives	
1.	Toexplaintheconceptofdesignthinkingforproductandservicedevelopment in a practical way.
2.	Toexplainthefundamentalconceptofinnovationanddesignthinking& to develop hands-on skill and knowledge about various engineering components and devices.
3.	Todiscussthemethodsofimplementingdesignthinkingintherealworld& learn modern tools and techniques to develop the proposed designed models, may be on paper, soft or hard-oriented.
4.	To improve interpersonal skills, enhance team work, written and oral communication skills. & examine the various components of a project plan, viz., literature survey, modern tools, methodologies and execution of the plan.
5.	To continuously evaluate the developed works through guide/supervisor.

Course Outcomes : At the end of the IDT course, the students will be able to	
CO1	Demonstrate a sound technical knowledge of their selected project topic& develop various types of design procedures.
CO2	Use literature survey for problem identification, formulation and solution& generate and develop design ideas through different techniques.
CO3	Analyze, design and develop engineering solutions to problems utilizing a systems approach& identify the significance of reverse Engineering to Understand products.
CO4	Prepare the working model/ simulation for the project and demonstrate the same& draw technical drawing for design ideas.
CO5	Effectively write a report on the project topic with obtained results& to inculcate project management, team building, communication, interpersonal and team management skills.

Teaching-LearningProcess(GeneralInstructions) – Practical Based (Mini-Project Category) – Project Based Learning Approach

1. These are sample strategies;which teachers can use to accelerate the attainment of the various course outcomes.
2. Encouragecollaborative(GroupLearning), group learningintheclass/practical/lab by designing group based mini-projects in any domain.
3. Showvideo/animationfilmstoexplainconcepts of practicality in solving the designed problems.
4. Practical based-hands on methodologies, may be hardware or software oriented in the class.
5. Case-study oriented, Survey based orientations.
6. Adopt ProblemBased Learning (PBL), which fosters students' Analytical skills, develops thinking skillssuchastheabilitytoevaluate, generalize,andanalyzeinformationratherthansimplyrecall it.
7. Discusshoweveryconceptcanbeappliedtotherealworld –andwhenthat'spossible,ithelps improvethe students' understanding by doing case study or solving using simulations or doing some real time implementation in hardware.
8. Conducting design thinking workshops, Design Thinking Workshop Empathize, Design, Ideate, Prototype and Test the products.
9. Model building, Prototype building thro' innovative design thinking concepts.
10. Learn different types of simulation tools for solving real world problems

Week 1, 2 & 3: Orientation and Team Formation (related to only mini-project development – resulting in a prototype with either s/w or h/w or both)
Week -1&2: Introduction to Social Entrepreneurship, Innovation and Design Thinking Group discussion on What is Innovation v/s Invention. Why Design Thinking is important. Brief about 5 stages: Empathize – Define – Ideate – Prototype – Test. **Week -3:** Innovation warm-up activities, forming interdisciplinary teams, Instructions about Next week activities
Week 4–5: Empathy and Field Exploration(related to only mini-project development)
Week-4&5: Field (any public places of student's interest e.g. - Village, Government Office, Industry. R&D institute, NGO etc) visits, stakeholder interviews and interaction. Recording all interaction through handwritten in activity book prescribed by the University.
Week 6, 7 and 8: Problem Definition(related to only mini-project development)
Week-6: Documentation, categorization and Group discussion on interactions and problems/challenges. **Week-7&8:** Problem framing using "How Might We" approach, Identification of social problems and user insights through affinity Clustering and Problem Tree. Mention of clearly defined challenge statements.
Week 9, 10 &11: Ideation Sprint(related to only mini-project development)
Week-9&10: Presentation by teams on Defined Problems, Brainstorming interactions and Mind Mapping. **Week-11:** Idea Filtering - Shortlist of creative, eco -friendly and feasible ideas. Selection of one Suitable IDEA for next process, Designing/Structuring of Prototype model.
Week 12, 13 &14: Rapid Prototyping using Atal Idea Lab/Makers Space(related to only mini-project development)
Week-12&13: Building low-fidelity and working models using tools like Arduino, 3D printers,: Digital fabrication, electronics kits and recycled materials. **Week-14:** User testing, Feedback collection, Iteration - Observation Notes, Feedback Forms (Designing a business model for impact and scalability, if possible) Preparation of Draft of social venture plan
Week 15 &16: Final Demo and Social Pitch& Project Exhibition / Poster Presentation / Seminar(related to only mini-project development)
Innovation showcase, Poster display, Project pitching to jury, Presentation of the project (ppt) with impact with assessment, prototype, and sustainability plan, report making, video making. ***Weeks 1 to 16 to be converted into a project with case study or software oriented or hardware oriented or both.*** Final phase review (on/off line) with project demo, poster presentation & project presentation, hackathon participation, coding contest participation, working module explanation, power point presentation by the project group in the project exhibition.

List of Innovatively Designed Mini-Projects (samples & not restricted to these, but can be from other topics also, but should be related to the particular department & course undertaken)

Low-cost fire alarm system.	IC 555 based traffic signal system.
Battery charger circuit using SCR.	Piezo electricity generation circuit model.
Air pollution detection and control.	Headphone amplifier using op-amp.
Transistor as a switch.	Smart parking system design & development.
Home automation	Voting system using parallel adder circuit.

Referencematerials

1. https://www.electronicshub.org/electronics-mini-project-circuits/
2. https://nevonprojects.com/project-ideas/communication-project-ideas/
3. https://www.electronicsforu.com/
4. https://www.elprocus.com/

ActivityBasedLearning(SuggestedActivitiesinClass)/PracticalBasedlearning

1. Activity Based Learning.
2. Group discussion, Presentations.
3. One faculty member shall be assigned to group of 60+ students or one division.
4. Each group shall contain a min of 1 & maximum of 5 students.
5. Nature of the group shall be multidisciplinary (Group shall be formed by selecting students from the same branch & same section only).

No.	CIE Component/Week	Marks	Description
1.	Orientation Activities & Communication Skills	10	Participation in Week 1–3 orientation, communication and team work skill-building exercises.
2.	Empathy & Field Exploration Documentation	20	Quality and completeness of field visit reflections, stakeholder interviews, and activity book.
3.	Problem Definition and Framing	20	Clarity of challenge statements, use of "How Might We", Affinity Mapping, Problem Trees.
4.	Ideation & Mind Mapping	10	Participation in brainstorming, mind mapping, idea filtering sessions.
5.	Prototype Development &Iteration	20	Quality and creativity of prototype/ model, user testing, feedback collection, iterations.
6.	Final Presentation &Pitch, Exhibition	10	Project pitching, poster presentation, storytelling and scalability model.
7.	Teamwork, Journal, Project Report and Engagement	10	Peer and mentor evaluation of participation, Team work, journal updates, ppt presentation Project Exhibition, Poster Presentation, Seminars, etc…
8.	Total CIE marks	100	Final CIE marks to be considered

Minimum marks to qualifyfor CIE& to get eligible:

40 Out of 100 in CIE (4 Reviews) based on project report, presentation, Q & A, Demo, Model making, Awards-Prizes obtained @ various project exhibitions, poster design & weekly progress.

CIE – 1	First Phase Review – Batch formation, Topic Selection, Synopsis/Problem formulation	25 Marks
CIE – 2	Second Phase Review – 50% of the project to be completed,Ideation sprint s/w	25 Marks
CIE – 3	Third Phase Review– 100% of the project to be completed with poster design,Rapid prototyping	25 Marks
	Fourth Phase Review – Project exhibition, Video of working, Project report, Demo, PPT (H/W)	25 Marks
	Total CIE-1 + CIE-2 + CIE-3 + Final	**100 M**

Scheme of evaluation

- CIE Marks allocation Parameters for Social Entrepreneurship, Innovation & Design Thinking using Atal Idea/Tinkering Lab or Maker Space
- The CIE marks shall be awarded by the project guide or the class handling faculty or who is guiding the IDT project.
- The CIE marks awarded for the mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the respective ratios and as per the standard rubrics.
- The CIE marks awarded for the project report shall be the same for all the batch mates or may be varying depending on how they answer in the CIE tests.
- CIE marks is awarded for the project, poster, demo.

ASSESSMENT DETAILS (ONLY CIE)

The weightage of Continuous Internal Evaluation (CIE) is 100%. The minimum passing mark for the CIE is 40% of the maximum marks of 100 (40 marks out of 100). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject / course if the student secures morethanor equal to 40% (40 Marks out of 100) in the (CIE) and would be eligible for the next semester.

CONTINUOUS INTERNAL EVALUATION (CIE):

Weekly Group Reviews can be conducted (project evaluation as per rubrics), where the students in groups have to give a demo of their work status in front of the project guide, the average of the 4 reviews shall be taken, i.e., initial review, mid review, the final review (similar to 3 internals) along with the final pitching demo. There are no assignments or quiz for this course as it is project-based learning, except 4 reviews with Poster Design, Power Point Presentation, Report making& Project Demo.

Total Marks scored (Sum of all the 4 reviews) out of 100maximum is min of 40 Marks to be obtained.

No.	CIE Component/Week	Marks	Description
1.	Prototype / Solution Demonstration	30	Working functionality, creativity, use of lab tools, and relevance to the problem.
2.	Final Presentation / Social Pitch	20	Clarity, storytelling, problem-solution fit, communication, visual aids.
3.	Business Model or Sustainability Plan	10	Feasibility, cost-effectiveness, scalability, and alignment with SDGs.
4.	Viva Voce	20	Individual understanding, contribution, tools used, learning outcomes.
5.	Documentation Report/Portfolio	20	Project report, reflection, team activity log, and stakeholder input summaries.
	Total CIE Marks	100	

Submission Requirements:

- Hand written activity book with CIE marks and Final project report (Typed or Handwritten).
- Observation booklet to be maintained with weekly progress& signed regularly by the guide.
- Book to be signed by teacher every week.
- Final presentation ppt / pdf (hard and soft copy).
- Prototype or working model [physical or conceptual (shall be drawn / sketched clearly on card sheet paper)].
- Peer / team feedback and reflection entries (if applicable).

Blooms level in developing the project / proposal / design:

Bloom's Category	Preparation of Project Report/ Profile
Marks (Out of 100)	100
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	50

Comprehensive Continuous Assessment in Developing IDT Hands-On Designing Projects

1. **Project-Based Assessment - Capstone Projects -** Long-term, often team-based, real-world problems that require designing and implementing solutions - **Mini Projects -** Short-term individual or group projects based on course content - **Design Challenges -** Students design and prototype a solution to a specific engineering problem.
2. **Problem-Based Learning (PBL) -** Students are given complex, open-ended engineering problems to solve using learned concepts, Encourages critical thinking, teamwork, and research.
3. **Presentations and Seminars - Technical Presentations -** Individual or group presentations on engineering topics, case studies, or projects – **Seminars -** Students present findings from independent or guided research.

4. **Simulations Studies -** Simulations using tools like MATLAB, Simulink, or ANSYS, LABVIEW, Multisim, Proteas, ProE, pSPICE, etc…
5. **Portfolios -** A collection of a student's work over time: reports, projects, designs, reflections, Useful for design, CAD, architecture, and software engineering courses.
6. **Case Studies and Technical Reports -** Students analyze real-world engineering problems, disasters, or innovations, Write a report with analysis, proposed solutions, and conclusions.
7. **Coding or Simulation Assignments -** For courses like software engineering, control systems, or mechanical design, Students are assessed on the design, logic, efficiency, and functionality of code or CAD models.
8. **Concept Mapping / Mind Mapping -** Students create visual representations of interrelated concepts, Helps assess conceptual understanding, Website design, App design.
9. **Annotated Bibliographies / Literature Reviews Study -** Useful in research-based or under-graduate courses, Students analyze and summarize existing research in a structured format.
10. **Reflective Journals / Learning Logs -** Students regularly write reflections on what they've learned, challenges, and how they overcame them.
11. **Rubric-Based Design Reviews -** Used during the design stages of projects (mid-review, final review), Evaluated using predefined rubrics for innovation, feasibility, teamwork, etc.
12. **Service Learning or Community-Based Projects -** Applying engineering skills to benefit a local community, Example: Designing water filters, low-cost housing solutions, etc.

Different stages in 15 weeks for Developing IDT Hands-On Designing & Developing of Projects

1. **Problem Identification & Survey -** Define the problem statement, Collect background information through surveys, literature review, and case studies, Identify user requirements, constraints, and feasibility, Conduct field or market survey to understand practical needs.
2. **Requirement Analysis -** Document functional and non-functional requirements, Specify performance targets, cost limits, and timelines, Decide hardware and software platforms to be used, Perform risk assessment and resource planning.
3. **Conceptual & Preliminary Design -** Develop block diagrams and flowcharts, Propose multiple solution approaches, Select the best feasible design through evaluation, Prepare preliminary specifications for hardware and software.
4. **Detailed Design -** Circuit/system design for hardware modules, Algorithm and architecture design for software, Interface design between hardware and software, Simulation and modeling (using MATLAB, CAD, NS2, C, Python, Multisim, etc.).
5. **Development & Implementation -** Hardware prototyping (PCB design, fabrication, testing), Software coding, database creation, and UI development, Integration of hardware and software modules, Implement communication interfaces, protocols, and controllers.
6. **Testing & Validation -** Unit testing of each hardware and software component, System-level testing for functionality, performance, and safety, Debugging and fault rectification, Validation against initial requirements and survey outcomes.
7. **Deployment & Demonstration -** Assemble the complete project prototype/system, Demonstrate the working to stakeholders/end users, Collect feedback and refine the system, Ensure reliability under different operating conditions.
8. **Documentation -** Prepare detailed technical report (survey results, design steps, methodology, results, conclusions), Create user manuals, flow diagrams, and circuit diagrams, Record test results, simulations, and comparisons, publish a paper, do a poster, create a video of full project working.
9. **Conclusion & Future Work -** Summarize achievements of the project, Identify limitations of the current design, Suggest improvements, scalability, or new features for future work.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	-	-	-	-	-	-	-	-
CO2	3	1	1	-	1	1	1	-	1	-	-
CO3	3	2	3	2	2	1	2	2	1	1	2
CO4	2	3	3	1	2	1	1	-	1	-	2
CO5	2	1	1	-	-	-	-	-	1	2	2
CO6	-	-	-	-	-	2	2	2	3	3	2