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

II Semester Scheme and Syllabus
(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)

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MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

Scheme of Teaching and Examinations – 2025

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

(Effective from the Academic Year 2025-26)

II Semester — Chemistry Group: CSE — 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	B25MCS201	Numerical Methods	Maths	3	2	0		50	3	50	100	4
2.	ASC(IC)	B25CCS202	Chemistry for Smart Systems	CHE	3	0	2		50	3	50	100	4
3.	ETC	B25AAK203	Introduction to AI and Applications	AIML	3	0	0		50	3	50	100	3
4.	ESC	B25ESC204	Introduction to Electronics and Communication	ECE	3	0	0		50	3	50	100	3
5.	PLC(IC)	B25PLB205	Python Programming	ISE	3	0	2		50	3	50	100	4
6.	AEC	B25CSK206	Communication Skills	Humanities	1	0	0		50	2	50	100	1
7.	NCMC	B25ICK207	Indian Constitution and Engineering Ethics	Humanities	1	0	0		100	--	--	100	PP
8.	AEC/ SDC	B25PRJ208	Interdisciplinary Project Based Learning	Combination of Depts.	0	0	0	2	100	--	--	100	1
				TOTAL					500		300	800	20

S-(SAAE) Students Academic Activity Engagement Hours, **ASC** – Applied Science Course, **ESC** - Engineering Science Courses, **IC** - Integrated Course (Practical 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, Social Science and management Course, **CIE** - Continuous Internal Evaluation, **SEE** -Semester End Examination, **NCMC** - Non Credit Mandatory Course, **PP/NP** - (Pass/Not Pass).

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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)

II Semester — Chemistry Group: CSE(IC), AI&ML — 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	B25MCS201	Numerical Methods	Maths	**3**	**2**	**0**		**50**	**3**	**50**	**100**	**4**
2.	ASC(IC)	B25CCS202	Chemistry for Smart Systems	CHE	**3**	**0**	**2**		**50**	**3**	**50**	**100**	**4**
3.	ETC	B25AAK203	Introduction to AI and Applications	AIML	**3**	**0**	**0**		**50**	**3**	**50**	**100**	**3**
4.	ESC	B25ESB204	Introduction to Electrical Engineering	EEE	**3**	**0**	**0**		**50**	**3**	**50**	**100**	**3**
5.	PLC(IC)	B25PLB205	Python Programming	ISE	**3**	**0**	**2**		**50**	**3**	**50**	**100**	**4**
6.	AEC	B25CSK206	Communication Skills	Humanities	**1**	**0**	**0**		**50**	**2**	**50**	**100**	**1**
7.	AEC NCMC	B25ICK207	Indian Constitution and Engineering Ethics	Humanities	**1**	**0**	**0**		**100**	**--**	**--**	**100**	**PP**
8.	AEC/ SDC	B25PRJ208	Interdisciplinary Project Based Learning	Combination of Depts.	**0**	**0**	**0**	**2**	**100**	**--**	**--**	**100**	**1**
				TOTAL					**500**		**300**	**800**	**20**

S-(SAAE) Students Academic Activity Engagement Hours, **ASC** – Applied Science Course, **ESC -** Engineering Science Courses, **IC -** Integrated Course (Practical 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, Social Science and 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)

Applied Mathematics-II					**Applied Chemistry**				
Course Code	**Title**	**L**	**T**	**P**	**Course Code**	**Title**	**L**	**T**	**P**
B25MME201	Integral Calculus and Numerical Methods: CV & ME	3	2	0	B25CCV102/ 202	Chemistry for Sustainable Structure and Material Design: CV Stream	3	0	2
B25MEE201	Calculus, Laplace Transform and Numerical Techniques: EEE Stream	3	2	0	B25CME102/ 202	Chemistry for Advanced Metal Protection and Sustainable Energy systems: ME Stream	3	0	2
B25MCS201	Numerical Methods: 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-II (ESC-II)					**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					

Interdisciplinary Project **(B25PRJ208):** Students of different engineering disciplines form a team to complete the project. For example, a team may include students from Mechanical Engineering, Electronics and Communication Engineering (ECE), and Computer Science and Engineering (CSE), working collaboratively implement the project.

Dean-Academics **Principal**

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Computer Science and Engineering

Computer Science and Engineering (IC)

Artificial Intelligence and Machine Learning

(2025 Scheme)

SEMESTER-II					
NUMERICAL METHODS **Category: ASC(IC)**					
Course Code	:	B25MCS201	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.	To Develop the knowledge of numerical methods and apply them to solve algebraic and Transcendental equations.
2.	To Analyze the properties and application of vector norms and LU decomposition.
3.	To Familiarize about interpolation techniques to estimate values between data points.
4.	To analyze boundary and initial value problems for differential equations.
5.	Develop the knowledge of numerical methods and apply them to solve differential equations.

Module– 1:Differential Equations of First and Higher Order	**No. of Hours**
Linear and Bernoulli`s differential equations. Exact and reducible to exact differential equations with integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{-1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$. Homogeneous and non-homogeneous Differential equations of higher order with constant coefficients. Inverse differential operators - $e^{ax}\ sin(ax+b), cos(ax+b)$and x^n.	9
Module– 2: Introduction to Numerical Methods	**No. of Hours**
Errors and their computation: Round off error, Truncation error, Absolute error, Relative error and Percentage error. Solution of algebraic and transcendental equations: Bisection, Regula-Falsi, Secant and Newton-Raphson methods.	9
Module– 3: Numerical solutions for system of linear equations	**No. of Hours**
Norms: Vector norms and Matrix norms- L_1, L_2 and L_∞, Ill conditioned linear system, condition number. Solution of system of linear equations: Gauss Seidel method and LU-decomposition method (Chowlesky method). Eigen values and Eigen vectors: Rayleigh power method, Jacobi's method.	9
Module– 4: Interpolation	**No. of Hours**
Finite differences, interpolation using Newton Gregary forward and Newton Gregary backward difference formulae, Newton's divided difference. Lagrange interpolation formulae, piecewise interpolation-linear and quadratic.	9
Module– 5: Numerical Integration and Numerical Solution of Differential Equations	**No. of Hours**
Numerical integration: Trapezoidal, Simpson's 1/3rd, Simpson's 3/8th rule and Weddle's rule. Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector method.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply numerical methods to solve transcendental equations, perform interpolation, numerical integration, and solve ordinary differential equations.
CO2	Solve first and higher-order differential equations using analytical methods and apply them to mathematical models.
CO3	Demonstrate the applications of computer science and allied engineering science using modern ICT tools.

Text Books	
1.	M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8thEdition, 2022.
2.	David C Lay, Linear Algebra and its Applications, Pearson Publishers, 5thEdition, 2023.
3.	B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2021.

Reference Text Books	
1.	V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education, 11th Edition, 2017
2.	N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Edition, 2022.
3.	S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 5th Edition, 2012.

Web links and Video lectures (e-Resources)
• https://nptel.ac.in/courses/111105160 • https://nptel.ac.in/courses/127106019 • https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/ • https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2012/pages/syllabus/

ASSESSMENT STRUCTURE: CIE and SEE

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	Max. Marks Scaling down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
Self Learning	**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

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**		
B25MCS201 (L:T:P:S 3:2:0:3)	Numerical Methods	**45**	**30**	**0**	**45**	**120**	**4**

SEMESTER-II					
CHEMISTRY FOR SMART SYSTEMS **Category: ASC(IC)**					
Course Code	:	B25CCS202	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	Name of the 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	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment1	50	40 (Average of Best two Assessments)	50/2 = 25
	Internal Assessment2	50		
	Internal Assessment3	50		
Self Learning	Two Assignments	20	10	
Laboratory	Lab Conduction & Record	Evaluating each expt. for 10 marks*12 expts.	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)	Chemistry for Smart Systems	**45**	**00**	**26**	**50**	**120**	**4**

SEMESTER-II					
INTRODUCTION TO AI AND APPLICATIONS **Category: ETC**					
Course Code	:	B25AAK203	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. ***Textbook 1: Chapter 1 (1.1-1.5), Chapter 3 (3.1-3.7.2), Chapter 4 (4.1-4.4)***	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. ***Textbook 2: Chapters 1, 3, 4 & 5***	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). ***Textbook 1: Chapter 2 (2.1-2.8)***	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). ***Textbook 1: Chapter 8 (8.1, 8.2, 8.4), Chapter 9 (9.1- 9.3)***	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. ***Textbook 3: Chapter 3, Chapter 5 (5.1)***	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	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
Self Learning	**Two Assignments**	**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-II					
INTRODUCTION TO ELECTRICAL ENGINEERING **Category: ESC**					
Course Code	:	B25ESB204	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:

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CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
Self Learning	**Two Assignments**	**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**		
B25ESB204 (L:T:P:S 3:0:0:3)	Introduction to Electrical Engineering	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-II					
INTRODUCTION TO ELECTRONICS AND COMMUNICATION **Category: ESC**					
Course Code	:	B25ESC204	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	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40**	**50**
	Internal Assessment2	**50**	**(Average of Best two**	
	Internal Assessment3	**50**	**Assessments)**	
Self Learning	**Two Assignments**	**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**		
B25ESC204 (L:T:P:S 3:0:0:3)	Introduction to Electronics and Communication	**45**	**00**	**00**	**45**	**90**	**3**

SEMESTER-II					
PYTHON PROGRAMMING **Category: PLC(IC)**					
Course Code	:	B25PLB205	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

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CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	Max Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50/2 = 25**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
Self Learning	**Two Assignments**	**20**	**10**	
Laboratory	**Lab Conduction & Record**	**Evaluating each expt. For 10 marks*12 expts.**	**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**		
B25PLB205 **(L:T:P:S 3:0:2:3)**	Python programming	**45**	**00**	**26**	**50**	**120**	**4**

SEMESTER-II					
COMMUNICATION SKILLS **Category: AEC**					
Course Code	:	B25CSK206	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	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1 (MCQs)**	**50**	**40 (Average of Best Two Assessments)**	**50**
	Internal Assessment2 (MCQs)	**50**		
	Internal Assessment3 (MCQs)	**50**		
Self Learning	**Seminar**	**10**	**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 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-II					
INDIAN CONSTITUTION AND ENGINEERING ETHICS					
Category: NCMC					
Course Code	:	B25ICK207	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	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1 (MCQs)**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2 (MCQs)	**50**		
	Internal Assessment3 (MCQs)	**50**		
Self Learning	**Seminar**	**10**	**10**	
Grand Total				**50**

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-II					
INTERDISCIPLINARY PROJECT BASED LEARNING **Category: AEC/SDC**					
Course Code	:	B25PRJ208	CIE	:	100 Marks
Teaching Hours L:T: P	:	0 : 0 : 1	SEE	:	--
Total Hours	:	15 (P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	--
Semester running periods : 15-16 weeks					
Examination type (Only CIE– Internals) divided into 4 reviews (R1 to R4) in a semester with each review of 25 marks, which is equivalent to doing continuous evaluation every month. Components : Practical Field Work /PPT Presentation/Seminar/Demonstration/Poster Presentation/ Project Exhibition/Project Report/Project Exhibition/ Project Reviews/Observation - activity book/Case-Study/Simulation Study/Prototype Development/Model Making / Developing Patent / Hackathon					

Course Objectives :	
1.	To help students explore & understand real-world problems that require knowledge from more than 1 engineering discipline, enabling them to identify an innovative project topic, apply suitable design strategies. (*Aligned with CO1*)
2.	To guide students in performing a meaningful literature review, so that they learn to frame problem correctly, propose appropriate solution approaches using basic science, engineering, and technology concepts. (*Aligned with CO2*)
3.	To enable students to practice system-level thinking while designing or analyzing solutions, including ability to apply reverse-engg. concepts, work collaboratively with clear roles &responsibilities within team. (*Aligned with CO3*)
4.	To train students in converting ideas into practical working models or simulations, while also developing their technical drawing& effective demonstration skills using project management tools. (*Aligned with CO4*)
5.	To develop students' ability to prepare a structured interdisciplinary project report and present project outcomes with strong communication, leadership, teamwork, and social responsibility through sustainable and innovative project execution. (*Aligned with CO5*)

CO - Course Outcomes (Course Skill Sets) : At the end of the IDPW course, first year students will be able to	
CO1	Demonstrate a sound technical knowledge of their selected project topic& develop various types of design procedures by identifying and defining practical problems which requires interdisciplinary knowledge.
CO2	Use literature survey for problem identification, formulation and solution, generate and develop design ideas / simple solutions through different techniques by applying the basic concepts of science, engineering, and concerned branch's technological ideas.
CO3	Analyze, design and develop engineering solutions to problems utilizing a systems approach& identify the significance of reverse engineering to understand products by working effectively in teams with defined roles and responsibilities.
CO4	Prepare the working model/ simulation for the project and demonstrate the same& draw technical drawing for design ideas by using project management, documentation, and presentation skills.
CO5	Effectively write an interdisciplinary project report on the project topic with obtained results& to inculcate project management, team building, communication, interpersonal and team management skills by developing socially relevant, sustainable, and innovative prototypes/solutions.

Teaching-Learning Process(Constructive Delivery Methods)
Activity based /Practical based / Hands on Based Learning – *Project can be an extension of 1st semester work also*

1. Hands-on Activity Based Learning
2. Group discussion & time to time Presentations.
3. One faculty member shall be assigned to group of 60 students or one division, the same faculty member

shall also be assigned to another group of 60 students or another division as the project work is interdisciplinary in nature, i.e., one faculty has to handle two different sections, i.e., 1 section of CSE & 1 section of ECE (but, not mandatory).

4. Each project group batch shall contain Min. of 2 and Max. of 4 students.
5. Nature of the group shall be multidisciplinary (Group shall be formed by selecting students from all branches).
6. Use sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.
7. Encourage collaborative (Group Learning), (Collaborative Learning), group learning in the class/practical/lab by designing group-based projects in any domain.
8. Show video /animation films to explain concepts of practicality in solving the designed problems or the students can be taken to industry visits to show case some of the practical orientations and do some industry-based case study.
9. Practical based-hands on methodologies, may be hardware or software oriented in the class.
10. Case-study oriented, Survey based orientations, Review based orientations.
11. Adopt Problem Based Learning (PBL), which fosters students' analytical skills, develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
12. Discuss how every concept can be applied to the real world –and when that's possible, it helps improve the students' understanding by doing case study or solving using simulations or doing some real time implementation in hardware.
13. Conducting creative workshops, to empathize, design, ideate, prototype and test the products in the form of hands on or hackathons.
14. Model building, Prototype building thro' creative conceptual developments.
15. Learn different types of simulation tools for solving real world problems such as multisym, pspice, labview, matlab, ansys, pro-e, catia, proteas, etc…

Week - 1, 2 & 3: Introduction, Orientation, Team Formation and Literature Survey(related to only interdisciplinary-project development – resulting in a prototype with either s/w or h/w or both)

Week -1: Introduction to project-based learning & interdisciplinarity activity. Motivational talk / case studies of successful student projects. Ice-breaking and team-building activities, briefing about 5 stages: Empathize – Define – Ideate – Prototype – Testing ….. (*give a brief orientation*)

Week -2: Formation of groups (*2 to 4 students from same branch or different branch*). Selection of broad theme areas. Brainstorming techniques {*mind mapping*, *5W1H* (*what*, *who*, *when*, *where*, *why*, *and how*)}. Identifying problems. Discuss feasibility & Inter-disciplinarity. Mentor or project guide's approval of project problem.

Week-3: How to search for prior work (*journals*, *patents*, *research project*, *case studies*, *search engines*, *google*, *yahoo*, ChatGPT, *etc*…). Understanding student needs. Role of each engineering branch in solving the problem.

Deliverables - Team list + chosen theme area of the interdisciplinary project work and literature survey report.

Week- 4, 5 & 6: Problem Statement by selection of field or domain area, Multiple Solution Ideas and Selection of Best Idea Consideration (related to only interdisciplinary-project development)

Week-4: Refining the problem statement& defining it. Identifying constraints and scope. Framing objectives & expected outcomes. Generating multiple solution ideas. Discussing feasibility (*technical*, *economic*, *social*).

Week-5: Project team roles assigned (*design*, *research*, *coding*, *documentation*, *testing*). Criteria-based selection of best idea (decision matrix). Documentation, categorization and Group discussion on interactions and problems / challenges

Week-6: Rough sketches, block diagrams, flowcharts. Resource planning (*materials*, *software*, *tools*).

Deliverables - Finalized Problem definition with objectives, List of solution concepts (*sketches*) and Design document (*line diagrams*, *flow-charts*, *algorithms*, *DFDs*, *pictures*, block-*diagrams*)

Week -7, 8 and 9: Selection of Best IDEA and Prototyping by trying to develop a project model (related to only interdisciplinary-project development) …. Prototyping stage 1 using s/w or h/w or using any labspace

Week-7: Work breakdown structure (task division). Timeline for development. Safety & ethical considerations.

Week-8: Development of subsystems / modules of the project

Week-9: Application of classroom knowledge (electrical circuits, software coding, mechanics, CAD, debugging, reverse engineering, etc.), Peer & mentor review sessions.

Deliverables - Prototype development plan, Subsystem demos (partial working models).
Week 10, 11&12 : Prototyping stage 2 using Atal Idea Lab / Makers Space / Virtual Labs (related to only interdisciplinary-project development)…. Prototyping stage 2 using s/w or h/w or using any labspace
Week-10: Integration of subsystems. Debugging & troubleshooting, building low-fidelity and working models using tools like Arduino, 3D printers, Digital fabrication, electronics kits and recycled materials (*may be drones or home automation models*) **Week-11:** Improvement in project based on test results, User testing, Feedback collection, Iterations doing to build the product (may be h/w or s/w oriented), Testing against objectives & user requirements. **Week-12:** Experimentation results (tables, graphs). Analyzing failures/limitations & Designing / Structuring of Prototype model in partial stage (say, three-fourth completed project).
Deliverables – Prototype/working model development, Testing Results, Limitations/challenges
Week 13 &14: Refinement & Pre-Final Interdisciplinary Project Review
Week 13: Refining prototype for efficiency, cost, sustainability. Internal review & peer feedback. **Week 14:** Preparing visuals for final presentation (posters, PPT, demo video).
Deliverables – Final Results of Experimentation or Testing & Working / Prototype Model
Week 15 &16: Final Project Demo and Social Pitch& Project Exhibition / Poster Presentation / PPT presentation of stage / Seminar(related to only project development)
Showcased Projects, Poster display, Project pitching to jury, Presentation of the project (ppt) with impact with assessment, prototype, and sustainability plan, report making, video making ending with an project expo. ***Weeks 1 to 16 to be converted into a project with case study or software oriented or hardware oriented or both having 4-stage reviews.*** 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 Interdisciplinary-Projects (*samples & not restricted to these, but can be from other topics also, but should be related to the particular department & course undertaken*)

1. Case – study projects
2. Design projects (app, circuit, web-site, system, etc…)
3. Survey projects
4. Pure software-oriented projects
5. Pure hardware-oriented projects
6. Both software & hardware-oriented projects
7. Combination of the previous 5 types of works related to a hybrid interdisciplinary project

4 Reviews Rubrics→

No.	Stage/Activity/ Component per week	Weigh -tage	Marks Out of 100	Description
1.	Weeks 1–4: Problem Identification & Literature Survey	10	10	Focus on forming teams, identifying problems, understanding user needs, and reviewing prior work through journals, patents, etc.
2.	Weeks 5–7: Concept Development & Design	20	20	Defining problem statements, framing objectives, generating ideas, preparing diagrams, flowcharts, and resource planning.
3.	Weeks 8–11: Prototype Development	30	30	Creating subsystems, applying theoretical knowledge, peer and mentor review sessions, debugging, and troubleshooting.
4.	Week 12: Testing & Validation	10	10	Evaluating the prototype's performance, user requirements, experiments, and analysis of failures.
5.	Weeks 13–16: Documentation & Presentation, Exhibition, Project Report, Demo	30	30	Finalizing the prototype, improving based on feedback, preparing presentations, reports, and demonstration materials.
6.	Total CIE marks	100%	100	Final CIE marks to be considered

Minimum marks to qualify for CIE& to get eligible to clear the subject:

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, conference paper presentation, journal paper publication & weekly progress (in a observation activating booklet).

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

Fourth Phase Review – Project exhibition / expo, Video of working, Project report, Demo, PPT (h/w or s/w) rubrics

Component for	Weightage (%) approx	Marks (outof 25)	Description
Final Presentation &Demonstration	15%	4	Clear articulation of the problem, solution approach, prototype, and team contribution. Delivery, engagement, and response to questions are evaluated.
Prototype Quality & Functionality	15%	4	Working model evaluation, application of engineering principles, problem-solving effectiveness, debugging, and system integration.
Documentation Report	15%	4	Completeness, structure, accuracy, clarity in diagrams, data analysis, testing results, and conclusions.
Social Impact &Sustainability	15%	4	Relevance to society, cost-effectiveness, ethical considerations, environmental impact, and scalability.
Innovation & Originality	15%	4	Creativity, uniqueness, feasibility, and application of interdisciplinary concepts.
Viva– voce	25%	5	Final presentation on stage & project demo in project exhibition.
Total Marks for R-4	**100%**	**25 Marks**	

Assessment Structure: CIE Marks allocation Parameters for Social Entrepreneurship, Product development using Atal Idea/Tinkering Lab or Maker Space / Virtual Labs / Project lab shall depend on the 4 reviews performance by the project batches.

- The CIE marks shall be awarded by the project guide or the class handling faculty or who is guiding the IDPW course.
- The CIE marks awarded for the interdisciplinary-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 reviews.
- CIE marks are awarded for the project, poster, demo, exhibition, paper, app, prizes, patent, etc…

Assessment Details& its Structure (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 morethan or equal to 40% (40 Marks out of 100) in the (CIE) and would be eligible for the next semester. To quality & pass or become eligible for completing this interdisciplinary project based learning work course, a student must score at least 40% of the total 100 marks, i.e., 40

marks.

Continuous Internal Evaluation (CIE): Monthly, 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 of their work idea (may be h/w or s/w or both). 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 (Project Exhibition).

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

Blooms level in developing the project / proposal / design:

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

Submission Requirements:

- Hand written activity book with CIE marks and Final project report (Typed or Handwritten), number of reports to the submitted being no. of students + 1 to the guide/department.
- Observation booklet to be maintained with weekly progress & signed regularly by the guide (activity report).
- Observation booklet 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 day-to-day entries (if applicable).
- End outcome – Reflection notes what they learnt from the project work.

Useful&student-friendly list of websites where students can explore ideas, gather information, and access tutorials for doing interdisciplinary software + hardware project works.

Some reference materials

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/

Electronics, Robotics & Embedded Systems

- Electronics Hub – https://www.electronicshub.org(Robotics, wireless communication projects)
- EEWeb – https://www.eeweb.com(Electronic design news & tutorials)
- Microchip Developer Help – https://developerhelp.microchip.com(PIC, dsPIC, ARM MCU development resources)
- ARM Developer – https://developer.arm.com(Embedded programming & MCU architecture)
- OpenHardware.io – https://www.openhardware.io(Community hardware designs)
- Robotics Every Day – https://robocraze.com/blogs(Hands-on robotics articles & DIY learning)
- DFRobot Community – https://community.dfrobot.com(Sensors, automation & STEM project ideas)

Project Ideas & Documentation Resources

- Instructables – https://www.instructables.com(Large variety of DIY electronics & mechanical projects)
- Hackster.io – https://www.hackster.io(IoT, robotics, embedded systems projects with tutorials)
- Hackaday – https://hackaday.io(Innovative hardware hacking and maker projects)
- All About Circuits – https://www.allaboutcircuits.com(Circuit ideas, discussions, and project support)
- Electronics For You (EFY) – https://www.electronicsforu.com(Indian electronics project magazines and tutorials)
- Circuit Digest – https://circuitdigest.com(Circuit implementation, Arduino, and PCB design guides)

Mechanical, 3D Printing & Industrial Design
- Autodesk Design Academy – https://academy.autodesk.com(Fusion 360, AutoCAD training)
- GrabCAD – https://grabcad.com/library(3D CAD models for robotics/mechanics)
- PrusaPrinters – https://www.printables.com(3D printable models, maker ideas)
- MyMiniFactory – https://www.myminifactory.com(3D prototypes inspiration)

Power Electronics, Control & Industrial Automation
- Power Electronics News – https://www.powerelectronicsnews.com(Converters, EV power systems)
- PLC Academy – https://www.plcacademy.com(PLC programming & automation)
- Control.com – https://control.com(Industrial automation discussions)
- EETimes – https://www.eetimes.com(Electronics technology trends)

Networking, Cybersecurity & Cloud
- Cisco Networking Academy – https://www.netacad.com(Networking & IoT skills)
- OWASP – https://owasp.org(Cybersecurity project references)
- DigitalOcean Tutorials – https://www.digitalocean.com/community(Cloud & DevOps learning)
- GNS3 Community – https://www.gns3.com(Network simulation and lab setups)

Embedded, Robotics & IoT Platforms
- Arduino Project Hub – https://create.arduino.cc/projecthub
- Raspberry Pi Projects – https://projects.raspberrypi.org
- ESP32/IoT Tutorials – https://randomnerdtutorials.com
- Adafruit Learning System – https://learn.adafruit.com
- SparkFun Tutorials & Projects – https://learn.sparkfun.com
- NVIDIA Jetson Projects – https://developer.nvidia.com/embedded/community

Software Development & ML/AI Resources
- w3schools – https://www.w3schools.com(Web & programming basics)
- GeeksforGeeks – https://www.geeksforgeeks.org(Programming, placements, and algorithms)
- Kaggle – https://www.kaggle.com(Datasets & machine learning projects)
- Google Developers – https://developers.google.com(ML models, APIs, Cloud platform)
- PyImageSearch – https://pyimagesearch.com(Computer vision projects using Python)
- MIT OpenCourseWare – https://ocw.mit.edu(Free engineering & CS courses)

AI/ML, IoT & Software Development
- Towards Data Science – https://towardsdatascience.com(AI & ML concepts explained practically)
- TutorialsPoint – https://www.tutorialspoint.com(Programming, OS, networking basics)
- FreeCodeCamp – https://www.freecodecamp.org(Complete software & web development courses)
- EdX – https://www.edx.org(Engineering MOOCs from top universities)
- Coursera – https://www.coursera.org(ML & embedded specialization programs)
- MDN Web Docs – https://developer.mozilla.org(Web development, protocols, APIs)
- IBM Developer – https://developer.ibm.com(Cloud & AI tools, IoT real-time coding guides)

Circuit Design, Simulation & PCB Tools (Online)
- Tinkercad Circuits – https://www.tinkercad.com/circuits(Beginner-friendly simulation & Arduino support)
- EasyEDA – https://easyeda.com(PCB & circuit design online)
- KiCad EDA – https://www.kicad.org(Open-source PCB design)
- Proteus info & resources – https://labcenter.com(Simulation of microcontrollers and electronics)
- LTspice – https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html (Power/analog circuit simulation)

Hardware, Sensors & 3D Printing Information

- Arduino Store – https://store.arduino.cc
- OEMs like Texas Instruments – https://www.ti.com/design-resources/design-tools-simulation.html
- Thingiverse – https://www.thingiverse.com(3D printing models for robotics/mechanics)
- Make Magazine – https://makezine.com(Maker community and engineering prototypes)

Research Papers & Technical References

- IEEE Xplore – https://ieeexplore.ieee.org
- ScienceDirect – https://www.sciencedirect.com
- Google Scholar – https://scholar.google.com
- ResearchGate – https://www.researchgate.net
- SpringerLink – https://link.springer.com
- arXiv – https://arxiv.org(Free latest papers in CS, EE, robotics)
- Academia.edu – https://www.academia.edu(Research project references)
- DOAJ – https://doaj.org(Free access scientific journals)

Bonus — Competitions & Innovation Platforms

- Smart India Hackathon – https://www.sih.gov.in
- AICTE Idea Lab & Projects – https://www.aicte-india.org
- NASA Open Innovation Projects – https://solve.mit.edu/challenges

Alternate Assessment Tool (AAT) in Developing IDPW Hands-On Designing Projects

1. **Project-Based Assessment - Capstone Projects -** Long-term, often team-based, real-world problems that require designing and implementing solutions - **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 Interdisciplinary Projects : 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)

Course Outcomes CO / Program	PO1 Engineering Knowl	PO2 Problem Anal	PO3 Design & Develo	PO4 Investigations of	PO5 Modern Too	PO6 Engineer &	PO7 Environment &	PO 8 Ethics	PO9 Individual &	PO10 Communication Skills	PO11 Project Management	PO12 Life-long

Outcomes PO	edge	ysis	pment of Solutions	Complex Problems	l Usage	Society	Sustainability		Team Work		& Finance	Learning
CO1 Demonstrate technical knowledge & design procedures	3	2	2	1	1	1	–	–	1	1	2	–
CO2 Literature survey & simple engineering solutions	2	3	2	2	1	–	–	–	1	1	1	1
CO3 Systems approach, reverse engineering & teamwork	2	2	3	2	2	1	1	1	3	2	2	1
CO4 Working model/simulation & project management skills	2	2	3	2	3	1	1	–	2	3	3	1
CO5 Report writing, team building & social relevance	1	1	2	1	2	2	2	2	3	3	3	2

L = Low (**1**), M = Medium (**2**), H = High (**3**) - Blank = No significant mapping correlation levels
CO1 & CO2 directly build technical foundation → aligns to PO1, PO2
CO3 & CO4 involve design, tools, team work & applied engineering → strong mapping with PO3, PO5, PO9
CO5 adds professional, social & sustainability skills → aligns to PO6, PO7, PO10, and PO11