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DAYANANDA SAGAR UNIVERSITY

SCHOOL OF ENGINEERING

SCHOOL OF ENGINEERING

Department of

Artificial Intelligence and Robotics

SCHEME AND SYLLABUS

B.Tech. PROGRAMME– 2023-24 BATCH

Academic Year 2023-24

Devarakaggalahalli, Harohalli,
Kanakapura Main Road,
Ramanagara District – 562 112

DAYANANDA SAGAR UNIVERSITY

SCHOOL OF ENGINEERING

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Vision and Mission of DSU

VISION

- To be a centre of excellence in education, research & training, innovation & entrepreneurship and to produce citizens with exceptional leadership qualities to serve national and global needs.

MISSION

- To achieve our objectives in an environment that enhances creativity, innovation and scholarly pursuits while adhering to our vision.

Vision and Mission of School of Engineering

VISION

- Transform lives through excellence in engineering education, research and innovation with an emphasis on sustainability, inclusive technologies and global needs.

MISSION

- Design and deliver contemporary engineering curricula to address regional and global needs while emphasizing ethics, values, integrity and regional relevance.
- Carry out high impact academic research, industry projects and innovation activities with active student engagement to advance science and engineering knowledge and state-of-the-art industry practices.
- Develop regional and national leaders to advance the society and economy.

Vision and Mission of AI & Robotics

VISION

- To offer a leading program, fostering innovation and research, where intelligent systems enhance human experiences, guided by responsible AI practices and a diverse community of forward-thinking professionals.

MISSION

- To educate and empower students in the fields of AI and Robotics, equipping them with the skills and knowledge to develop intelligent systems that improve lives and contribute to societal progress.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Within a few years after graduation, the graduates of Artificial Intelligence and Robotics will be able to:

1. Demonstrate technical proficiency in in Robotics and Artificial Intelligence, showcasing a deep understanding of their core principles and practical applications.
2. Design and implement hardware solutions tailored for robotics applications and develop software solutions optimized for the integration of Artificial Intelligence into Robotics systems.
3. Pursue higher studies to carry out engaging in cutting-edge research and development endeavours within the realms of Robotics and Artificial Intelligence, contributing to technological advancements.
4. Engage in lifelong learning, effectively communicate complex technical ideas, demonstrate strong leadership skills, and exhibit unwavering commitment to professional ethics and responsibilities

PROGRAM OUTCOMES (POs)

Background: ***Program Outcomes*** are statements that describe what students are expected to know and be able to do upon graduating from the ISE program. These relate to the skills, knowledge, attitude and behavior that students acquire through the program. The National Board of Accreditation (NBA) has pre-defined the Program Outcomes common for every discipline.

Engineering Graduates will be able to:

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design / Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Background: ***Program Specific Outcomes*** (PSOs) are statements that describes what students are expected to know and be able to do in a **specialized area of discipline** upon graduation from a program. In fact, PSOs are the statements, which are specific to the particular program and they are beyond Program Outcomes (POs). Program Curriculum and other activities during the program must help in the achievement of PSOs along with POs.

Engineering Graduates will be able to:

1. **PSO 1:** Design and build robotic systems for different applications using analytical, logical, and problem-solving skills.
2. **PSO 2:** Develop AI-powered software systems to control and operate robotic systems.
3. **PSO 3:** Apply robotics and AI to solve real-world problems in a variety of domains, including industrial robotics, service robots, exoskeletons, surgical robots, delivery vehicles, autonomous vehicles, and crewless micro aerial vehicles.

Unique Selling Proposition (USP) of AI&R Degree Program at DSU Campus

- **Interdisciplinary Approach:** The program integrates cognitive technologies, AI/ML, computer vision, and robotics. This holistic approach provides a well-rounded understanding of the field.
- **Practical Experience:** A strong emphasis on hands-on learning ensures that students don't just learn theory but also apply it in practical scenarios.
- **Innovation and Ethics:** Encouraging innovation while promoting ethical considerations ensures that students develop a responsible mindset towards the development of intelligent systems.
- **Industry Partnerships and Research Collaboration:** These opportunities provide real-world experience and keep students updated with the latest technological advancements.

Definitions / Descriptions

Definition of Credit:	
1 Hour Lecture (L) Per Week	01 Credit
1 Hour Tutorial (T) Per Week	01 Credit
1 Hour Practical (P) Per Week	0.5 Credit
1 Hour Project (J) Per Week	0.5 Credit

Course code and Definition:	
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management Courses
IPCC	Integrated Professional Core Course
PCC	Professional Core Courses
PEC	Professional Elective Courses
OEC	Open Elective Courses
AEC	Ability Enhancement Courses
UHV	Universal Human Value Course
PROJ	Project Work
INT	Internship

SCHEME 2023 – 2024 Batch

I-SEMESTER (CHEMISTRY CYCLE)											
S.N	Course Type & Code	Course Title	Teaching Hours / Week				Examination				Credits
			Lecture	Tutorial	Practical	Project	Contact Hours	CIE Marks	SEE Marks	Total Marks	
			L	T	P	J					
1	24EN1101	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS	3	0	0	0	3	60	40	100	**3**
2	24EN1102	C PROGRAMMING FOR PROBLEM SOLVING	2	1	2	0	5	60	40	100	**4**
3	24EN1103	ENGINEERING CHEMISTRY	2	0	2	0	4	60	40	100	**3**
4	24EN1104	INTRODUCTION TO MECHANICAL ENGINEERING	2	0	2	0	4	60	40	100	**3**
5	24EN1105	INTRODUCTIONTO ELECTRICAL ENGINEERING	2	0	0	0	2	60	40	100	**2**
6	24EN1106	ENGINEERING MECHANICS	2	0	0	0	2	60	40	100	**2**
7	24EN1107	TECHNICAL ENGLISH	2	0	0	0	2	100	-	100	**2**
8	24EN1108	ENVIRONMENTAL SCIENCE	1	0	0	0	1	50	-	50	**1**
9	24EN1109	KANNADA KALI / MANASU	1	0	0	0	1	50	-	50	**0**
	TOTAL		**17**	1	**6**	**0**	**24**	**560**	**240**	**800**	**20**

L – Lecture, T – Tutorial, P – Practical, J – Project, CIE – Continuous Internal Evaluation, SEE- Semester End Examinations.

I-SEMESTER (PHYSICS CYCLE)											
S.N	Course Type & Code	Course Title	Teaching Hours / Week				Examination				Credits
			Lecture	Tutorial	Practical	Project	Contact Hours	CIE Marks	SEE Marks	Total Marks	
			L	T	P	J					
1	24EN1101	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS	3	0	0	0	3	60	40	100	**3**
2	24EN1102	C PROGRAMMING FOR PROBLEM SOLVING	2	1	2	0	5	60	40	100	**4**
3	24EN1110	ENGINEERING PHYSICS	3	0	2	1	5	60	40	100	**4**
4	24EN1111	INTRODUCTION TO ELECTRONICS ENGINEERING	3	0	0	0	3	60	40	100	**3**
5	24EN1112	ENGINEERING GRAPHICS AND DESIGN THINKING	2	0	2	0	4	60	40	100	**3**
6	24EN1113	BIOLOGY FOR ENGINEERS	2	0	0	0	2	100	-	100	**2**
7	24EN1114	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	1	0	0	0	1	50	-	50	1
	TOTAL		**16**	1	**6**	**0**	**23**	**450**	**200**	**650**	**20**

L – Lecture, T – Tutorial, P – Practical, J – Project, CIE – Continuous Internal Evaluation, SEE- Semester End Examinations.

II-SEMESTER (CHEMISTRY CYCLE)											
S.N	Course Type & Code	Course Title	Teaching Hours / Week				Examination				Credits
			Lecture	Tutorial	Practical	Project	Contact Hours	CIE Marks	SEE Marks	Total Marks	
			L	T	P	J					
1	24EN1201	SINGLE AND MULTIVARIATE CALCULUS	3	0	0	0	3	60	40	100	**3**
2	24EN1202	OBJECT ORIENTED PROGRAMMING	2	1	2	0	5	60	40	100	**4**
3	24EN1103	ENGINEERING CHEMISTRY	2	0	2	0	4	60	40	100	**3**
4	24EN1104	INTRODUCTION TO MECHANICAL ENGINEERING	2	0	2	0	4	60	40	100	**3**
5	24EN1105	INTRODUCTIONTO ELECTRICAL ENGINEERING	2	0	0	0	2	60	40	100	**2**
6	24EN1106	ENGINEERING MECHANICS	2	0	0	0	2	60	40	100	**2**
7	24EN1107	TECHNICAL ENGLISH	2	0	0	0	2	100	-	100	**2**
8	24EN1108	ENVIRONMENTAL SCIENCE	1	0	0	0	1	50	-	50	**1**
9	24EN1109	KANNADA KALI / MANASU	1	0	0	0	1	50	-	50	0
	TOTAL		**17**	1	**6**	**0**	**24**	**560**	**240**	**800**	**20**

L – Lecture, T – Tutorial, P – Practical, J – Project, CIE – Continuous Internal Evaluation, SEE- Semester End Examinations.

II-SEMESTER (PHYSICS CYCLE)											
S.N	Course Type & Code	Course Title	Teaching Hours / Week				Examination				Credits
			Lecture	Tutorial	Practical	Project	Contact Hours	CIE Marks	SEE Marks	Total Marks	
			L	T	P	J					
1	24EN1201	SINGLE AND MULTIVARIATE CALCULUS	3	0	0	0	3	60	40	100	**3**
2	24EN1202	OBJECT ORIENTED PROGRAMMING	2	1	2	0	5	60	40	100	**4**
3	24EN1110	ENGINEERING PHYSICS	3	0	2	1	5	60	40	100	**4**
4	24EN1111	INTRODUCTION TO ELECTRONICS ENGINEERING	3	0	0	0	3	60	40	100	**3**
5	24EN1112	ENGINEERING GRAPHICS AND DESIGN THINKING	2	0	2	0	4	60	40	100	**3**
6	24EN1113	BIOLOGY FOR ENGINEERS	2	0	0	0	2	100	-	100	**2**
7	24EN1114	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	1	0	0	0	1	50	-	50	1
	TOTAL		**16**	1	**6**	**0**	**17**	**450**	**200**	**650**	**20**

L – Lecture, T – Tutorial, P – Practical, J – Project, CIE – Continuous Internal Evaluation, SEE- Semester End Examinations.

III-SEMESTER													
S.N	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Project	Contact Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	BSC	24AIR2301	PROBABILITY AND STATISTICS	MAT	3	0	0	0	3	60	40	100	**3**
2	IPCC	24AIR2302	DATA STRUCTURES	CSE	2	0	2	0	4	60	40	100	**4**
3	IPCC	24AIR2303	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	AIR	3	0	0	0	3	60	40	100	**3**
4	IPCC	24AIR2304	FOUNDATIONS OF MACHINE LEARNING AND NEURAL NETWORKS	AIR	3	0	2	0	5	60	40	100	**4**
5	IPCC	24AIR2305	FUNDAMENTALS OF ROBOT MECHANICS	AIR	3	1	0	0	4	60	40	100	**3**
6		24AIR23XX	LIBERAL STUDIES - I		1	0	0	0	1	50	--	50	**1**
7	SEC	24AIR23XX	SKILL ENHANCEMENTCOURSE - I		1	0	2	0	3	100	--	100	**2**
8	AEC	24AIR2306	COGNITIVE AND TECHNICAL SKILLS - III	ANY DEPT.	0	0	4	0	4	100	--	100	**2**
		TOTAL			**17**	**0**	**12**	**0**	**29**	**550**	**200**	**750**	**22**

Skill Enhancement Course – I		
S.N	**Course Code**	**Course Name**
1	24AIR23XX	PLC Programming for Automated Systems
2	24AIR23XX	Hydraulics and Pneumatics for Robotics

IV-SEMESTER													
S.N	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Project	Contact Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	BSC	24AIR2401	TRANSFORMS AND NUMERICAL TECHNIQUES	MAT	3	0	0	0	3	60	40	100	**3**
2	IPCC	24AIR2402	MECHATRONICS AND SMART MANUFACTURING	CSE	2	0	2	2	6	60	40	100	**4**
3	IPCC	24AIR2403	KINEMATICS AND DYNAMICS FOR ROBOTICS	AIR	2	0	2	2	6	60	40	100	**4**
4	IPCC	24AIR2404	COMPUTER ORGANIZATION AND ARCHITECTURE	CSE	3	1	0	0	4	60	40	100	**4**
5	IPCC	24AIR2405	ADVANCED DEEP LEARNING	AIR	3	0	0	0	3	60	40	100	**3**
6	SEC	24AIR24XX	SKILL ENHANCEMENTCOURSE - II	CST	1	0	2	0	3	100	--	100	**2**
7	AEC	24AIR2406	COGNITIVE AND TECHNICAL SKILLS - IV	CST	0	0	4	0	4	100	--	100	**2**
		TOTAL			**14**	**1**	**10**	**4**	**29**	**500**	**200**	**700**	**22**

Skill Enhancement Course – II		
S.N	**Course Code**	**Course Name**
1	24AIR24XX	Prototyping with 3 D Printing
2	24AIR24XX	Internet of Things

	V-SEMESTER												
S.N	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Project	Contact Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	IPCC	24AIR3501	MOBILE ROBOTICS	AIR	2	0	0	2	4	60	40	100	**3**
2	IPCC	24AIR3502	REINFORCEMENT LEARNING	AIR	2	0	2	0	4	60	40	100	**3**
3	IPCC	24AIR3503	CONTROL SYSTEMS FOR ROBOTICS		3	0	0	0	3	60	40	100	**3**
4	IPCC	24AIR3504	ROBOT OPERATING SYSTEMS		3	0	0	2	5	60	40	100	**4**
5	IPCC	24AIR3505	ROBOTIC VISION		3	0	2	0	5	60	40	100	**4**
6	SEC	24AIR35XX	PROFESSIONAL ELECTIVE - I		3	0	0	0	3	60	40	100	**3**
7	AEC	24AIR3506	COGNITIVE AND TECHNICAL SKILLS - V		0	0	4	0	4	100	--	100	**2**
					16	**0**	**8**	**4**	**28**	**460**	**240**	**700**	**22**

Professional Elective Course – I		
S.N	**Course Code**	**Course Name**
1	24AIR3507	THERMAL FLUIDS AND ELECTRONICS COOLING
2	24AIR3508	PATTERN RECOGNITION
3	24AIR3509	ADVANCED AI TECHNIQUES FOR ROBOTICS
4	23AIR3510	HEALTHCARE ROBOTICS

VI-SEMESTER														
S.N	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Project	Contact Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	IPCC	24AIR3601	GENERATIVE AI		3	0	2	0	5	60	40	100	**4**
2		24AIR3602	MANAGEMENT AND ENTREPRENUERSHIP		2	0	0	0	2	60	40	100	**2**
3		24AIR3603	HUMANOID ROBOTS		3	0	2	0	5	60	40	100	**4**
4		24OE36XX	OPEN ELECTIVE - I		3	0	0	0	3	60	40	100	**3**
5		24AIR36XX	PROFESSIONAL ELECTIVE - II		3	0	0	0	3	60	40	100	**3**
6		24AIR36XX	PROFESSIONAL ELECTIVE - III		3	0	0	0	3	60	40	100	**3**
7		24AIR3604	COGNITIVE AND TECHNICAL SKILLS - VI		0	0	4	0	4	100	--	100	**2**
		TOTAL			**17**	**0**	**8**	**0**	**25**	**460**	**240**	**700**	**21**

NOTE:

Internship: All the students admitted to III year shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A university examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

Open Electives-I		
S.N	**Course Code**	**Course Name**
1	XXXXX	Agile Methodology for Project Development
2	XXXXX	Product Engineering & Entrepreneurship

Professional Elective Course – II		
S.N	**Course Code**	**Course Name**
1	24AIR3605	ROBOTIC MANIPULATION AND GRASPING
2	24AIR3606	HEURISTIC ALGORITHMS FOR GLOBAL OPTIMIZATION
3	24AIR3607	COGNITIVE ARCHITECTURES
4	24AIR3608	AGRICULTURAL ROBOTICS

Professional Elective Course – III		
S.N	**Course Code**	**Course Name**
1	24AIR3609	MULTI-ROBOT SYSTEMS
2	24AIR3610	BLOCKCHAIN AND SECURITY IN AI
3	24AIR3611	EXPERT SYSTEMS AND APPLICATIONS
4	24AIR3612	ROBOTIC LOGISTICS AND WAREHOUSING

	VII-SEMESTER												
S.N	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Lecture	Tutorial	Practical	Project	Contact Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1		24AIR4701	FUNDAMENTALS OFECONOMICS		3	0	0	0	3	60	40	100	**3**
2		24AIR4702	COGNITIVE SYSTEMS IN AI AND ROBOTICS		3	0	0	2	5	60	40	100	**4**
3		24OE47XX	OPEN ELECTIVE - II		3	0	0	0	3	60	40	100	**3**
4		24AIR47XX	PROFESSIONAL ELECTIVE - IV		3	0	0	0	3	60	40	100	**3**
5		24AIR47XX	PROFESSIONAL ELECTIVE - V		3	0	0	0	3	60	40	100	**3**
6		24AIR4703	CAPSTONE PROJECT PHASE - I		0	0	0	6	6	100	--	100	**3**
		TOTAL			**15**	**0**	**0**	**8**	**23**	**400**	**200**	**600**	**19**

Open Electives-II		
S.N	**Course Code**	**Course Name**
1	XXXXX	Lean Startup Methodology
2	XXXXX	Business Analytics
3	XXXXX	Design Thinking

Professional Elective Course – IV		
S.N	**Course Code**	**Course Name**
1	24AIR4704	INDUSTRIAL ROBOTICS
2	24AIR4705	MULTILINGUAL SPEECH AND LANGUAGE PROCESSING
3	24AIR4706	EMBEDDED SYSTEMS
4	24AIR4707	AUTONOMOUS VEHICLES

Professional Elective Course – V		
S.N	**Course Code**	**Course Name**
1	24AIR4708	SOFT ROBOTICS
2	24AIR4709	FUNDAMENTALS OF VIRTUAL REALITY AND APP DEVELOPMENT
3	24AIR4710	INTODUCTION TO QUANTUM COMPUTING
4	24AIR4711	ROBOTICS IN MANUFACTURING

VIII SEMESTER													
S.N	Course Type	Course Code	Course Name	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Project	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	PROJ	24CS4801	CAPSTONE PROJECT PHASE - II		0	0	0	22	22	60	40	100	12
2	INT	24CS4802	RESEARCH INTERNSHIP/ INDUSTRY INTERNSHIP		0	0	6	0	6	60	40	100	03
			Total		00	00	06	22	28	120	80	200	15

NOTE 1: Internship
Completed during the intervening vacations of VI and VII semesters and /or VII and VIII semesters or VIII semesters
NOTE: Total Credits (I-Sem to VIII Sem) = 160 credits.

SEMESTER	CREDITS
I	20
II	20
III	22
IV	22
V	22
VI	21
VII	19
VIII	15
TOTAL CREDITS	**161**

SCHEME AND SYLLABUS FOR THE FIRST YEAR B.TECH. PROGRAME

Definitions / Descriptions

Definition of Credit	
1 Hour Lecture (L) Per Week	01 Credit
1 Hour Tutorial (T) Per Week	01 Credit
1 Hour Practical (P) Per Week	0.5 Credit
1 Hour Project (J) Per Week	0.5 Credit

Course code and Definition	
BSC	Basic Science Courses
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SEC	Skill Enhancement Courses
UHV	Universal Human Value Course
PROJ	Project Work
INT	Internship

LINEAR ALGEBRA & DIFFERENTIAL EQUATIONS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Course Code	:	23EN1101	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–J	:	3–0–0–0			

Course Learning Objectives:

This Course will enable students to:

1. **Apply** the method of Gauss elimination to solve systems of linear equations and determine the row echelon form of a matrix
2. **Analyze** vector spaces, subspaces, and their properties to identify linear independence, span, and bases in the context of finite-dimensional vector spaces.
3. **Evaluate** and compute the dimensions of vector spaces by understanding the concepts of rank and nullity
4. **Analyze** the properties and characteristics of linear transformations and their corresponding matrices to gain a deeper understanding of their behaviour and applications.
5. **Utilize** the concepts of eigenvalues and eigenvectors, employing diagonalization techniques to determine the diagonal form of a matrix and its implications in various contexts.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I	**08 Hours**

INTRODUCTION:

System of Linear equations. ***(Text Book-1: Chapter 1: 1.1)***

Row reduction and echelon form. ***(Text Book-1: Chapter 1: 1.2)***

Rank of a matrix by row echelon form. ***(Text Book-1: Chapter 4: 4.6)***

Gauss elimination, Inverse of a matrix by Gauss Jordan ***(Text Book-5: Chapter 3: 3.7 and 3.11)***

LU decomposition ***(Text Book-1: Chapter 2: 2.5)***,

UNIT – II	08 Hours
Vector spaces – Subspaces ***(Text Book-1: Chapter 4: 4.1)*** Linear independence – Span - Bases and Dimensions -Finite dimensional vector spaces ***(Text Book-1: Chapter 4: 4.3***) Dimensions, finite dimensional vector spaces ***(Text Book-1: Chapter 4: 4.5)***	
UNIT – III	**09 Hours**
Linear transformation - Matrices of linear transformations ***(Text Book-1: Chapter 1: 1.7 and 1.8)*** Vector space of linear transformations – Inner Product, Orthogonal Vectors - Projections ***(Text Book-1: Chapter 6: 6.1, 6.2 and 6.3)*** Gram- Schmidt Orthogonalization process ***(Text Book-1: Chapter 6: 6.4)***	
UNIT – IV	**07 Hours**
Introduction to Eigenvalues and Eigenvectors ***(Text Book-1: Chapter 5: 5.1)*** Diagonalization of a Matrix ***(Text Book-1: Chapter 5: 5.3)***	
UNIT – V	**07 Hours**
Linear second order ordinary differential equation with constant coefficients (***Text Book-5: Chapter 2***) Solutions of homogenous and non-homogenous equations ***(Text Book-5: Chapter 2: 2.2 to 2.7***) Method of variation of parameters ***(Text Book-5: Chapter 2: 2.10***) Solutions of Cauchy-Euler and Cauchy-Legendre differential equations ***(Text Book-5: Chapter 2: 2.5***)	

Course Outcomes:

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

1. **Solve** systems of linear equations using Gauss elimination and determine the inverse of a matrix by applying the Gauss-Jordan method.
2. **Solve** problems involving row reduction and echelon form in linear algebra to demonstrate an understanding of the concepts and their applications in solving systems of linear equations and transforming matrices.
3. **Analyze** matrices and determine their rank by using row echelon form, examining the relationships between rows and columns, and identifying the motives or causes behind the rank.
4. **Apply** LU decomposition techniques to factorize a matrix into lower and upper triangular matrices, illustrating their understanding of the process and its applications.
5. **Apply** the concepts of vector spaces, subspaces, linear independence, span, bases, and dimensions to solve problems related to finite-dimensional vector spaces, applying acquired knowledge and techniques.

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1						1					
CO2	3	2	1		1				1					
CO3	3	2	1		1				1					
CO4	3	2	1						1					
CO5	3	2	1		1				1					

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. D C Lay, S R Lay and JJ McDonald, Linear Algebra and its Applications, Pearson India, Fifth edition.
2. Linear Algebra and its Applications by Gilbert Strang, 4th Edition, Thomson Brooks/Cole, Second Indian Reprint 2007.
3. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R. Hill, 9th Edition, Pearson Education, 2011.
4. Thomas' Calculus, George B. Thomas, D. Weir and J. Hass, 2014, 13th edition, Pearson.
5. Advanced engineering mathematics, Erwin Kreyszig, Wiley, London, 1972.

REFERENCE BOOKS:

1. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).
2. Higher Engineering Mathematics by B S Grewal, 42nd Edition, Khanna Publishers.
3. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press (2016).
4. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003.
5. Practical Linear Algebra, Farin and Hansford, CRC Press (2013).

E-Resources:

1. https://nptel.ac.in/courses/111101115
2. https://nptel.ac.in/courses/111108066
3. Linear Algebra Basics | Coursera
4. https://nptel.ac.in/courses/111108081
5. https://nptel.ac.in/courses/111106100
6. Differential Equations for Engineers Course (HKUST) | Coursera

Activity Based Learning (Suggested Activities in Class)

1. Introduce the concept of matrix transformations, such as translation, rotation, scaling, and reflection. Provide visual examples and interactive tools that allow students to manipulate shapes and observe the effects of different transformation matrices.
2. Using real-life scenarios or word problems to make the activity of solving linear equations using matrix method.
3. Some real-world scenarios that can be modelled using ODEs, such as population growth, radioactive decay, or chemical reactions that can be discussed and solve using appropriate methods.

ENGINEERING CHEMISTRY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	23EN1102	**Credits**	:	03
Hours / Week	:	04 Hours	**Total Hours**	:	26 + 26 Hours
L–T–P–J	:	2–0–2–0			

Course Learning Objectives:

This Course will enable students to:

- **Understand** the principles of chemical fuel towards energy production.
- **Apply** the concept of energy conversion from solar to electric energy in photovoltaic cells.
- **Understand** the basic principles of electrochemistry to measure the potential of redox reactions. **Illustrate** the construction, working, and applications of batteries, and fuel cells as energy storage devices.
- **Understand** the electrochemical theory of corrosion of metals and its prevention by metal finishing techniques.
- **Understand** the synthesis, structure–property relationship, and the applications of commercial polymers.
- **Understand** the different techniques for the purification of sewage water. **Analyse** the impurities present in waste water systems.

Teaching-Learning Process (General Instructions)

These are some of the innovative pedagogical approaches to accelerate the attainment of the various course outcomes.

1. **Lecture method**: Chalk and talk method, and demonstrations may be adopted to achieve the course outcomes.
2. **Interactive Teaching: Active learning** that includes brainstorming, group work, formulating questions, notetaking, and annotating.
3. Show **Video**s to explain and illustrate the various concepts.
4. Encourage **Collaborative** learning in the class.
5. **Problem Based Learning**, may foster students' analytical skills, ability to evaluate, and process the information.
6. Inculcate the culture of research and encourage students to come up with their own creativity.

UNIT – I Chemical Energy Source	**06 Hours**

Fuels: Introduction to energy; Fuels - definition, classification, importance of hydrocarbons as fuels; Calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Numerical problems on GCV&NCV. Petroleum cracking-fluidized catalytic cracking. Reformation of petrol. octane number, cetane number, anti-knocking agents, power alcohol, and Biodiesel. ***(Text Book-1: Module-3)***

Solar Energy: Thermal energy: Photovoltaic cells-Introduction, definition, importance, working of PV cell. Solar grade silicon physical and chemical properties relevant to photo-voltaics, doping of silicon by diffusion technique. ***(Text Book-1: Module-3)***

UNIT – II Energy Science and Technology	06 Hours
Electrochemistry and Battery Technology: Single electrode potential - Definition, and sign conventions. Standard electrode potential- Definition. EMF of a cell-Definition, notation and conventions. Reference electrodes– Calomel electrode, Ag/AgCl electrode. Measurement of standard electrode potential. Battery technology: Basic concepts including characteristics of anode, cathode, electrolyte and separator. Battery characteristics. Classification of batteries– primary, secondary and reserve batteries. State of the art Batteries-Construction working and applications of Zn-air, Lead acid battery, Nickel-Metal hydride and Lithium ion batteries. ***(Text Book-2: Module-1)*** **Fuel Cells:** Introduction to fuel cells, types of fuel cells. Construction, working and application of Methanol-Oxygen fuel cell. ***(Text Book-2: Module-1)***	
UNIT – III Corrosion Science and Surface Modification Techniques	**06 Hours**
Corrosion Science: Definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Factors affecting the rate of corrosion, Corrosion control: Metal coatings-Galvanization, Tinning and its disadvantages. Cathodic protection of Corrosion: Sacrificial anode method and current impression method. ***(Text Book-2: Module-2)*** **Surface Modification Techniques:** Definition, Technological importance of metal finishing. Significance of polarization, decomposition potential and over-voltage in electroplating processes. Electroless Plating. Distinction between electroplating and Electroless plating, advantages of electroless plating. Electroless plating of copper. ***(Text Book-2: Module-2)***	
UNIT – IV Polymers	**02 Hours**
Polymers: Introduction to polymers, Glass transition temperature, structure and property relationship. Synthesis, properties and applications of Teflon. PMMA. Synthesis, properties and application of silicone rubber. ***(Text Book-1: Module-4)***	
UNIT – V Water Technology & Instrumental Methods of Analysis:	**06 Hours**
Water Technology: Impurities in water. Hardness of Water: Types of Hardness and determination of total hardness of water by using disodium salt of ethylenediaminetetraacetic acid method. Alkalinity. Potable water treatment by Electro dialysis and Reverse Osmosis. Water analysis- Biochemical oxygen demand and Chemical oxygen demand. Determination of COD. Numerical problems on COD. Sewage treatment. ***(Text Book-2: Module-5)*** **Instrumental Methods of Analysis:** Instrumental methods of analysis, Principles of Potentiometry, Conductometry (Strong acid against strong base, weak acid against strong base, mixture of strong acid and a weak acid against strong base).	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Determination** of calorific value of fuels and **apply** the concepts of energy conversion for photovoltaic cells.	L3
2	**Apply** the basic principles of electrochemistry for the construction of energy storage devices.	L3
3	**Implement** the electrochemical theory to **analyze** the concept of corrosion of metals and its prevention by surface modifications.	L3
4	**Apply** the concept of polymerization for the synthesis of polymers and study their structure-property relationship for commercial applications.	L3
5	**Demonstrate** the techniques in the purification of sewage water. **Determine** the hardness and oxygen demand of the provided waste water samples.	L2

Table: Mapping Levels of COs to POs

COs	Program Outcomes (POs)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	3	0	0	0	0	0	0	0	0	0
CO2	3	2	2	0	0	0	0	0	0	0	0	0
CO3	3	1	1	0	0	0	0	0	0	0	0	0
CO4	3	1	3	0	0	0	0	0	0	0	0	0
CO5	3	1	3	0	0	0	0	0	0	0	0	0

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

Text Books

1. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978- 93-85155-70-3, 2022.
2. Engineering Chemistry - by Chandra Shekara B M and Basavaraju B C, Banbayalu (publications), Bengaluru, 2014, 294 pages.

Reference Books

1. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
2. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.
3. Wiley's Engineering Chemistry (Wiley India), 2nd Edition, 2013, 1026 pages.

E-Resources

1. https://nptel.ac.in/

2. https://swayam.gov.in/

3.https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Electrochemistry/Basics_of_Electrochemistry

Activity Based Learning (Suggested Activities in Class)

1. Analyze research problems by reading research articles, group discussion, and presentations.
2. Demonstration of solution to a problem through experiential learning.
3. Demonstrations using real objects, taking students on an educational tour.

ENGINEERING CHEMISTRY- LABORATORY

Total: 26 Hrs

Volumetric Analysis and Preparations

1. Evaluation of quality of water in terms of total hardness by complexometric titration.
2. Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample.
3. Determination of alkalinity of the given water sample

Instrumental methods of Analysis

1. Potentiometric titration–Estimation of FAS using standard $K_2Cr_2O_7$ solution.
2. Conductometric estimation of a mixture of a weak and strong acid using standard sodium hydroxide solution
3. Determination of viscosity coefficient of a given liquid
4. Colorimetric estimation of copper in a given solution
5. Determination of pKa of given weak acid.

Reference Books

1. Dayananda Sagar University laboratory manual.
2. J. Bassett, R.C. Denny, G.H. Jeffery, Vogels, Text book of quantitative inorganic analysis, 4^{th} Edition.

SEMESTER	I/II					
COURSE CODE	23EN1103					
TITLE OF THE COURSE	INTRODUCTION TO MECHANICAL ENGINEERING					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	2	0	2	0	26(L)+26(P) = 52	3

COURSE OBJECTIVES:

The course will enable the students to

- Acquire a basic understanding of renewable energy resources and basic concepts of hydraulicturbines.
- Acquire knowledge of various engineering materials and metal joining techniques.
- Acquire essential knowledge of modern manufacturing tools and techniques.
- Acquire knowledge on basics of refrigeration and air-conditioning.
- Explain about the cooling of electronic devices.
- Acquire knowledge of basic concepts of mechatronics and robotics.
- Explain about the electric and hybrid vehicles.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Describe basic concepts of renewable energy resources andpower generation	L2
CO2	Distinguish various engineering materials and metal joining techniques	L2
CO3	Demonstrate different modern manufacturing tools andtechniques	L3
CO4	Make use of basic concepts of refrigeration and air-conditioning concepts	L3
CO5	Illustrate essential knowledge of basic concepts of mechatronics and robotics	L2
CO6	Comprehend the important concepts of electric and hybrid vehicles	L2

COURSE CONTENT:	
MODULE 1 Energy Sources and Power Generation	**10 Hrs**
Review of energy sources: Construction and working of Hydel power plant, Thermal power plant, Nuclear power plant, Solar power plant, Tidal power plant, Wind power plant. Principle and Operation of Hydraulic turbines, Pelton Wheel, Francis Turbine and Kaplan Turbine. Working of Centrifugal Pump& reciprocating pump. **Thermodynamics:** System, boundary, surroundings, types of systems, Zeroth law, First and second laws of thermodynamics, Efficiency, COP, Carnot theorem	

MODULE 2 Engineering Materials and Metal Joining Processes	10 Hrs
Metals-Ferrous: Tool steels and stainless steels. Non-ferrous /metals: aluminum alloys. **Ceramics-** Glass, optical fiber glass, cermets. **Composites-** Fiber reinforced composites, Metal matrix Composites.	
Smart materials- Piezoelectric materials, shape memory alloys, semiconductors, and super-insulators. **Metal Joining Processes:** Fitting, Sheet metal, Soldering, brazing and Welding: Definitions. Classification and methods of soldering, brazing, and welding. Brief description of arc welding, Oxy- acetylene welding, Introduction to TIG welding and MIG welding.	
MODULE 3 Modern Manufacturing Tools and Techniques	**12 Hrs**
CNC: Introduction, components of CNC, advantages and applications of CNC, CNC Machining centres and Turning Centers Concepts of Smart Manufacturing and Industrial IoT. **Additive Manufacturing:** Introduction to reverse Engineering, Traditional manufacturing vs Additive Manufacturing, Computer aided design (CAD) and Computer aided manufacturing (CAM) and Additive Manufacturing (AM), Different AM processes, Rapid Prototyping, Rapid Tooling, **3D printing:** Introduction, Classification of 3D printing process, Applications to various fields.	
MODULE 4 Thermal Systems and Management	**10 Hrs**
Heat in Electronic Devices: Modes of Heat Transfer, heat generation in electronics, temperature measurement, heat sink, Cooling of electronic devises: Active, Passive, and Hybrid Cooling . **Refrigeration:** Principle of refrigeration, Refrigeration effect, Ton of Refrigeration, COP, Refrigerants and their desirable properties. Principles and Operation of Vapor Compression and Vapor absorption refrigeration. Applications of Refrigerator. **Air-Conditioning:** Classification and Applications of Air Conditioners. Concept and operation of Centralized air conditioning system.	
MODULE 5 Advanced Technologies	**10 Hrs**
Mechatronics: Introduction, Concept of open-loop and closed-loop systems, Examples of Mechatronic systems and their working principle. **Robotics:** Introduction, Robot anatomy, Joints & links, common Robot configurations. Applications of Robotics in Material Handling, Processing, Assembly, and Inspection. **Electric and Hybrid Vehicles:** Introduction, Components of Electric and Hybrid Vehicles, Drives and Transmission. Advantages and disadvantages of EVs and Hybrid vehicles.	

List of Laboratory/Practical Experiments activities to be conduct
• Demonstration on Principle and Operation of any one Turbo machine • Demonstration on pumps • Visit any one Conventional or Renewable Energy Power Plant and prepare a comprehensive report. • One exercises each involving Fitting and Sheet metal.One exercises each involving welding and Soldering. • Study oxy-acetylene gas flame structure and its application to gas welding • Demonstration on Principle and Operation of CNC machine. • Demonstration on Principle and Operation of 3D printing process. • Demonstration of anyone Heat transfer application device and prepare a comprehensive report. • Demonstration of anyone air conditioning system. • Demonstration of the machine consists of Gear Trains. • Demonstration of various elements of mechatronic system. • Demonstration of any one model of Robot

TEXT BOOKS:

1. Basic and Applied Thermodynamics, P.K.Nag, Tata McGraw Hill 2nd Ed., 2002
2. Non-Conventional Energy Sources, G.D Rai, Khanna Publishers, 2003
3. Elements of Workshop Technology (Vol. 1 and 2), Hazra Choudhry and Nirzar Roy, Media Promoters and Publishers Pvt. Ltd., 2010
4. Thermal Management in Electronic Equipment, HCL Technologies, 2010
5. Robotics, Appu Kuttan KK K. International Pvt Ltd, volume 1

REFERENCES:

1. An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, Third Edition,2012
2. Turbo Machines, M. S. Govindegowda and A. M. Nagaraj, M. M. Publications 7th Ed, 2012
3. Manufacturing Technology- Foundry, Forming and Welding, P.N.Rao Tata McGraw Hill 3rd Ed.,2003.
4. Thermal Management of Microelectronic Equipment, L. T. Yeh and R. C. Chu, ASME Press, NewYork, 2002
5. Fundamentals of Robotics: Analysis and Control, Robert J. Schilling, Pearson Education (US).

INTRODUCTION TO ELECTRICAL ENGINEERING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	23EN1104	**Credits**	:	02
Hours / Week	:	02 Hours	**Total Hours**	:	26 Hours
L–T–P-J	:	2–0–0-0			

Course Learning Objectives:

This course enables students to:

- **Demonstrate** a foundational understanding of electrical quantities, including current, voltage, power, and energy.
- **Apply** fundamental laws of electric circuits, such as Ohm's law and Kirchhoff's laws to evaluate electrical circuits.
- **Explain** fundamental concepts of electro-magnetic circuits.
- **Demonstrate** a foundational understanding of the working principles, construction, and characteristics of DC machines.
- **Illustrate** the construction, operation, and types of transformers, considering their significance in electrical systems.
- **Explain** the structure and components of electrical power system, highlighting their interconnections.
- **Explain** emerging trends of green energy technologies and smart metering.
- **Explain** the importance of earthing, protective devices, and proper wiring for ensuring electrical safety.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I	**10 Hours**

Fundamentals laws of Electrical circuit and elements: Electrical charge, potential; current; power and energy; AC and DC current (mathematical treatment); Ohm's law; KCL and KVL in resistive circuits; series and parallel combination of resistors; voltage and current division rule;

V-I relationships for inductor and capacitor under AC voltage; impedance and admittance (series RC and RL); Overview of active power, reactive power and power factor; Introduction to 3 phase systems; Simulation using LTspice software to demonstrate voltage division, current division in resistive circuits. Simulation using LTspice software to show voltage and current waveform for RC and RL circuit.

(TextBook-1: Chapter 1: 1.1 to 1.4, 1.6 to 1.8. Chapter 2: 2.1 to 2.3. Chapter 4: 4.1 to 4.4 Chapter 6: 6.1 to 6.4)

UNIT – II	**10 Hours**

Electromagnetic circuits:
Magnetic circuits: Basics of magnetic circuits (flux, mmf, permeability, reluctance, B and H); Relation between field theory and circuit theory; Faraday's and lenz's laws, Lorentz force; Self and Mutual inductance.
DC machines: Principle of operation of DC generator; generated EMF equation; classification; characteristics and applications. (Introductory treatment only); Principle of operation of DC Motor; back EMF; speed and torque; classification; characteristics and applications. Losses and efficiency in DC machines.
Transformers: Construction, working principle, induced emf equation; step-up and step down; losses and efficiency.

(TextBook-2: Chapter 7: 7.1 to 7.12; Textbook 1: 10.1, 10.2, 10.4, 10.5, 10.8, 10.9, 10.11 and 10.12; Chapter 8: 8.1, 8.2 and 8.9)

UNIT – III	**06Hours**

Powers system fundamentals: Power system structure; generations sources; green energy; smart meters; power tariff calculations; Electrical safety and standards (IS: 732-2019, IEC: 60446): Colour code of wires for single phase supply, earthing, fuse and MCB.

(Textbook 1: , Chapter 16: 16.1 to 16.5; Textbook 2: Chapter 24: 24.1 to 24.6)

Course Outcome	**Description**	**Bloom's Taxonomy Level**
At the end of the course the student will be able to:		
CO1	**Solve** for voltage, current, power and energy in purely R, series RL and RC circuits under DC and AC voltages.	L3
CO2	**Demonstrate** understanding of principle of operation of DC machines and its applications.	L2
CO3	**Demonstrate** understanding of the working principle of transformers.	L2
CO4	**Demonstrate** understanding of the working principle of transformers, generation sources, the significance of renewable energy sources in electrical engineering, and safety practices.	L2
CO5	Demonstrate proficiency in using simulation software (e.g., LTspice) to simulate and **solve** electrical parametrs.	L3

Table: Mapping Levels of COs to POs / PSOs															
COs	**Program Outcomes (POs)**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2		1	3						1		1		
CO2	3	2									1		1		
CO3	3	2									1		1		
CO4	3					2	3	2			1		1	1	2
CO5	3	3	2	1	3				1	1	2	2	1	1	

TEXT BOOKS:

1. D.P.Kothari and I.J. Nagrath, "Basic Electrical Engineering", 4th Edition, Tata McGraw Hill, 2019.
2. B.L. Theraja and A.K. Therja, "A textbook of electrical technology, Vol. I (Basic electrical Engineering)", S. Chand Publishing, 23rd Rev Ed, 2006.

REFERENCE BOOKS:

1. Clayton Paul, Syed A Nasar and Louis Unnewehr, "Introduction to Electrical Engineering", 2nd Edition, McGraw-Hill, 1992.
2. William H Hayt and Jack E Kimberly and Steven M Durbin, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill, 2013.

E-Resources:

1. https://nptel.ac.in/courses/108/108/108108076

Activity Based Learning (Suggested Activities in Class):

1. Real world problem solving using group discussion and hands-on activities. E.g., Interfacing different types of sensors using Arduino.
2. Simulation of different electrical circuits. E.g., RL and RC circuits.

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C PROGRAMMING FOR PROBLEM SOLVING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Course Code	:	23EN1112	**Credits**	:	04
Hours/Week	:	05 Hours	**Total Hours**	:	26(L) + 13(T) + 26 (P) Hours
L–T–P–J	:	2–1-2–0			

Course Learning Objectives:

This Course will enable students to:

1. **Elucidate** the basic architecture and functionalities of C programming language.
2. **Apply** programming constructs of C language to solve the complex problems
3. **Explore** data structures like arrays, structures, unions and pointers in implementing solutions to real world problems
4. **Design** and Develop Solutions to problems using structured programming constructs such as functions.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. ***Interactive Teaching:*** Adopt the Active learning that includes brainstorming,
discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that possible, it helps improve the students' understanding.

UNIT – I	**07 Hours**

Basics and overview of C: Introduction to Problem Solving using Algorithms and Flowchart: Key features of Algorithms: Sequence, Decision, Repetition with examples. Background, structure of C program, keywords, Identifiers, Data Types, Variables, Constants, Input / Output statements, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions. Conditional Branching Statements-if and switch statements, iterative statements (loops)-while, for, do-while statements, Loop examples, Nested loops, break, continue, go to statement.

(Text Book-1: Chapter 2 & Chapter 3)

UNIT – II	**05 Hours**

Arrays: Introduction, declaration & initialization of array, reading and writing array elements,

Operations on array: Traversal, searching (Linear and Binary search), sorting (Bubble sort and Selection Sort). Declaration and Initialization of two-dimensional arrays. Matrix Operations (addition, subtraction, multiplication, transpose) using two-dimensional array.
Strings: Definition, declaration, initialization, and representation. String handling functions and character handling functions.
(Text Book-1: Chapter 5:5.1 to 5.9 & Chapter 6)

UNIT – III	**06 Hours**

Pointers: Definition and declaration and initialization of pointers. Accessing values using pointers. Accessing array elements using pointers.
Functions: Definition and declaration. Built-in functions and User-defined functions. Categories of functions with example. Pointers as function arguments, array as function argument, Call-by-value and call-by-reference. Recursion.
(Text Book-1: Chapter 7: 7.1 to 7.17 & Chapter 4:4.1 to 4.8, 4.10)

UNIT – IV	**04 Hours**

Structures: Purpose and usage of structures. Declaration of structures. Assignment with structures. Structure variables and arrays. Nested structures. Student and employee database implementation using structures.
Unions: Declaration and initialization of a union. Difference between structures and unions. Example programs.
(Text Book-1: Chapter 8: 8.1, 8.2,8.6)

UNIT – V	**04 Hours**

Memory allocation in C programs: Dynamic memory allocation, memory allocation process, allocating a block of memory, releasing the used space, altering the size of allocated memory.
Files: Defining, open, read, write, seek and closing of both textual and random files.
(Text Book-1: Chapter 7: 7.18 to 7.20 & Chapter 9: 9.1 to 9.5, 9.8)

Course Outcome	**Description**	**Bloom's Taxonomy Level**
At the end of the course the student will be able to:		
1	**Apply** programming constructs of C language to solve the real-world problem.	L3
2	**Choose** appropriate data type for implementing solutions to solve problems like searching and sorting.	L3
3	**Examine** suitable user-defined data structures in implementing solutions, using modular programming constructs.	L4
4	**Analyze** efficient ways for managing data and storage.	L4
5	**Justify** a solution using a modern IDE and associated tools, conduct a code review and contribute in a small-team.	L5

Table: Mapping Levels of COs to POs / PSOs														
COs	**Program Outcomes (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3													
CO2		2												
CO3			2										1	
CO4				2										
CO5					3				2				1	

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Reema Thareja, "Programming in C". Oxford University Press, Second Edition, 2016.

REFERENCE BOOKS:

1. Brian W. Kernigham and Dennis M. Ritchie, (2012) "The C Programming Language", 2nd Edition, PHI.
2. Behrouz A. Forouzan, Richard F. Gilberg, "Computer Science - A Structured Approach Using C", Cengage Learning, 2007.
3. Vikas Gupta, "Computer Concepts and C Programming", Dreamtech Press 2013.

E-Resources:

1. https://nptel.ac.in/courses/106/105/106105171/ MOOC courses can be adopted for more clarity in understanding the topics and verities of problem-solving methods.
2. https://www.w3schools.com/c/index.php
3. https://www.guvi.in/courses/web-development/c-programming/
4. https://www.tutorialspoint.com/cprogramming/index.htm
5. https://pythontutor.com/

Activity Based Learning (Suggested Activities in Class)

- Demonstration of solution to a problem through designing the Flowchart or any design notations using **draw.io** in the group of four and justify using snippets or algorithms.

C PROGRAMMING FOR PROBLEM SOLVING LABORATORY

Total Contact Hours: 26

List of Laboratory/Practical Experiments activities to be conducted
1. Programming Basics: Swapping Numbers, Simple Interest, and Factorial. 2. Quadratic Equation Solver 3. Number Operations: Palindrome Check and Power Calculation. 4. Fibonacci Series and Greatest Common Divisor (GCD) Calculation. 5. Calculator Emulation 6. String Manipulation 7. Sorting an Array of Integer Elements. 8. Searching an Array of Elements. 9. Pointer Demonstration using Functions. 10. Case Study on Strings and Functions.

ENGINEERING MECHANICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	23EN1106	**Credits**	:	02
Hours / Week	:	02 Hours	**Total Hours**	:	26 Hours
L–T–P–J	:	2–0–0–0			

Course Learning Objectives:

This Course will enable students to:

1. **Illustrate** Couples and equivalent force couple system
2. **Understand the** principles of resolution and composition of forces
3. **Calculate** moment of coplanar concurrent and coplanar non-concurrent forces
4. **Draw** free body diagrams of objects subjected to coplanar concurrent and non-concurrent force systems
5. **Calculate** center of gravity/centroid for various planar figures
6. **Determine** area moment of inertia for various planar geometrical objects and standard symmetrical sections
7. **Explain** Limiting friction and Laws of Friction
8. **Solve numerical on** wedge friction, ladder friction
9. **Explain** assumptions made in analysis of Trusses
10. **Determine** axial forces in members of Planar determinate Truss
11. **Illustrate** rectilinear, plane curvilinear and projectile motions

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I Introduction to Engineering Mechanics	**06 Hours**

INTRODUCTION:

Introduction to Engineering Mechanics, Force Systems Basic concepts, Particle Equilibrium in 2-D; System of Forces, Co-planar Concurrent Forces, Resultant- Moment of Forces and its Application; Couples and Resultant of force System, Equilibrium of System of Forces,

UNIT – II Centroid, Centre and gravity and Moment of inertia	05 Hours
Introduction, Centroid of simple figures from first principle, centroid of standar sections Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections	
UNIT – III Friction	**05 Hours**
Introduction, Free body diagrams, Equations of Equilibrium. Types of friction, Limiting friction, Cone of Friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, related problems.	
UNIT – IV Dynamics	**05 Hours**
Introduction, Rectilinear motion; Plane curvilinear motion (rectangular path, and polar coordinates); Projectile motion, Basic terms, general principles in dynamics; Types of motion, motion and simple problems, Kinetics- Newton's laws of motion and related problems.	
UNIT – V Analysis of Trusses	**05 Hours**
Introduction, Classification of trusses, Equilibrium in two and three dimension; Method of Joints; To determine if a member is in tension or compression; Simple Trusses; Zero force members.	

Course Outcomes:

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

1. **Compute** Resultant and reactions by principles and resolution of forces in a plane.
2. **Analyse** the objects under the action of applied and frictional forces in a plane by equations of equilibrium.
3. **Determine** the Moment of Inertia of composite geometrical sections in a plane
4. **Analyse** determinate two-dimensional truss by the method of joints and method of section.
5. **Analyze** the motion of objects by equations of motion, equations of equilibrium, and Newton's laws of motion and **calculate** quantities in projectile motion by equations of motion.

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	0	0	1	1	0	0	0	0	1	3	2
CO2	2	2	2	2	0	0	1	0	0	0	0	0	2	2	0
CO3	3	3	2	2	0	0	1	0	1	0	0	0	3	2	0
CO4	3	3	2	2	0	0	1	0	0	0	0	0	3	3	0
CO5	3	2	2	2	0	0	1	0	0	0	0	0	2	2	0

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall publications.
2. A Nelson (2009), Engineering Mechanics: Statics and dynamics, Tata McGraw Hill publications.

REFERENCE BOOKS:

1. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill publications.
2. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
3. H.J. Sawant, S.P Nitsure (2018), Elements of Civil Engineering and Engineering Mechanics, Technical Publications.

E-Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105108/
2. https://onlinecourses.nptel.ac.in/noc22_ce46/preview
3. https://www.youtube.com/watch?v=LIZ-PQbGZkA

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem through experiential learning.
3. Demonstrations using real objects, taking students on an educational tour.

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TECHNICAL ENGLISH

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I / II

Course Code	:	23EN1107	**Credits**	:	02
Hours / Week	:	02 Hours	**Total Hours**	:	26 Hours
L–T–P-J	:	2-0- 0-0			

Objective:

Developing Communicative competence: Enhancing the Language competence in the technical discourse and augmenting the strategic competence in the social and professional environment.

Course Learning Objectives:

This course will enable students to:

a. To enable students to improve their lexical and grammatical competence.
b. To enhance their verbal and nonverbal communication in a professional environment
c. To optimize oral and written communication.
d. To familiarize the students with employability and job search skills.
e. To enhance the students with soft skills
f. To inculcate critical thinking

Teaching-Learning Process (General Instructions)

These are some of the innovative pedagogical approaches to accelerate the attainment of the various course outcomes.

1. ***Lecture method***: Anecdotes, case studies and Examples from real-life situations may be adopted along with the traditional method of chalk and talk to achieve the course outcome.
2. ***Interactive Teaching: Active learning*** may be adopted which includes brainstorming, Teamwork, focused listening, formulating questions, note-taking, and Role play.
3. ***Collaborative*** learning through Debates and Group Discussion
4. ***Activity-based learning*** to inculcate Critical ***thinking*** – conceptualizing, applying, analyzing, synthesizing, and/or evaluating information from observation, perception, and expression. Minimum three higher-order questions from the real-world context
5. ***Problem-Solving method through*** Activities and discussion / Minimum of three situations to inculcate ***Problem-Solving skills*** and encourage the students to come up with creative ways to solve the problem
6. ***Audio-visual methods*** through language Lab in the teaching of LSRW skills.
7. ***Short films/ Ted talks/ Videos/Animation*** films to explain the functioning of various concepts.
8. ***Flipped learning***
9. ***Peer learning / Peer tutoring***

Module – I	**06 Hours**

Grammar and Usage, Language and Communication.

(Branches of Grammar and Vocabulary Word Formation and Types of Word Formation. Communication process diagram. Types of Communication: Managerial, Corporate, Technical and Other Organizational Communication. Barriers to Effective Communication. Listening: Types and their Importance. Difference between hearing and listening. Speaking: Different aspects of Effective Speaking. Oral presentation Pronunciation Guidelines- Common Errors of Pronunciation-Various Techniques for Neutralization of Mother Tongue Influence)

Objective:

- Revising and practicing grammar will help students to optimize their language Competence
- Listening steps up language learning and improves pronunciation
- Speaking improves one's ability to construct phrases naturally and spontaneously in everyday discussions, Clarity and comprehensiveness in speech.
- Communicating effectively in the Professional environment, to interact with the colleagues and to involve in collaborate initiatives

Module – II	**06 Hours**

Reading: Extensive and Intensive. Technical Paper Writing and Minutes of the Meeting.

Objective:

- Reading provides exposure to the chosen field and helps in the coherence of the thought process
- Technical writing techniques enable the knowledge in the relevant domain and creates better content based on the need of the target group
- Meeting minutes allows to access information such as facts, opinions, votes cast, conflicts, attendees, and other crucial elements at the workplace.

Module – III	**05 Hours**

Memo and E-mail Etiquette. Referencing Skills for Academic Report Writing.

Objective:

- Familiarizing with email etiquettes and correspondence provides learners to form an excellent first impression, establishing trust and confidence.
- Following the Academic conventions helps the students to optimize their reference skills and use references to acknowledge the input of other authors and scholars in their work and avoid plagiarism.
- Writing technical reports develop competence in creating a legally bound account of efforts and choices and engineering technical report propose a solution to a problem in order to inspire action.

Module – IV	**04 Hours**

Group Discussion: Definition, How GD Helps in Student Life & Corporate Life.

Objective: GD helps individuals to achieve the skills of organizing and presenting the ideas and concepts in a cohesive manner and to overcome the inhibition of expression in communication

Module – V	**05 Hours**

Drafting Curriculum Vitae, Resumes, and Cover- Letters. Job Applications.

{Types of Resumes, Preparing Resume, CV and Cover- Letter. Filling Job Application. Difference between Curriculum Vitae, Interview techniques: Telephonic interviews, Group interviews, face-to-face interviews -Mannerism and etiquette}.

Objective: Learning the specifics of creating a CV or Resume helps in the effective presentation of their achievements and skills, and a cover letter is a chance for them to exhibit a few aspects of their personality.

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course, the student will be able to:		
1	Developing language competence **improves** one's ability to construct phrases naturally in everyday discussions and Communication skills and soft skills enhance the self-confidence of students,	L3
2	**Applying** the fundamentals of technical writing techniques provides adequate exposure to the respective domain and creates better content. **Implementing** the technicalities of writing provides better exposure in the domain.	L3
3	**Following** an appropriate style of email reveals the aspect of professionalism. **Develop** technical writing skills to increase the quality of the work and testimony of conduct.	L3
4	**Practicing** communication with greater clarity and ease enable the students to discuss a wide spectrum of topics.	L3
5	Writing resumes or curriculum vitae provides a practice to exhibit their skills and achievements concisely and writing a covering letter enables them to express their personality in the formal context.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1										2				
CO2										2				
CO3										2				
CO4										2				
CO5										2				

TEXT BOOKS:

1. Dhanavel, S.P. "English and Communication Skills for Students of Science and Engineering". Orient Blackswan Pvt. Ltd., 2009.
2. Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice". 3rd Edition, Oxford University Press, 2009.
3. Murphy R. "English Grammar in Use", Cambridge University Press,2012.
4. N. Krishnaswamy and T. Sri Raman. "Creative English for communication", Macmillan Publication, 2005.

REFERENCE BOOKS:

1. Day. R A. "Scientific English: A Guide for Scientists and Other Professional". 2nd Edition, Hyderabad: Universities Press, 2000.
2. Ashraf Rizvi M. "Effective Technical Communication". McGraw Hill Education, 2017.
3. Eastwood J. "Oxford Practice Grammar". Oxford University Press, 1999.

4. Swan M and Walter C. “Oxford English Grammar Course”. Oxford University Press, 2011.
5. Dale, Carnegie. “The Quick and Easy Way to Effective Speaking”. JAICO Publishing House, 2019.
6. Chauhan, Gajendra S and Smita, Kashiramka. “Technical Communication”. India: Cengage Learning India Private Limited, 2018.
7. Bailey, Stephen. “Academic Writing: A Handbook for International Students”. 5th Edition, Routledge, 2017.
8. Kumar, Shiv K and Nagarajan, Hemalatha. “Learn Correct English: Grammar, Composition and Usage”**.** 1st edition, India: Pearson, 2005.
9. Board of Editors. Language and Life: A Skills Approach. Orient BlackSwan, 2018.
10. Sudharshana, NP and C Savitha. English for Engineers. Cambridge University Press, 2018.
11. Kumar, Sanjay and Pushp Lata. English Language and Communication Skills for Engineers. Oxford University Press, 2018.
12. Thomson, A.J. and Martinet, A.V. A Practical English Grammar, OUP, New Delhi: 1986
13. Anne Laws, ―Writing Skills‖, Orient Black Swan, Hyderabad, 2011
14. Richards, C. Jack. Interchange Students’ Book-2 New Delhi: CUP, 2015.

E-Resources:

1. https://gnindia.dronacharya.info/ME/Common-Subjects/Downloads/Technical-Communication/Books/Technical-Communication-Book-9.pdf. Web.
2. https://projects.iq.harvard.edu/files/hks-communications-program/files/ho_murphy_michael-pp-slides_9_30_14.pdf. Web.
3. https://www.youtube.com/watch?v=TR0JZiapxXM. Web.
4. file:///C:/Users/rochn/Downloads/ManualofEnglishGrammarandComposition_10012575.pdf. Web.
5. https://www.youtube.com/watch?v=f5Tao6KHV5w. Web.
6. https://www.sastra.edu/nptel/download/Prof%20GPRagini/pdf_New/Unit%2026.pdf. Web.
7. https://www.hansrajcollege.ac.in/hCPanel/uploads/elearning/elearning_document/English_communication_chapter_13.pdf. Web.
8. https://www.youtube.com/watch?v=voyGGhlpBR8. Web.

Activity Based Learning (Suggested Activities in Class)

1. Observing and responding appropriately to the real-life situations.
2. Encouraging students to participate in Group discussions.
3. Articulating internal observations precisely and confidently through extempore.
4. Producing sentences easily without any grammatical errors in speaking, writing essays, and creative writing.
5. Conducting mock interviews, to refine their expressions, familiarize them with the interview techniques, and provide training for the spontaneous response to tricky questions.
6. Directing students for PowerPoint presentations and orienting them towards the higher order skills of expressing their ideas and concepts with cohesion.

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ENVIRONMENTAL SCIENCES

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	23EN1108	**Credits**	:	01
Hours / Week	:	01 Hour	**Total Hours**	:	13 Hours
L–T–P–J	:	1–0–0–0			

Course Learning Objectives:

This Course will enable students to:

1. Understand the concepts of environment, pollution, energy resources Understand basic engineering principles imminently run physiological processes particularly about engineering designs and solutions are arrived citing body functional examples.
2. Learn water as a resource, rain water harvesting as a method of conversation of water.
3. Explain solid waste and its management.
4. Understand environmental Protection Act laws, environmental Impact Analysis and air monitoring

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* like power point presentations and group discussion may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three higher order thinking questions in the class.
6. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

COURSE CONTENT:

UNIT 1: Environment and ecosystem	**3 Hrs**

Definition of environment; Scope and importance of environmental studies; Basic concepts: Xenobiotic, natural & anthropogenic; why are we concerned? Eco-kinetic & Bio-kinetic Properties of a xenobiotic, Dose-Response Relationships;3 T's, Chronic and acute effects.

UNIT 2 : Pollution and management	**4 Hrs**

Air Pollution: Criteria pollutants – Ozone, Particulate Matter, Carbon Monoxide, Nitrogen, Oxides, Sulphur Dioxide, Lead; Acid Rain Cycle. Water as a resource; Lentic and Lotic Water Systems; Rain Water Harvesting; Water Pollution; Noise pollution-sources and effects of noise; Municipal Solid Waste: Hazardous Waste: Electronic Waste: Biomedical Waste; Solid Waste Management: Landfills, composting Process.

UNIT 3: Energy	**2 Hrs**
Energy Types of energy: Conventional sources of energy, fossil fuel, Coal, Solar, wind; Non-conventional Sources of Energy, Biofuels - biomass, biogas.	
UNIT 4: Disaster	**2 Hrs**
Disasters & Management; Definition, Natural (Earthquakes, landslides, floods), Man-made disasters (biological, chemical, nuclear, radiological explosions) – definition, causes and management and/or mitigation strategies; Bhopal & Chernobyl Disasters.	
UNIT 5: Environmental acts	**2 Hrs**
Environmental Impact Assessment (EIA); Air pollution monitoring and Ambient Air Quality Standards (AAQS); Environment Protection Act, 1986.	

Course Outcome	**Description**	**Bloom's Taxonomy Level**
At the end of the course the student will be able to:		
1	**Critically elucidate** the basic concepts that govern environmental quality, ambient air quality standards.	L3
2.	**Distinguish** different Energy resources and their environmental implications	
3.	**Distinguish** natural and manmade disasters and prevention	L3
4.	**Demonstrate** different types of pollution and waste streams	L3
5.	**Apply** the process of environmental impact assessment and implications of Indian Environment Laws	

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem through experiential learning.
3. Demonstrations using real objects, taking students on an educational tour.

TEXT BOOKS:

1. Benny Joseph (2005). "Environmental Studies", Tata McGraw – Hill Publishing Company Limited, New Delhi.
2. R. J. Ranjit Daniels and Jagadish Krishnaswamy (2014). "Environmental Studies" (2014), Wiley India Pvt Limited, New Delhi.

REFERENCE BOOKS:

1. P. Aarne Vesilind, Susan M.Morgan, Thomson (2008). "Introduction to Environmental Engineering" (2008), Thomson learning, Second Edition, Boston.
2. R. Rajagopalan (2005). "Environmental Studies – From Crisis to Cure" Oxford University Press, New Delhi.

KANNADA KALI

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	23EN1109	**Credits**	:	01
Hours / Week	:	01 Hours	**Total Hours**	:	13 Hours
L–T–P-J	:	1–0–0-0			

Course Learning Objectives:

This course enables students:

- To introduce Kannada language & culture to Non – Kannada speakers.
- To train them to communicate in colloquial Kannada with connivance.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.

UNIT – I	**08 Hours**
Introduction to Karnataka & Kannada Culture, Evolution of Kannada. Introduction to Kannada Alphabets. Introduction to Kannada Numbers.	
UNIT – II	**08 Hours**
Kannada words, sentences & phrase making for colloquial communication.	

TEXT BOOKS:

1. Kannada Kali –Dr. Lingadevaru Halemane
2. Kannada Paatagalu– Editor: Dr. Chandrashekara Kambara.
3. SLN Sharma & K Shankaranarayana “Basic Grammar”, Navakarnataka Publications.
4. Spoken Kannada. Publication: Kannada Sahitya Parishat Bengaluru.

SINGLE AND MULTI VARIABLE CALCULUS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – II

Course Code	:	23EN1201	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–J	:	3–0–0-0			

Course Learning Objectives:

This Course will enable students to:

1. **Apply** sophisticated techniques of differential calculus to solve problems involving functions of multiple variables.
2. **Apply** double and triple integrals in various coordinate systems (Cartesian, polar, cylindrical, and spherical) and effectively employ them to calculate areas, volumes.
3. **Acquire** a comprehensive understanding of fundamental concepts related to functions of multiple variables, including limits, continuity, and partial derivatives.
4. **Analyze** critical points of functions of two or more variables using partial derivatives and Lagrange multipliers, evaluate extreme values.
5. **Apply** vector calculus principles, such as line integrals, surface integrals, and the divergence theorem effectively to vector field.
6. **Analyze** the convergence and divergence of sequences and infinite series of real numbers by employing various convergence criteria and tests.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I	**09 Hours**

Differential Calculus

Functions of two or more variables: Definition, Region in a plane, Level curves, Level surfaces, Limits, Continuity, Partial derivatives, Differentiability, Extreme values and saddle points, Lagrange multipliers. (***Textbook 1: Chapter 14: 14.1 – 14.4, 14.7, 14.8***)

Self-Learning Component: Single variable calculus

UNIT – II	09 Hours

Integral calculus

Double integral and iterated integrals - Cartesian and polar coordinates, Triple integral, Change of variables, Multiple integrals in cylindrical and spherical coordinates. (***Textbook 1: Chapter 15: 15.1 – 15.5, 15.7***)

UNIT – III	09 Hours

Vector Calculus

Line Integrals, Vector Fields, Work, Circulation and flux, Path independence, Potential functions, and Conservative fields, Green's theorem in the plane, Surface area and surface integrals, Surface area of solid of revolution, Parametrized surfaces, Stokes' theorem, The Divergence theorem. (***Textbook 1: Chapter 16: 16.1-16.8***), (***Textbook 2: Chapter 10: 10.1, 10.2, 10.4 – 10.7, 10.9***)

UNIT – IV	6 Hours

Sequence and Series I:

Sequences of real numbers and their convergence criteria, Infinite series, Sequence of partial sums, Tests for convergence/divergence - nth term test, Boundedness and monotonicity, Integral, Condensation, Comparison, Ratio and root tests (***Textbook 1: Chapter 10: 10.1-10.5***)

UNIT – V	06 Hours

Sequence And Series II:

Alternating series, Absolute and conditional convergence, Rearrangement theorem, Power series, Taylor and Maclaurin series (one and two variables). (***Textbook 1: Chapter 10: 10.6-10.8***)

Course Outcomes:

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

1. **Apply** the principles of differential calculus to solve problems involving functions of two or more variables.
2. **Utilize** double and triple integrals in Cartesian, polar, cylindrical, and spherical coordinates to compute areas, volumes, and evaluate mathematical expressions**.**
3. **Extend** a comprehensive understanding of the concepts related to functions of multiple variables, encompassing topics such as limits, continuity, and partial derivatives, and effectively apply them to practical situations and problem-solving scenarios.
4. **Analyze** and evaluate critical points, including extreme values and saddle points, in functions of two or more variables using partial derivatives and Lagrange multipliers.
5. **Analyze** vector calculus concepts, such as line integrals, surface integrals, and the divergence theorem, in the context of vector fields and their applications.
6. **Apply** convergence criteria and various tests, such as the nth term test, boundedness and monotonicity, integral, condensation, comparison, ratio, and root tests, to analyze and determine the convergence or divergence of sequences and infinite series of real numbers.

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1						1					
CO2	3	2	1						1					

CO3	3	2	1						1					
CO4	3	2	1						1					
CO5	3	2	1						1					
CO6	3	2	1						1					

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Thomas' Calculus, George B. Thomas, D. Weir and J. Hass, 2014, 13th edition, Pearson.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India.

REFERENCE BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, 2015, 43rd Edition, Khanna Publishers.
2. Higher Engineering Mathematics, John Bird, 2017, 6 th Edition, Elsevier Limited.
3. Calculus: Early Transcendentals, James Stewart, 2017, 8 th edition, Cengage Learning.
4. Engineering Mathematics, K.A. Stroud and Dexter J. Booth, 2013, 7 th Edition, Palgrave Macmillan.
5. Basic Multi Variable Calculus, Marsden, Tromba and Weinstein, W.H. Freeman, Third Edition

E-Resources:

1. **https://www.youtube.com/playlist?list=PLtKWB-wrvn4nA2h8TFxzWL2zy8O9th_fy**
2. **https://www.youtube.com/playlist?list=PLU6SqdYcYsfJqbZvQECrwnlQrp4fg6isX**

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem through programming.

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ENGINEERING PHYSICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I /II

Course Code	:23EN1110		**Credits**	:	04
Hours / Week	:	03 Hours	**Total Hours**	:	39 + 26 Hours
L–T–P-J	:	3–0–2-0			

Course Learning Objectives:

This Course will enable students to:

1. To introduce the fundamental ideas of quantum mechanics that are necessary for understanding and addressing engineering challenges.
2. To comprehend solids' band structure, semiconductors' electrical conductivity, and semiconductor devices such as LEDs, photodiodes, and solar cells, as well as their applications.
3. To examine many types of engineering materials, including electronic, electrical, mechanical, and magnetic materials, as well as dielectric material properties and applications in science and engineering.
4. To comprehend various crystal systems and determine structure using miller-indices.
5. Describe thin-film phenomena, thin-film production processes, and applications in science and engineering.
6. To understand how to create Nano materials utilizing a top-down and bottom-up method, as well as to explore Nano science and technology, as well as its practical applications in engineering, biology, and medicine.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

SYLLABUS

MODULE – I	08 Hours

QUANTUM MECHANICS:

- Foundations of quantum theory, Wave function and its properties, de-Broglie hypothesis, Heisenberg Uncertainty principle. One dimensional time independent Schrodinger wave equation, Eigen values and Eigen functions. Applications: one dimensional motion of an electron in a potential-well. Basics of Quantum computing - Concepts of Superposition, entanglement, Interference and Qubit. [5 hours]
  (Text book 1: Chapter 1.5 and Chapter 2 all units)

- **LASER PHYSICS:** Introduction to lasers. Conditions for laser action. Requisites of a Laser system Principle, Construction and working of Nd-YAG and Semiconductor Laser. Application of Lasers in Defense (Laser range finder), Engineering (Data storage) and Applications of Lasers in medicine [3 hours]
  (Text book 1: Chapter 5.1, 5.2, 5.3, 5.4, 5.5)

MODULE – II	08 Hours

- **Semiconductor Physics**: Band structure, Fermi level in intrinsic and extrinsic semiconductors, Density of energy states in conduction and valence bands of a semiconductor (Mention the expression), Expression for concentration of electrons in conduction band (Derivation), Hole concentration in valance band (Mention the expression), Intrinsic carrier concentration, Conductivity of semiconductors, Hall effect, Numericals. (5 hours)
  (Text Book-2: Chapter 24.1 to 24.9, Chapter 25.9 to 25.11)

- **Semiconducting devices for optoelectronics applications**: - Principle and working of LED, photodiode, Solar cell, BJT [3 hours]
  (Text Book-2: Chapter 25.1 to 25.8)

MODULE – III	08 Hours

- **Dielectrics:** Introduction – Dielectric polarization **–** Dielectric Polarizability, Susceptibility and Dielectric constant - Types of polarizations: Electronic, Ionic and Orientation polarizations (qualitative) – Lorentz Internal field (Expression only) – Claussius - Mossoti equation (derivation) – Applications of Dielectrics – Numericals. (4 hours)
  (Text book 1: Chapter 4.1, 4.2, 4.3, 4.4, 4.5)

- **Magnetic Materials:** Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability - Classification of magnetic materials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials - Engineering applications. Numiricals (4 hours)
  (Text book 1: Chapter 4.9, 4.10, 4.11)

MODULE – IV	08 Hours

- **Crystallography:** Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, Packing fraction for SCC, BCC and FCC crystal systems. Introduction to Miller Indices. Determination of Crystal structure by Miller Indices. Expression for Inter-planar distance. X-ray diffraction, Bragg's law and Determination of Crystal structure by Powder method. Numericals [4 hours]
  (Text book 1: Chapter 7 all units)

- **Mechanical Engineering Materials** – mechanical properties: stress- strain curve for different materials. Introduction to Tensile strength, Compressive strength, Ductility, Toughness, Brittleness, Impact strength, Fatigue, Creep. Testing of engineering materials: Hardness Tests: Brinell and Vickers hardness test& Numiricals- (4 hours)
  Text Book-2: Chapter 2.1 to 2.7)

MODULE – V	07 Hours

- **Thin films technology:** Introduction to thin-films-Advantages of thin-films over bulk materials. Thin film deposition processes- Physical vapour deposition (Thermal evaporation technique, and sputtering technique) process, Applications of Thin films. [3 hours]
  (Ref. Text Book-2: Chapter 2. All units)

- **Nano Science &technology**: Introduction to Nano materials, Classification of nano materials, Size dependent properties of materials, Top-down and Bottom-up approach- Ball-milling and Photolithography, Process. Fundamental Principles of Biophysics & Applications of Nano technology in Biology and Engineering. [4 hours]
  (Text Book-1: Chapter 8.1 to 8.7)

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Describe the concepts of Quantum mechanics and applications of Schrodinger time independent wave equation in one dimension.	L1 & L3
2	Illustrate Semiconductors, Semiconductor devices like Photo diode, LED, Solar cell and its applications.	L2 & L3
3	Distinguish the different engineering materials such as Electronic, electrical and mechanical materials properties and their applications in engineering.Apply the concept of magnetism to magnetic data storage devices.	L2 & L3
4	Classify Lattice parameters of different crystalline solids by using X-ray diffraction methods and its applications in science and engineering	L1 & L3
5	Interpret Basic concepts of thin films and thin film deposition processes and their applications leads to Sensors and engineering devices.	L2
6	Categorize Nano materials, Properties, and fabrication of Nano materials by using Top-down and Bottom –up approach's - Applications for Science and technology.	L2 & L3

Table: Mapping Levels of COs to POs / PSOs														
COs	**Program Outcomes (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2													1
CO2	2													1
CO3	2													1
CO4	1													1
CO5	1											1		2
CO6	3											2		3

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. P. S. Aithal, H. J. Ravindra, Textbook of Engineering Physics (2011), Acme learning Private Limited, New Delhi, India.
2. Shatendra Sharma, Jyotsna Sharma, Engineering Physics (2019), Pearson, Noida, Uttar Pradesh, India.

REFERENCE BOOKS:

1. M. Young (1977), Optics & Lasers An Engineering Physics approach, Springer
2 K.L. Chopra, Thin film Phenomena, McGraw Hill, New York.
3 S. O. Pillai (2018), Solid State Physics, revised edition, New Age International Publishers, New Delhi
4 M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy (2018), A textbook of Engineering Physics, S Chand, New Delhi.

E-Resources:

1. https://nptel.ac.in/courses/106/101/106101060/
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms

Activity Based Learning (Suggested Activities in Class)

1. Demonstration of solution to a problem through Project demo model.

ENGINEERING PHYSICS LAB

Total Contact Hours: 26

Following are experiments to be carried out in Engineering Physics Lab

LABORATORY EXPERIMENTS:

List of Experiments:

1. I-V characteristics of a Zener Diode

I–V Characteristics of a Zener diode in forward and reverse bias condition (Module 2)

2. Planck's constant

Measurement of Planck's constant using LED (Module 2)

3.**Transistor characteristics**

Input and output characteristics of a NPN transistor in C-E configuration (Module2)

4. Dielectric constant

Determination of dielectric constant of a dielectric material (Module 2)

5. Torsional Pendulum

Determination of moment of inertia of a circular disc using torsional pendulum

6. **Diffraction grating**

Determination of wavelength of a laser light using diffraction grating (Module 4)

7. LCR series and parallel resonance

Study the frequency response of a series and parallel LCR circuit (Module 3)

8. Band gap energy

Determination of energy gap of an intrinsic semiconductor (Module 2)

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INTRODUCTION TO ELECTRONICS ENGINEERING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	23EN1111	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P-J	:	3–0–0			

Course Learning Objectives:

This course enables students to

1. **Understand** the fundamental principles of diodes and their applications, including the band diagram of insulators, conductors, and semiconductors, diode construction, and V-I characteristics.
2. **Analyze** diode circuits under different biasing conditions and comprehend the behavior of diodes in applications such as AND gates, OR gates, rectifiers, and voltage regulators and simulate the same circuits using LTspice software.
3. **Comprehend** the construction, operation, and characteristics of bipolar junction transistors (BJTs), including input and output characteristics, different biasing techniques, and transistor amplification.
4. **Simulate** common emitter amplifier circuits with voltage divider bias using LTspice software.
5. **Demonstrate** an understanding of operational amplifiers (Op-amps), including their symbols, operation modes, properties, and applications such as amplifiers, comparators, and oscillators.
6. **Demonstrate** an understanding of digital electronics, including binary number systems, Boolean algebra, logic gates, sequential logic circuits, and the application of Flip-Flops.
7. **Simulate** digital circuits and components using LTspice software.
8. **Familiarize** themselves with microprocessors and microcontrollers, specifically Arduino boards, and understand their architecture and components.
9. Set up the Arduino development environment, write and upload code to the Arduino board, and **execute** simple Arduino programs.
10. Interface various sensors and engage in hands-on activities to reinforce understanding, including LED blinking and **designing** and **implementing** a complete Arduino-based system as a student project.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.

5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I	**09 Hours**

Diodes and its application: Band diagram of insulators, conductors and semiconductors; semiconductor types: intrinsic and extrinsic (n-type and p-type); overview of diode construction; diode under no-bias, forward bias and reverse bias; V-I characteristics of diode; simplified equivalent circuit of practical diode and ideal diode; overview of diode specifications: peak inverse voltage, reverse leakage current and maximum forward current; numerical on series diode configuration with DC input.
Applications: AND gate and OR gate using diodes, half wave rectifier and full-bridge full wave rectifier with smoothing capacitor; simulation of rectifier circuits with smoothing circuit using LTspice software; zener diode: zener region and voltage regulator; numerical on rectifier and voltage regulator.

(Textbook 1: Chapter 1: 1.1 to 1.7, 1.9, 1.12, 1.15, Chapter 2: 2.3, 2.5, 2.6, 2.7, 2.11)

UNIT – II	**08 Hours**

Transistors: Construction of npn and pnp BJT transistors; transistor operation; input and output characteristics of CB and CE configurations; significance of different regions of operation: active, cut-off and saturation (transistor as a switch); alpha, beta and current relations; transistor amplifying action; numerical on current relations and amplification; Need for biasing: Q-point; types of biasing: fixed, emitter stabilized and voltage divider; simulation of common emitter amplifier with voltage divider bias using LTspice software; numerical on biasing circuits; construction and characteristics of n-channel depletion type MOSFET;

(Textbook 1: Chapter 3: 3.1 to 3.5, Chapter 4: 4.1 to 4.5, Chapter 6.1 and 6.7)

UNIT – III	**08 Hours**

Operational amplifiers: Op-amp symbols, terminals and operation: single mode, differential mode and common mode; basic properties of ideal and practical Op-amp: input offset voltage, input resistance, output resistance, gain, bandwidth, CMRR, slew rate; basic Op-map applications: inverting amplifier, non-inverting amplifier, summing amplifier, differential amplifier, differentiator and integrator; Op-amp comparator; feedback: positive and negative feedback; criteria for stability and oscillations (Barkhausen criterion); RC phase shift and Wein bridge oscillators; simulation of summing amplifier and oscillators in LTspice software;

(Textbook 1: Chapter 10: 10.1, 10.4 to 10.7, Chapter 14: 14.5 to 14.7)

UNIT – IV	**08 Hours**

Digital Electronics: Binary number system: conversion and representation; logic levels: high and low; Boolean algebra: operators and DeMorgan's law; logic gates with truth-table and

representation: AND, OR, NOT, XOR, NAND, NOR; combination of gates and associated numerical; sequential logic circuits: SR latch using NAND/NOR gate, SR FLIP-FLOP, J-K Flip-Flop, D Flip-Flop; application of Flip-Flops: 4 bit binary counter and 4 stage shift register; simulation of counter using LTspice; (Textbook 2: Chapter 1: 1.1 to 1.3, Chapter 2: 2.1 to 2.5, Chapter 4: 4.1 to 4.3, Chapter 5.1 to 5.5, Chapter 6.1 to 6.4)

UNIT – V	**06 Hours**
Electronic Prototyping with Arduino: Introduction to microprocessor and microcontrollers (Architecture) , introduction to the Arduino board (UNO, R3) and components; setting up the Arduino development environment; writing and running a simple Arduino program in *wokwi* environment; introduction to various sensors and actuators compatible with Arduino in *wokwi* environment; student project: Designing and implementing a complete Arduino-based system. E-Resources: 1 and 2	

Course Outcome	**Description**	**Bloom's Taxonomy Level**
At the end of the course the student will be able to:		
1	**Demonstrate** a solid understanding of the fundamental principles underlying electronic components, such as diodes, transistors, operational amplifiers, logic gates, and microcontrollers.	L2
2	Apply knowledge of electronic components to **analyze** circuits for various applications, such as rectification, amplification, filtering, and digital logic operations.	L4
3	**Analyze** the performance of operational amplifiers (Op-amps) in various circuit configurations, including amplifiers, comparators, and oscillators, to optimize their functionality and address design requirements.	L4
4	Demonstrate proficiency in using simulation software (e.g., LTspice) to simulate and **analyze** electronic circuits, validate designs, and troubleshoot circuit performance**.**	L4
5	**Design** and implement electronic systems using Arduino microcontrollers, integrating sensors, actuators, and programming concepts to achieve specific functionalities and solve practical problems.	L6

Table: Mapping Levels of COs to POs / PSOs

COs	**Program Outcomes (POs)**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1		3							2	3		
CO2	3	3	2	1	3							2	3		
CO3	3	3	2	2	3							2	3	2	
CO4	3	3	2	2	3							2	3	2	
CO5	3	3	3	1	3							3	3	3	

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", 11th Ed, Pearson Education, 2013.
2. M. Moris. Mano and Michael D. Ciletti, "Digital Electronics", 4th Ed, Pearson Education, 2006.

REFERENCE BOOKS:

1. David A Bell, "Electronic Devices and Circuits", 5th Ed, Oxford university press, 2008.
2. Millman & Halkias, "Electronics Devices and Circuits", 2nd Ed, McGraw Hill, 2010.

E-Resources:

1. Arduino- https://docs.arduino.cc/learn/
2. Wokwi- https://wokwi.com/arduino/
3. NPTEL- https://nptel.ac.in/courses/122/106/122106025
4. Virtual Labs- http://vlabs.iitkgp.ac.in/be/

Activity Based Learning (Suggested Activities in Class):

1. Real world problem solving using group discussion and hands-on activities. E.g., Interfacing different types of sensors using Arduino.
2. Simulation of different electronic circuits. E.g., Rectifiers and Amplifiers.

OBJECT ORIENTED PROGRAMMING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – II

Course Code Code	:	23EN1202	**Credits**	:	04
Hours / Week	:	05 Hours	**Total Hours**	:	26(L) + 13(T) + 26(P) Hours
L–T–P–J	:	2–1–2–0			

Course Learning Objectives:

This Course will enable students to:

1. **Understand** different programming paradigms, significance of object-oriented programming approach and their applications.
2. **Make use of** Python programming environment to develop programs using conditionals, iterations, functions, strings and files to store and retrieve data in system.
3. **Gain** skills to develop python programs using core data structures like Lists, Tuples, Sets and Dictionaries.
4. **Describe** the concepts of object-oriented concept using class, objects, methods. Polymorphism and different levels of inheritance.
5. **Explain** operator overloading, overriding, single and multiple exception handling capabilities in python.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I	**05 Hours**

INTRODUCTION TO OBJECT ORIENTED PROGRAMMING AND PYTHON

Programming paradigms, Object oriented programming features, applications, merits & demerits, Features of Python, variables, Data types, input operation, Reserved words, Indentation, Expressions, String operations, Type conversions.

(Text Book-1: Chapter 2: 2.3,2.4,2.5,2.6 Chapter 3: 3.1,3.6,3.7,3.8,3.10,3.11,3.13,3.14,3.16)

DECISION AND LOOP CONTROL STATEMENTS:

Conditional branch statements, Iterative statements, Nested loops, break, continue, pass, The else statement used with loops.

(Text Book-1: Chapter 4: 4.1-4.8)

UNIT – II	5 Hours

FUNCTIONS AND MODULES:

Need for functions, Function definition, Function call, Scope, Return statement, Lambdafunctions, Recursive functions, Modules.

(Chapter 5: 5.1 to 5.11)

PYTHON STRINGS:

String operations, Immutable, string formatting operator, built-in string methods, string slices, membership operator, comparing strings, Iterating strings.

(Chapter 6: 6.1 to 6.9)

UNIT – III	6 Hours

DATA STRUCTURES IN PYTHON:

Sequence, List, Tuple, sets, dictionaries

(Chapter 8: 8.1, 8.2, 8.4 to 8.6)

FILE HANDLING METHODS:

File path, File types, File operations, File positions, Rename and delete files.

(Chapter 7: 7.1 to 7.7)

UNIT – IV	5 Hours

USER DEFINED CLASSES & OBJECTS:

Classes, Objects, class method and self Argument, constructor, destructor, class variables, public and private data members, private methods, Calling methods, static methods.

(Chapter 9: 9.1 to 9.10, 9.15)

INHERITANCE:

Introduction, Polymorphism, overriding, types of inheritance

(Text Book: Chapter 10: 10.1 to 10.6)

UNIT – V	5 Hours

OPERATOR OVERLOADING:

Introduction, Implementation of operator overloading, Reverse addition, overriding methods and functions.

(Text Book: Chapter 11: 11.1 to 11 .7)

ERROR AND EXCEPTION HANDLING:

Errors, Handling exceptions, Multiple except blocks, Multiple exceptions, Except block without exception, The else clause, Raising exceptions, Built-in and user defined exceptions, Finally block, clean-up action

(Text Book: Chapter 12: 12.1 to 12.7, 12.10 to 12.12)

Course Outcomes:

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

1. **Write** a python program using 4 conditionals, definite loop, indefinite loop withjump statements.
2. **Write** an application using lambda, recursive functions, strings and files to store andretrieve the data from the system.
3. **Write python** programs using Core data structures like Lists, Tuples, Sets and Dictionaries.
4. **Implement** the concepts of object-oriented concept using class, objects, methods. Polymorphism and different levels of inheritance.
5. **Implement** operator overloading, overriding, single and multiple exception handlingprogram capability in python

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1		2					1				
CO2	3	2	1		2					1		2	1	
CO3	3	2	2		2					1		2	1	
CO4	3	2	2		2					1		2	1	
CO5	3	2	2		2					1		2	1	

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Reema Thareja, "Python programming: Using problem solving approach", 2nd Edition,Oxford university press, 2019.

REFERENCE BOOKS:

1. John V Guttag, "Introduction to Computation and Programming Using Python", The MITpress, 3rd edition, 2021.
2. Tony Gaddis, "Starting out with python", 4th edition, Pearson, 2019.
3. Allen Downey, Jeffrey Elkner and Chris Meyers, "How to think like a Computer Scientist, Learning with Python", Green Tea Press, 2014.
4. Richard L. Halterman, "Learning to Program with Python", 2011.
5. Charles Dierbach, "Computer Science Using Python: A Computational Problem-Solving Focus", John Wiley, 2012.

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem through programming.

OBJECT ORIENTED PROGRAMMING LABORATORY

Total 26 Hours

List of Programming Experiments:

1. Python Program for Data Handling and Expression Evaluation.
2. Python Program for Quadratic Equation Roots and Number Analysis.
3. Python Program for Function Illustration and Module Creation.
4. Python Program for String Operations and Data Validation.
5. Python Program for File Handling and Script Copying.
6. Python Program for Data Structures and Built-in Methods.
7. Python Program for Object-Oriented Concepts and Inheritance.
8. Python Program for Operator Overloading and Special Methods.

ENGINEERING GRAPHICS & DESIGN THINKING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	23EN1113	**Credits**	:	03
Hours / Week	:	04 Hours	**Total Hours**	:	26+26 Hours
L–T–P–J	:	2–0–2–0			

Course Learning Objectives:

This Course will enable students to:

1. **Create** awareness and emphasize the need for Engineering Graphics & design thinking through Manual Sketching & Autocad Software
2. **Learn** using professional CAD software for construction of geometry
3. **Understand** the concepts of orthographic and isometric projections
4. **Draw** orthographic projection of points, lines, planes and solids by Manual Sketching & AutoCad Software
5. **Draw** development of surfaces of solids
6. **Draw** isometric projections of planes and solids
7. **Create** simple engineering 3D components
8. **Work** in a team for creating conceptual design of products
9. **Learn** application of design methods and tools on real world problem through Autocad Software & Physical Models

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

MANUAL & COMPUTER SKETCHING

UNIT – I Introduction	**06 Hours**

Introduction to Engineering Graphics: Fundamentals, Drawing standard - BIS,

dimensioning, Lines, lettering, scaling, symbols, dimensioning & tolerances, conventions, Introduction to orthographic projection. Types of projections & their principles - (For CIA only) **(For CIA only)**
(Text Book-1: Chapter 3 & 8)

Introduction to Computer Aided Drafting software- Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, coloring, mirror, rotate, trim, extend, break, chamfer, fillet and curves - **(For CIA only)**
(Text Book-2: Chapter 23 &24; Text Book-1: Chapter 26)

UNIT – II Projections of Points, Lines and Planes	**12 Hours**

Projection of Points - Orthographic projections of points in all the quadrants,
Orthographic projections of lines- inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method.
Orthographic projections of planes -triangle, square, rectangle, pentagon, hexagon and circular laminae.
(First Angle Projection only)
(Text Book-1: Chapter 9,10,12)

UNIT – III Projection of Solids & Development of Surfaces	**14 Hours**

Projection of regular solids like prisms, pyramids, cylinder & cone inclined to both the planes (change of position method)
(First Angle Projection only)
(Text Book-1: Chapter 13)

Development of lateral surfaces of regular solids – Prisms, pyramids cylinders and cones.
(Text Book-2: Chapter 16)

UNIT – IV Isometric Projections	**14 Hours**

Isometric projection - Principles of Isometric Projection, Isometric Scale, Isometric View, Isometric projection of combination of two solids
(Text Book-1: Chapter 17)

Transformation of Projections- Conversion of Isometric Views to Orthographic Views & Conversion of orthographic views to isometric projections.
(Text Book-1: Chapter 20; Text book- 2: Chapter 21)

UNIT – V Introduction to Design Thinking for Innovations	**10 Hours**

A brief history of Design, Engineering Design process, Product development cycle, creation of models and their presentation in standard 3D view. Theory, Practice & Examples in Design thinking, Storytelling, Creativity and Idea Generation, Concept Development, Testing and Prototyping.
(For CIA only)
(Text Book-3: Part 1- Chapter 1&2, Part3-Chapter 10)

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Make use of** instruments, dimensioning & tolerance principles, conventions and standards related engineering drawing	L1
2	**Construct** orthographic projections of points, lines, planes and solids	L3
3	**Develop** lateral surfaces of solids and **construct** isometric projections of solids	L3
4	**Apply** the design thinking principles for innovative product development	L3
5	**Make use of** AutoCad for modelling engineering components	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	0	0	0	0	0	0	0	0	0	0	3	0	2
CO2	2	1	0	0	0	0	0	0	0	0	0	0	3	0	2
CO3	2	1	0	0	0	0	0	0	0	0	0	0	3	0	2
CO4	2	1	0	0	0	0	0	0	0	0	0	0	3	0	2
CO5	3	1	0	0	0	0	0	0	0	0	0	0	3	0	2

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Engineering Drawing, Bhatt N.D., 54th Edition, Charotar Publishing House, Gujarat, India, 2023
2. Engineering Drawing & Graphics+Autocad, K Venugopal, Fifth Edition, New Age International Publishers, 2011.
3. Engineering Design- A Project Based Introduction, C. L. Dym and Patrick Little, John Wiley & Sons, 2022

REFERENCE BOOKS:

1. A Textbook of Computer Aided Engineering Drawing, Gopalakrishna, K. R. and Sudheer Gopala Krishna, Subash Publishers, Bangalore, India, 2017
2. Engineering Drawing with Introduction to AutoCAD, Dhananjay .A .J, Tata McGraw-Hill Publishing Company Ltd, 2018
3. Product Design and Development, Karl T Ulrich, Steven D Eppinger, Seventh Edition, McGraw-Hill Education, 2020

E-Resources:

1. https://archive.nptel.ac.in/courses/112/102/112102304/

2. https://nptel.ac.in/courses/112103019
3. https://nptel.ac.in/courses/112/105/112105294/
4. https://fractory.com/engineering-drawing-basics/

Activity Based Learning (Suggested Activities in Class)

1. Activity which makes students to apply the concepts learned in the course to the practical engineering graphics will be discussed in class.
2. Activity provides space to students giving responsibility for their own design & engineering drawing methods for the products
3. Activity that makes the students for the development of skill set in computer drafting
4. Activity that makes the students to have critical thinking, developing a mind set, problem-solving and teamwork in design thinking process.
5. Real world problem solving and puzzles using group discussion.
6. Demonstration of solution to a problem through experiential learning.

ENGINEERING GRAPHICS & DESIGN THINKING LABORATORY

Total Contact Hours: 26

Following are practical/laboratory experiments to be carried out:

1. Problems to be solved in first quadrant system.
2. Manual & Computer Sketching problems for all the modules in sketch book and also take print out of the problems.
3. Usage of various commands in AutoCad software and few simple exercises on the above commands
4. Practice Problems on Projections of Points, Lines and Planes using Manual Sketching & AutoCad Software
5. Solve Problems on Projection of Solids & Development of Surfaces
6. Practice problems on Isometric Projections
7. Individual/Group work on Introduction to Design Thinking for Innovations (Examples on Solid Modeling - Using 3D Modelling Software & Physical Model Prototype).

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BIOLOGY FOR ENGINEERS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	23EN1114	**Credits**	:	02
Hours / Week	:	02 Hours	**Total Hours**	:	26 Hours
L–T–P–J	:	2–0–0–0			

Course Learning Objectives:

This Course will enable students to:

1. Acquire an understanding on basic modern biological concepts with an emphasis on how bio-processes are analogous to engineering field, as a multidisciplinary field.
2. Understand basic engineering principles imminently run physiological processes particularly about engineering designs and solutions are arrived citing body functional examples.
3. Explain aspects that many bio-solutions could be foundational to design, develop better processes, products and useful to achieve quality of life.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* like power point presentations and group discussion may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three higher order thinking questions in the class.
6. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

COURSE CONTENT:

UNIT 1 : Biomimetics	**5 Hrs**
Biology for Engineers, Body Fluid: Blood- Mechanics of heart, Blood pressure, Life molecules: Water, Carbohydrates, Proteins, Lipids and Nucleic acids, Biomimetics: Bio-processes - engineering analogies	
UNIT 2 : Bioenergy	**5 Hrs**
Unit of life: Human and Plant cell, Metabolism: Enzymes as Bio-catalysts and physiological entities, Anabolism- Bioenergy from Sun-Photosynthesis, catabolism	

UNIT 3 : Biomechanics (Human Body Movement Mechanics)	**5 Hrs**
Normal Human Movement: Force-Vector of Body; Movement Angles; Muscle contraction - Relaxation; Posture – Static & Dynamic; Ideal and abnormal posture, Practical: Stepping-Lifting-Sit-Stand.	
UNIT 4 : Bioelectronics	**6 Hrs**
Brain & Computer: Senso-neural networks, Biosensors and IoT as applied to biology, Bionic Eye: Mechanism of Vision, Electronic Nose: Bio-olfactory mechanisms (Science of smell), Impulses: Cardiac and Nerve, Biological Clock and Circadian rhythm	
UNIT 5 : Biopharma	**5 Hrs**
Metabolic syndromes, Cancer and its diagnostics, Lab on a chip, Drug Discovery	

Course Outcome	**Description**	**Bloom's Taxonomy Level**
At the end of the course the student will be able to:		
1	**Apply and Utilize** essential knowledge of the biological mechanisms of living organisms from the perspective of engineers and find solutions to solve bio-engineering problems with appropriate tools.	L3
2	**Distinguish and make use of** optimal designs in engineering that are bio-mechanical in nature and build and use by observing and understanding bio-physiological processes involved in sensing, locomotion, and knowledge application of range of bio-chemicals.	L3
3	**Demonstrate** that bio-chemical, bio-sensory, bio-processes could be path-finders to optimise similarities for functional aspects of electronic, computer, mechanical, electrical machines.	L3

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem through experiential learning.
3. Demonstrations using real objects, taking students on an educational tour.

REFERENCES:

- Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson. "Biology: A global approach", , Global Edition, 10/E, 2014
- David Nelson, Michael Cox. "Lehninger Principles of Biochemistry". W H Freeman & Company, Seventh Edition, 2017.
- Janine M Benvus. "Biomimicry: Innovation inspired by Nature". William Morrow Paperbacks, 2002.
- Lecture Notes, PPT slides by course instructor.

CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	23EN1115	**Credits**	:	01
Hours / Week	:	01 Hours	**Total Hours**	:	13 Hours
L–T–P–J	:	1–0–0–0			

Course Learning Objectives:

This Course will enable students to:

1. Acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
2. Make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
3. Channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
4. Acquaint students with latest legislation and Laws with related regulatory framework.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* like power point presentations and group discussion may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three higher order thinking questions in the class.
6. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

COURSE CONTENT

UNIT 1 : Introduction and Basic Information about Indian Constitution	**6 Hrs**

Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution, Indian Constitution and its Salient Features, The Sources of Indian Constitution. The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule,

Financial Emergency, and Local Self Government – Constitutional Scheme in India	
UNIT 2 : Union Executive and State Executive	**7 Hrs**
Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Court	

Course Outcome	**Description**	**Bloom's Taxonomy Level**
At the end of the course the student will be able to:		
1	Identify and explore the basic features and modalities about Indian constitution.	L1
2	Differentiate and relate the functioning of Indian parliamentary system at the Centre and State level.	L2
3	Differentiate different aspects of Indian Legal System and its related bodies.	L2
4	Discover and apply different laws and regulations related to engineering practices.	L1
5	Correlate role of engineers with different organizations and governance models	L1

TEXT BOOKS:

1. The Indian Constitution, Madhav Khosla, Oxford University Press.
2. The Constitution of India, PM Bakshi. Latest Edition, Universal Law Publishing.

REFERENCE BOOKS:

1. The Indian Constitution: Cornerstone of a Nation (Classic Reissue), Granville Austin:, Oxford University Press.
2. Our Constitution: An Introduction to India's Constitution and Constitutional Law, Subhash C. Kashyap, NBT, 2018.
3. Introduction to the Indian Constitution, Brij Kishore Sharma, 8th Edition, PHI Learning Pvt. Ltd.