

Amrutvahini Sheti and Shikshan Vikas Sanstha's

AMRUTVAHINI COLLEGE OF ENGINEERING, SANGAMNER

Amrutnagar, Ghulewadi, Sangamner - 422608



(An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune)

Curriculum Structure and Syllabus of First Year B. Tech.



(Effective from Academic Year 2026-27)

INDEX

F. Y. B. Tech Syllabus – Semester I & II

Sr. No.	Illustration	Page No.
1	Institute Vision	i
2	Institute Mission	i
3	EOMS Policy	i
4	Knowledge and Attitude Profile	ii
5	Program Outcomes (POs)	iii
6	Preface	iv
7	Program Codes and Subject Code Policy	v
8	Course Cycles	vi
9	Course Approval Summary	vii
10	Guidelines for Examination Scheme	xiii
11	Syllabus Structure – Semester I and II	xv

Semester – I

Sr. No.	Course Name	Course Code	Page No.
1	Linear Algebra and Calculus	R26-SH-BSC-101	2
2	Engineering Physics	R26-SH-BSC-102	7
3	Engineering Chemistry	R26-SH-BSC-103	15
4	Basic Mechanical Engineering	R26-ME-ESE-121	23
5	Engineering Graphics	R26-ME-ESC-120	29
6	Engineering Graphics Lab	R26-ME-ESC-120-TW	33
7	Engineering Mechanics and Civil Engineering Systems	R26-CE-ESC-105	38
8	Fundamentals of Electrical Engineering	R26-EE-ESE-106	44
9	Fundamentals of Electronics Engineering	R26-ET-ESC-107	51
10	Programming & Problem Solving using Python	R26-CO-ESC-108	58
11	Engineering Workshop Skills Lab	R26-ME-VSEC-109	66
12	Digital Technology Lab	R26-AI-VSEC-115	70
13	Digital Technology Lab	R26-CE-VSEC-115	78
14	Digital Technology Lab	R26-EC-VSEC-115	86
15	Digital Technology Lab	R26-ET-VSEC-115	91
16	Engineering Drawing Lab	R26-ME-VSEC-110	96
17	Civil Engineering Lab	R26-CE-VSEC-111	101
18	Professional Communication Skill	R26-SH-AEC-112	106
19	Indian Knowledge System	R26-SH-AEC-113	110
20	Cocurricular Course - I (Art And Crafts)	R26-SH-CC-114.1	114
21	Cocurricular Course - I (Dance & Drama)	R26-SH-CC-114.2	116

Sr. No.	Illustration		Page No.
22	Physical Fitness and Sports	R26-SH-CC-114.3	118
23	Cocurricular Course - I (Yoga)	R26-SH-CC-114.4	121
24	Cocurricular Course - I (Entrepreneurship Essential – I)	R26-ME-PCC-114.5	123
Semester – II			
25	Differential Equations And Numerical Integration	R26-SH-BSC-116	128
26	Programming in C	R26-AI-PCC-119	133
27	Foundations of Automation and Robotics Engineering	R26-AR-PCC-118	137
28	Smart and Sustainable Civil Engineering	R26-CE-PCC-118	142
29	Programming in C	R26-CO-PCC-120	147
30	Programming in C	R26-EC-PCC-120	151
31	Programming in C	R26-EE-PCC-120	155
32	Programming in C	R26-ET-PCC-120	159
33	Programming in C	R26-IT-PCC-120	163
34	Basic Mechanical Engineering	R26-ME-PCC-121	167
35	Basic Mechanical Engineering Lab	R26-ME-PCC-121-TW	173
36	Programming in C Lab	R26-IT-PCC-119	178
37	Digital Technology Lab	R26-AR-VSEC-115	186
38	Digital Technology Lab	R26-CO-VSEC-115	192
39	Digital Technology Lab	R26-EE-VSE-115	196
40	Digital Technology Lab	R26-IT-VSE-115	201
41	Digital Technology Lab	R26-ME-VSEC-115	207
42	Cocurricular Course - II (Creative Arts & Design)	R26-SH-CC-117.1	210
43	Cocurricular Course - II (Wellness & Lifestyle Education)	R26-SH-CC-117.2	212
44	Cocurricular Course - II (Fire and Safety)	R26-SH-CC-117.3	214
45	Cocurricular Course - II (Self Defense)	R26-SH-CC-117.5	216
46	Cocurricular Course - II (Entrepreneurship Essential – II)	R26-ME-PCC-117.6	217

Abbreviation

AEC - Ability Enhancement Course

AICTE - All India Council for Technical Education

CEP - Community Engagement Project

EEM - Entrepreneurship/Economics/Management Courses

MDM - Multidisciplinary Minor

MOOC - Massive Open Online Course

NEP - National Education Policy

NPTEL - National Programme on Technology Enhanced Learning

OE - Open Elective

PCC - Program Core Course

CCC – Cocurricular Course

PEO - Programme Educational Objectives

PSO - Program Specific Outcomes

SWAYAM - Study Webs of Active-learning for Young Aspiring Minds

UGC - University Grants Commission

VEC - Value Education Course

VSE - Vocational and Skill Enhancement Course

WK - Knowledge and Attitude Profile

CCE - Comprehensive and Continuous Evaluation

ISO - International Organization for Standardization

EOMS - Educational Organization Management System

Institute Vision

To create opportunities for rural students to become able engineers and technocrats through continual excellence in engineering education.

Institute Mission

Our mission is to create self-disciplined, physically fit, mentally robust and morally strong engineers and technocrats with high degree of integrity and sense of purpose who are capable to meet challenges of ever advancing technology for the benefit of mankind and nature.

We, the management, the faculty and staff, therefore promise to strive hard and commit ourselves to achieve this objective through a continuous process of learning and appreciation of needs of time.

ISO 21001:2018 - EOMS Policy

We, at AVCOE Sangamner, are committed to:

- Provide quality technical education to the rural students
- Provide conducive environment for all round development of the students.
- Develop as a premier institute for technical education & research as per the needs and expectations of all stake holders.
- Comply all applicable requirements.
- Develop students into technocrats having social responsibility.
- Keep abreast about the advances in technology and innovation.
- Enhance industry-institute interaction.
- Managing intellectual property.
- Maintain hygiene, health and safety for applicable requirements.
- Achieve continual improvement in academic and administrative processes.
- We shall strive to maintain Educational Organizational Management System.

Knowledge and Attitude Profile

A Knowledge and Attitude Profile (KAP), often represented as WK (Knowledge and Attitude Profile) in some contexts, is a framework or assessment tool used to evaluate an individual's knowledge and attitudes related to a specific area, topic, or domain.

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

Program Outcomes (POs)

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

Preface

It gives us great pleasure to present the ‘Curriculum Structure and Syllabus’ for the First Year B. Tech. programme under the autonomous status of Amrutvahini College of Engineering, Sangamner. This curriculum marks an important milestone as it is designed for the first batch of students under academic autonomy, following the principles of the National Education Policy (NEP) 2020 and focusing strongly on Outcome-Based Education (OBE).

The first year is the foundation of every engineering programme. This curriculum provides a balanced combination of basic engineering sciences, engineering fundamentals, and interdisciplinary learning to help students build strong conceptual and analytical skills for their future studies. It also introduces them to the basics of various engineering branches such as mechanical, civil, electrical, electronics, computer engineering, and related disciplines, giving them an understanding of how different engineering systems work together.

In line with NEP 2020, the syllabus includes skill-based and practical learning through laboratories, vocational and skill enhancement courses, co-curricular activities, and foreign language learning for global prospects. It encourages students to develop practical skills, creativity, and critical thinking through hands-on activities and project-based learning.

The inclusion of Professional Communication, Indian Knowledge Systems, Ethics, and Emerging Technologies supports the overall development of students by improving their technical knowledge, social and environmental awareness, and ethical values. In addition, exposure to digital technologies, programming, and innovation-oriented learning prepares students for the challenges of emerging and future technologies.

This curriculum aims at the 360-degree development of students focusing on academic excellence, professional competence, physical fitness, and moral strength. The underlined objective is to mold the students in such a way that they become capable and responsible engineers who can contribute to society and the nation. It reflects the institute’s vision to create opportunities for rural students and help them become globally competent engineers through continuous excellence in education.

I sincerely thank the Board of Studies chairpersons and members, faculty, academic experts, and industry professionals for their valuable contributions in designing this outcome-based and future-ready curriculum. We believe that this document will serve as a useful guide for students, teachers, and all stakeholders in achieving the goals of holistic, flexible, and learner-centered education envisioned by the National Education Policy 2020.

Dr. P. R. Baviskar,

Principal

Amrutvahini College of Engineering, Sangamner

(An Autonomous Institute affiliated to Savitribai Phule Pune University, Pune)

Program codes:

The institute has assigned a unique program code to each branch.

Table 1 – Program codes

Sr. No.	Program code	Code
UG Programs		
1	Engineering Science & Humanities	SH
2	Civil Engineering	CE
3	Automation and Robotics	AR
4	Computer Engineering	CO
5	Electronics and Computer Engineering	EC
6	Mechanical Engineering	ME
7	Electronics & Telecommunication Engineering	ET
8	Information Technology	IT
9	Electrical Engineering	EE
10	Artificial Intelligence and Data Science	AI
PG Programs		
1	Master of Business Administration	MBA
2	M. Tech Computer Engineering	MCO
3	M. Tech Civil Engineering	MCE
4	M. Tech Mechanical Engineering	MME

Subject code nomenclature:

The following nomenclature demonstrates the subject codes:

- **R-Year** (of designing/revising syllabus) – **Program code** (as given in table 1) - **Course Type** (as per NEP) – **Course Number** (101 – FY B. Tech Subject 1, 201 - SY B. Tech Subject 1, 301 - TY B. Tech Subject 1, 401 - B. Tech Subject 1 etc.)

Course Cycles:

The following table outlines the semester-wise course distribution for Cycle 1 and Cycle 2 divisions, indicating the subjects offered in Semester I and Semester II for each cycle.

Table 2 – Semester-wise course cycles

Cycle 1 (Div – AI&DS, Civil, ETC, ECE)		Cycle 2 (Div – A&R, Comp, Electrical, IT, Mechanical)	
Sem – I	Sem - II	Sem – I	Sem - II
<u>Linear Algebra and Calculus</u>	<u>Differential equation and Numerical Integration</u>	<u>Linear Algebra and Calculus</u>	<u>Differential equation and Numerical Integration</u>
<u>Engineering Physics</u>	<u>Engineering Chemistry</u>	<u>Engineering Chemistry</u>	<u>Engineering Physics</u>
<u>Engineering Mechanics and Civil Engineering Systems</u>	<u>Engineering Graphics / Basic Mechanical Engineering</u>	<u>Basic Mechanical Engineering / Engineering Graphics</u>	<u>Engineering Mechanics and Civil Engineering Systems</u>
<u>Fundamentals of Electronics Engineering</u>	<u>Fundamentals of Electrical Engineering</u>	<u>Fundamentals of Electrical Engineering</u>	<u>Fundamentals of Electronics Engineering</u>
<u>Programming & Problem Solving Using Python</u>	<u>Program Core Course</u> <u>Program Core Course Lab</u>	<u>Programming & Problem Solving Using Python</u>	<u>Program Core Course</u> <u>Program Core Course Lab</u>
<u>Digital Technology Lab</u>	<u>Engineering Workshop Skills Lab</u>	<u>Engineering Workshop Skills Lab</u>	<u>Digital Technology Lab</u>
<u>Civil Engineering Lab</u>	<u>Engineering Graphics Lab</u>	<u>Engineering Graphics Lab</u>	<u>Civil Engineering Lab</u>
<u>Professional Communication Skill</u>	<u>Indian Knowledge System</u>	<u>Indian Knowledge System</u>	<u>Professional Communication Skill</u>
Cocurricular Courses - I 1. <u>Art & Crafts</u> 2. <u>Dance & Drama</u> 3. <u>Yoga</u> 4. Physical Fitness and Sports 5. Entrepreneurship Essentials - I	Cocurricular Courses - II 1. Creative Art & <u>Design</u> 2. Wellness and Lifestyle Education 3. Fire and Safety 4. Self Defense 5. Entrepreneurship Essentials - II	Cocurricular Courses – 1. <u>Art & Crafts</u> 2. <u>Dance & Drama</u> 3. <u>Yoga</u> 4. Physical Fitness and Sports 5. Entrepreneurship Essentials - I	Cocurricular Courses - II 1. Creative Art & <u>Design</u> 2. Wellness and Lifestyle Education 3. Fire and Safety 4. Self Defense 5. Entrepreneurship Essentials - II

Course Approval Summary:



AMRUTVAHINI COLLEGE OF ENGINEERING, SANGAMNER
Amrutnagar, Ghulewadi, Sangamner- 422608
(An Autonomous Institute, Approved by AICTE and Affiliated to SPPU, Pune)

Sr. No.	Name of the course	Course Code	Signature of BoS Chairman (with stamp)
1	Linear Algebra and Calculus	R26-SH-BSC-101	
2	Engineering Physics	R26-SH-BSC-102	
3	Engineering Physics	R26-SH-BSC-102-TW	
4	Engineering Chemistry	R26-SH-BSC-103	
5	Engineering Chemistry	R26-SH-BSC-103-TW	
6	Basic Mechanical Engineering	R26-ME-ESC-121	
7	Engineering Mechanics and Civil Engineering Systems	R26-CE-ESC-105	
8	Fundamentals of Electrical Engineering	R26-EE-ESC-106	

9	Fundamentals of Electrical Engineering	R26-EE-ESC-106-TW	
10	Fundamentals of Electronics Engineering	R26-ET-ESC-107	
11	Fundamentals of Electronics Engineering	R26-ET-ESC-107-TW	
12	Programming & Problem Solving Using Python	R26-CO-ESC-108	
13	Programming & Problem Solving Using Python	R26-CO-ESC-108-TW	
14	Engineering Graphics	R26-ME-ESE-120	

15	Engineering Workshop Skills Lab	R26-ME-VSEC-109	
16	Engineering Drawing Lab	R26-ME-VSEC-110	
17	Digital Technology Lab (AI&DS)	R26-AI-VSEC- 115	

18	Digital Technology Lab (Civil)	R26-CE-VSEC- 115	
19	Digital Technology Lab (ECE)	R26-EC-VSEC- 115	
20	Digital Technology Lab (ETC)	R26-ET-VSEC- 115	
21	Engineering Graphics Lab	R26-ME-VSEC-122	
22	Civil Engineering Lab	R26-CE-VSEC-111	
23	Professional Communication Skill	R26-SH-AEC-112	
24	Indian Knowledge System	R26-SH-AEC-113	
25	Cocurricular Courses – I (Art & Crafts)	R26-SH-CC-114.1	
26	Cocurricular Courses – I (Dance & Drama)	R26-SH-CC-114.2	

27	Cocurricular Courses – I (Yoga)	R26-SH-CC-114.4	
28	Cocurricular Courses – I (Entrepreneurship Essentials-I)	R26-SH-CC-114.5	
29	Cocurricular Courses – I (Physical Fitness and Sports00)	R26-SH-CC-114.6	
30	<u>Differential equation and Numerical Integration</u>	R26-SH-BSC-116	
31	Programming in C	R26-AI-PCC-121	
32	Foundations of Automation and Robotics Engineering	R26-AR-PCC-118	
33	Smart and Sustainable Civil Engineering	R26-CE-PCC-118	

34	Programming in C	R26-CO-PCC-121	
35	Programming in C	R26-EC-PCC-121	
36	Programming in C	R26-EE-PCC-121	
37	Programming in C	R26-ET-PCC-121	
38	Programming in C	R26-IT-PCC-121	
39	Basic Mechanical Engineering	R26-ME-PCC-121	
40	Basic Mechanical Engineering	R26-ME-PCC-121-TW	

41	Programming in C Lab	R26-IT-PCC-119	
42	Digital Technology Lab (A&R)	R26-AR-VSEC- 115	
43	Digital Technology Lab (Computer)	R26-CO-VSEC- 115	
44	Digital Technology Lab (Electrical)	R26-EE-VSEC- 115	
45	Digital Technology Lab (IT)	R26-IT-VSEC- 115	
46	Digital Technology Lab (Mechanical)	R26-ME-VSEC- 115	
47	Cocurricular Courses – II (Creative Arts & Design)	R26-SH-CC-117.1	
48	Cocurricular Courses – II (Wellness & Lifestyle Education)	R26-SH-CC-117.2	

49	Cocurricular Courses – II (Fire and Safety)	R26-SH-CC-117.4	
50	Cocurricular Courses – II (Self Defence)	R26-SH-CC-117.5	
51	Cocurricular Courses – II (Entrepreneurship Essential – II)	R26-SH-CC-117.6	

Dr. P. R. Baviskar
Chairman
Academic Council

Guidelines for Examination Scheme:

The evaluation of students shall be based on continuous academic performance in a course based on Comprehensive Continuous Evaluation (CCE) and End Semester Examination (ESE).
Components of the Examination System:

1. Comprehensive Continuous Evaluation (CCE):

- CCE of 40 marks based on all the Units of course.
- To design a Comprehensive Continuous Evaluation scheme for a theory subject of 40 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Table 3: Allocation of marks & structure

Sr. No.	Examination	Conduction Marks	Marks	Coverage of Units
1	CCE –I (Class test – 1)	32	16	Units 1 & Unit 2 (8 Marks/Unit)
2	CCE –II (Assessment tools: Assignments, seminar, quiz, course project, field visit etc.)	8	8	Units 3
3	CCE –III (Assessment tools: Assignments, seminar, quiz, course project, field visit etc.)	8	8	Unit 4
4	CCE –IV (Assessment tools: Assignments, seminar, quiz, course project, field visit etc.)	8	8	Unit 5

The distribution of marks across various assessment tools and their mapping to COs is detailed in the table below.

Table 4: Allocation of marks & structure

EXAM	Assessment tool	CO1	CO2	CO3	CO4	CO5
CCE	CT1	08	08			
	CT2			08	08	
	Assignments	Subject teacher should select any two of the assessment tool				08
	Course Project					
	Case study					
	Field Activity					
	Presentation					
	Quiz					
ESE	60	12	12	12	12	12
Total	100	20	20	20	20	20

Timeline for conduction of CCE:

- Weeks 1- 4 : Completion of Unit 1 and 2
- Week 5: Conduct Unit Test 1 (16 marks)
- Weeks 6 - 7 : Completion of Unit 3
- Conduct Seminar/Course project/Presentation/Quiz/Open Book test (8 marks)
- Week 8 - 9 : Completion of Unit 4
- Conduct Seminar/Course project/Presentation/Quiz/Open Book test (8 marks)
- Weeks 10 - 11 : Completion of Unit 5
- Week 12 : Conduct Seminar/Course project/Presentation/Quiz/Open Book test (8 marks)

Evaluation and Feedback:

- **Unit Test:** Student answer papers will be evaluated promptly, and constructive feedback will be provided highlighting strengths and areas for improvement.
- **Assignments / Case Study:** Student submissions will be assessed as per the given rubric, and meaningful feedback will be provided to help students understand their performance and scope for enhancement.
- **Seminar Presentation:** Students will be evaluated based on content accuracy, delivery, and responses during the Q&A session. Feedback will be shared on communication skills and conceptual understanding.
- **Open Book Test:** Evaluation will focus on the depth of analysis and the ability to apply concepts. Feedback will emphasize students' critical thinking and problem-solving skills.
- **Mini Project:** Students will be assessed on problem identification, design approach, implementation quality, and documentation. Innovation, teamwork, and practical application of concepts will be strongly considered.
- **Field Visit:** Evaluation will be based on the student's report and reflection, focusing on understanding of real-world practices and their relevance to the course outcomes. Marks will reflect clarity, insight, and active participation.

2. End Semester Examination (ESE):

The ESE is a compulsory examination for all students. The ESE examination will be conducted at the end of the semester by the institute Department of Examination and Evaluation (DEE). The ESE will be based on 100% syllabus (Unit 1 to Unit 5). The ESE shall be of 60 marks (12 Marks / Unit) conducted for all theory courses as mentioned in the programme structure.

Syllabus Structure (AIDS, Computer, ETC, E&CE, Electrical, IT)

Sr. No.	Subject Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credit			
				TH	PR	TUT	CCE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL
Semester-I																
1	R26-SH-BSC-101	Basic Sciences	Linear Algebra and Calculus	4	-	-	40	60	-	-	-	100	4	-	-	4
2	R26-SH-BSC-102 R26-SH-BSC-103	Basic Sciences	Engineering Physics / Engineering Chemistry	3	2	-	40	60	25	-	-	125	3	1	-	4
3	R26-ME-ESC-104 R26-CE-ESC-105	Engineering Science Course	Engineering Graphics / Engineering Mechanics and Civil Engineering Systems	3	-	-	40	60	-	-	-	100	3	-	-	3
4	R26-EE-ESC-106 R26-ET-ESC-107	Engineering Science Course	Fundamentals of Electrical Engineering / Fundamentals of Electronics Engineering	2	2	-	40	60	25	-	-	125	2	1	-	3
5	R26-CO-ESC-108	Engineering Science Course	Programming & Problem Solving Using Python	2	2	-	40	60	25	-	-	125	2	1	-	3
6	R26-ME-VSEC-109 R26-Prog.Code-VSEC-115	Vocational & Skill Enhancement Course	Engineering Workshop Skills Lab / Digital Technology Lab	-	2	-	-	-	50	-	-	50	-	1	-	1
7	R26-ME-VSEC-110 / R26-CE-VSEC-111	Vocational & Skill Enhancement Course	Engineering Graphics Lab / Civil Engineering Lab	-	2	-	-	-	50	-	-	50	-	1	-	1
8	R26-SH-AEC-112 / R26-SH-AEC-113	Ability Enhancement Course	Professional Communication Skill /Indian Knowledge System	2	-	-	-	-	50	-	-	50	2	-	-	2
9	R26-SH-CC-114	Co-curricular Courses	Co-curricular Courses - I	-	2	-	-	-	25	-	-	25	-	1	-	1
			Total	14	12	2	200	300	250	0	0	750	14	6	2	22

Sr. No.	Subject Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credit			
				TH	PR	TUT	CCE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL
Semester-II																
1	R26-SH-BSC-116	Basic Sciences	Differential equation and Numerical Integration	4	-	-	40	60	-	-	-	100	4			4
2	R26-SH-BSC-103 R26-SH-BSC-102	Basic Sciences	Engineering Chemistry / Engineering Physics	3	2	-	40	60	25	-	-	125	3	1		4
3	R26-CE-ESC-105 R26-ME-ESC-104	Engineering Science Course	Engineering Mechanics and Civil Engineering Systems / Engineering Graphics	3	-	-	40	60	-	-	-	100	3			3
4	R26-ET-ESC-107 R26-EE-ESC-106	Engineering Science Course	Fundamentals of Electronics Engineering / Fundamentals of Electrical Engineering	2	2	-	40	60	25	-	-	125	2	1		3
5	R26-Prog.code-PCC-118	Program Core Course	Programming in C	2	-	-	40	60	-	-	-	100	2			2
6	R26-IT-PCC-119	Program Core Course Lab	Programming in C Lab	-	2	-	-	-	25	-	-	25		1		1
7	R26-Prog.Code-VSEC-115/ R26-ME-VSEC-109	Vocational & Skill Enhancement Course	Digital Technology Lab / Engineering Workshop Skills Lab	-	2	-	-	-	50	-	-	50		1		1
8	R26-ME-VSEC-111 R26-CE-VSEC-110	Vocational & Skill Enhancement Course	Civil Engineering Lab / Engineering Graphics Lab	-	2	-	-	-	50	-	-	50		1		1
9	R26-SH-AEC-113 R26-SH-AEC-112	Indian Knowledge System	Professional Communication Skill / Indian Knowledge System	2	-	-	-	-	50	-	-	50	2			2
10	R26-SH-CC-117	Co- curricular Courses	Co-curricular Courses - II	-	2		-	-	25	-	-	25		1		1
			Total	14	12	2	200	300	250	0	0	750	14	6	2	22

Syllabus Structure (A&R)

Sr. No.	Subject Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credit			
				TH	PR	TUT	CCE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL
Semester-I																
1	R26-SH-BSC-101	Basic Sciences	Linear Algebra and Calculus	4	-	-	40	60	-	-	-	100	4	-	-	4
2	R26-SH-BSC-102 / R26-SH-BSC-103	Basic Sciences	Engineering Physics / Engineering Chemistry	3	2	-	40	60	25	-	-	125	3	1	-	4
3	R26-ME-ESC-104 / R26-CE-ESC-105	Engineering Science Course	Basic Mechanical Engineering / Engineering Mechanics and Civil Engineering Systems	3	-	-	40	60	-	-	-	100	3	-	-	3
4	R26-EE-ESC-106 / R26-ET-ESC-107	Engineering Science Course	Fundamentals of Electrical Engineering / Fundamentals of Electronics Engineering	2	2	-	40	60	25	-	-	125	2	1	-	3
5	R26-CO-ESC-108	Engineering Science Course	Programming & Problem Solving Using Python	2	2	-	40	60	25	-	-	125	2	1	-	3
6	R26-ME-VSEC-109 R26-Prog.Code-VSEC-115	Vocational & Skill Enhancement Course	Engineering Workshop Skills Lab / Digital Technology Lab	-	2	-	-	-	50	-	-	50	-	1	-	1
7	R26-ME-VSEC-110 / R26-CE-VSEC-111	Vocational & Skill Enhancement Course	Engineering Graphics Lab / Civil Engineering Lab	-	2	-	-	-	50	-	-	50	-	1	-	1
8	R26-SH-AEC-112 / R26-SH-AEC-113	Ability Enhancement Course	Professional Communication Skill /Indian Knowledge System	2	-	-	-	-	50	-	-	50	2	-	-	2
9	R26-SH-CC-114	Co-curricular Courses	Co-curricular Courses - I	-	2	-	-	-	25	-	-	25	-	1	-	1
			Total	14	12	2	200	300	250	0	0	750	14	6	2	22

Sr. No.	Subject Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credit			
				TH	PR	TUT	CCE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL
Semester-II																
1	R26-SH-BSC-116	Basic Sciences	Differential equation and Numerical Integration	4	-	-	40	60	-	-	-	100	4			4
2	R26-SH-BSC-103 R26-SH-BSC-102	Basic Sciences	Engineering Chemistry / Engineering Physics	3	2	-	40	60	25	-	-	125	3	1		4
3	R26-CE-ESC-105 R26-ME-ESC-104	Engineering Science Course	Engineering Mechanics and Civil Engineering Systems / Basic Mechanical Engineering	3	-	-	40	60	-	-	-	100	3			3
4	R26-ET-ESC-107 R26-EE-ESC-106	Engineering Science Course	Fundamentals of Electronics Engineering / Fundamentals of Electrical Engineering	2	2	-	40	60	25	-	-	125	2	1		3
5	R26-Prog.code-PCC-118	Program Core Course	Program Core Course: (To be proposed by dept.)	2	-	-	40	60	-	-	-	100	2			2
6	R26-IT-PCC-119	Program Core Course Lab	Programming in C	-	2	-	-	-	25	-	-	25		1		1
7	R26-Prog.Code-VSEC-115/ R26-ME-VSEC-109	Vocational & Skill Enhancement Course	Digital Technology Lab / Engineering Workshop Skills Lab	-	2	-	-	-	50	-	-	50		1		1
8	R26-ME-VSEC-111 R26-CE-VSEC-110	Vocational & Skill Enhancement Course	Civil Engineering Lab / Engineering Graphics Lab	-	2	-	-	-	50	-	-	50		1		1
9	R26-SH-AEC-113 R26-SH-AEC-112	Indian Knowledge System	Professional Communication Skill / Indian Knowledge System	2	-	-	-	-	50	-	-	50	2		-	2
10	R26-SH-CC-117	Co- curricular Courses	Co-curricular Courses - II	-	2		-	-	25	-	-	25		1		1
			Total	14	12	2	200	300	250	0	0	750	14	6	2	22

Syllabus Structure (Mechanical)

Sr. No.	Subject Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credit			
				TH	PR	TUT	CCE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL
Semester-I																
1	R26-SH-BSC-101	Basic Sciences	Linear Algebra and Calculus	4	-	-	40	60	-	-	-	100	4	-	-	4
2	R26-SH-BSC-102 R26-SH-BSC-103	Basic Sciences	Engineering Physics / Engineering Chemistry	3	2	-	40	60	25	-	-	125	3	1	-	4
3	R26-ME-ESC-104 R26-CE-ESC-105	Engineering Science Course	Engineering Graphics / Engineering Mechanics and Civil Engineering Systems	3	-	-	40	60	-	-	-	100	3	-	-	3
4	R26-EE-ESC-106 R26-ET-ESC-107	Engineering Science Course	Fundamentals of Electrical Engineering / Fundamentals of Electronics Engineering	2	2	-	40	60	25	-	-	125	2	1	-	3
5	R26-CO-ESC-108	Engineering Science Course	Programming & Problem Solving Using Python	2	2	-	40	60	25	-	-	125	2	1	-	3
6	R26-ME-VSEC-109 R26-Prog.Code-VSEC-115	Vocational & Skill Enhancement Course	Engineering Workshop Skills Lab / Digital Technology Lab	-	2	-	-	-	50	-	-	50	-	1	-	1
7	R26-ME-VSEC-110 R26-CE-VSEC-111	Vocational & Skill Enhancement Course	Engineering Graphics Lab / Civil Engineering Lab	-	2	-	-	-	50	-	-	50	-	1	-	1
8	R26-SH-AEC-112 R26-SH-AEC-113	Ability Enhancement Course	Professional Communication Skill /Indian Knowledge System	2	-	-	-	-	50	-	-	50	2	-	-	2
9	R26-SH-CC-114	Co-curricular Courses	Co-curricular Courses - I	-	2	-	-	-	25	-	-	25	-	1	-	1
			Total	14	12	2	200	300	250	0	0	750	14	6	2	22

Sr. No.	Subject Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credit			
				TH	PR	TUT	CCE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL
Semester-II																
1	R26-SH-BSC-116	Basic Sciences	Differential equation and Numerical Integration	4	-	-	40	60	-	-	-	100	4			4
2	R26-SH-BSC-103 R26-SH-BSC-102	Basic Sciences	Engineering Chemistry / Engineering Physics	3	2	-	40	60	25	-	-	125	3	1		4
3	R26-CE-ESC-105 R26-ME-ESC-104	Engineering Science Course	Engineering Mechanics and Civil Engineering Systems / Engineering Graphics	3	-	-	40	60	-	-	-	100	3			3
4	R26-ET-ESC-107 R26-EE-ESC-106	Engineering Science Course	Fundamentals of Electronics Engineering / Fundamentals of Electrical Engineering	2	2	-	40	60	25	-	-	125	2	1		3
5	R26-Prog.code-PCC-118	Program Core Course	Program Core Course: (To be proposed by dept.)	2	-	-	40	60	-	-	-	100	2			2
6	R26-IT-PCC-119	Program Core Course Lab	Program Core Course Lab (To be proposed by dept.)	-	2	-	-	-	25	-	-	25		1		1
7	R26-Prog.Code-VSEC-115/ R26-ME-VSEC-109	Vocational & Skill Enhancement Course	Digital Technology Lab / Engineering Workshop Skills Lab	-	2	-	-	-	50	-	-	50		1		1
8	R26-ME-VSEC-111 R26-CE-VSEC-110	Vocational & Skill Enhancement Course	Civil Engineering Lab / Engineering Graphics Lab	-	2	-	-	-	50	-	-	50		1		1
9	R26-SH-AEC-113 R26-SH-AEC-112	Indian Knowledge System	Professional Communication Skill / Indian Knowledge System	2	-	-	-	-	50	-	-	50	2			2
10	R26-SH-CC-117	Co- curricular Courses	Co-curricular Courses - II	-	2		-	-	25	-	-	25		1		1
			Total	14	12	2	200	300	250	0	0	750	14	6	2	22

Syllabus Structure (Civil)

Sr. No.	Subject Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credit			
				TH	PR	TUT	CCE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL
Semester-I																
1	R26-SH-BSC-101	Basic Sciences	Linear Algebra and Calculus	4	-	-	40	60	-	-	-	100	4	-	-	4
2	R26-SH-BSC-102 R26-SH-BSC-103	Basic Sciences	Engineering Physics / Engineering Chemistry	3	2	-	40	60	25	-	-	125	3	1	-	4
3	R26-ME-ESC-104 R26-CE-ESC-105	Engineering Science Course	Engineering Graphics / Engineering Mechanics and Civil Engineering Systems	3	-	-	40	60	-	-	-	100	3	-	-	3
4	R26-EE-ESC-106 R26-ET-ESC-107	Engineering Science Course	Fundamentals of Electrical Engineering / Fundamentals of Electronics Engineering	2	2	-	40	60	25	-	-	125	2	1	-	3
5	R26-CO-ESC-108	Engineering Science Course	Programming & Problem Solving Using Python	2	2	-	40	60	25	-	-	125	2	1	-	3
6	R26-ME-VSEC-109 R26-Prog.Code-VSEC-115	Vocational & Skill Enhancement Course	Engineering Workshop Skills Lab / Digital Technology Lab	-	2	-	-	-	50	-	-	50	-	1	-	1
7	R26-ME-VSEC-110 R26-CE-VSEC-111	Vocational & Skill Enhancement Course	Engineering Graphics Lab / Civil Engineering Lab	-	2	-	-	-	50	-	-	50	-	1	-	1
8	R26-SH-AEC-112 R26-SH-AEC-113	Ability Enhancement Course	Professional Communication Skill /Indian Knowledge System	2	-	-	-	-	50	-	-	50	2	-	-	2
9	R26-SH-CC-114	Co-curricular Courses	Co-curricular Courses - I	-	2	-	-	-	25	-	-	25	-	1	-	1
			Total	14	12	2	200	300	250	0	0	750	14	6	2	22

Sr. No.	Subject Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credit			
				TH	PR	TUT	CCE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL
Semester-II																
1	R26-SH-BSC-116	Basic Sciences	Differential equation and Numerical Integration	4	-	-	40	60	-	-	-	100	4			4
2	R26-SH-BSC-103 R26-SH-BSC-102	Basic Sciences	Engineering Chemistry / Engineering Physics	3	2	-	40	60	25	-	-	125	3	1		4
3	R26-CE-ESC-105 R26-ME-ESC-104	Engineering Science Course	Engineering Mechanics and Civil Engineering Systems / Engineering Graphics	3	-	-	40	60	-	-	-	100	3			3
4	R26-ET-ESC-107 R26-EE-ESC-106	Engineering Science Course	Fundamentals of Electronics Engineering / Fundamentals of Electrical Engineering	2	2	-	40	60	25	-	-	125	2	1		3
5	R26-Prog.code-PCC-118	Program Core Course	Program Core Course: (To be proposed by dept.)	2	-	-	40	60	-	-	-	100	2			2
6	R26-IT-PCC-119	Program Core Course Lab	Programming in C Lab	-	2	-	-	-	25	-	-	25		1		1
7	R26-Prog.Code-VSEC-115/ R26-ME-VSEC-109	Vocational & Skill Enhancement Course	Digital Technology Lab / Engineering Workshop Skills Lab	-	2	-	-	-	50	-	-	50		1		1
8	R26-ME-VSEC-111 R26-CE-VSEC-110	Vocational & Skill Enhancement Course	Civil Engineering Lab / Engineering Graphics Lab	-	2	-	-	-	50	-	-	50		1		1
9	R26-SH-AEC-113 R26-SH-AEC-112	Indian Knowledge System	Professional Communication Skill / Indian Knowledge System	2	-	-	-	-	50	-	-	50	2			2
10	R26-SH-CC-117	Co- curricular Courses	Co-curricular Courses - II	-	2		-	-	25	-	-	25		1		1
			Total	14	12	2	200	300	250	0	0	750	14	6	2	22



Semester - I



Program:		F. Y. B. Tech			Semester:		I	
Course:		Linear Algebra and Calculus			Course Code:		R26-SH-BSC-101	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
4	-	-	04	40	60	-	-	
Course Description To Provide foundational knowledge in linear algebra, multivariable calculus, partial differentiation, and numerical methods for engineering problem-solving.								
Course Relevance To Equip the students with essential mathematical tools for analyzing and solving real-world engineering challenges across Engineering disciplines.								
Prerequisite: 1. Fundamentals of Matrices and Determinants 2. Basics of Differentiation, 3. Concepts of Maxima and Minima in one variable								
Bridge Content: Algebra of matrices, System of linear equations using determinants, Differentiation, Maxima - Minima in one variable & Problem-solving skills.								
Course Objectives: To educate the students with concepts and techniques in Linear Algebra, Calculus, and Numerical Differentiation. The aim is to develop the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking in their respective disciplines.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome					Bloom's Level		
CO1	SOLVE systems of linear equations, linear dependence and transformations using matrix methods and the rank of matrices.					3		
CO2	DETERMINE eigenvalues and eigenvectors of matrices for diagonalization of matrices and reduce quadratic forms to canonical form.					3		
CO3	APPLY partial differentiation techniques to functions of several variables, including Euler's theorem and total derivatives.					3		
CO4	APPLY Jacobian to evaluate functional dependence and optimization techniques like Maxima- Minima and Lagrange multipliers to various problems.					3		
CO5	SOLVE nonlinear equations using numerical methods such as Bisection, Regula-Falsi and Newton-Raphson to find the roots and expand the functions using Taylor's and Maclaurin's theorem.					3		



Course Contents			
Unit 1	Linear Algebra – Matrices and System of Linear Equations	10 Hrs.	CO1
Matrix algebra, Rank of a Matrix, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations, Application to problems in - Electric Circuit, Rotation Branch-wise utilization of the unit.			
Exemplars / Practical Applications, Usage: - Solving network equations in electrical circuits using matrix methods. - Modeling and analyzing robot motion and rotation in mechanical systems. - Structural analysis of trusses and beams in civil engineering. - Computer engineers use them in graphics transformations, data processing, and simulation models, Transformations in computer graphics and image processing.			
Assignments: - System of Linear Equations: Analyzing an electrical circuit - Linear Dependence and Independence: Optimizing power distribution in an electrical grid.			
Unit 2	Linear Algebra - Eigen Values, Eigen Vectors and Diagonalization	10 Hrs.	CO2
Eigen Values and Eigen Vectors, Cayley Hamilton theorem, Diagonalization of a matrix, Reduction of Quadratic forms to Canonical form by Linear and Orthogonal transformations, Application to PCA algorithm. Branch-wise utilization of the unit.			
Exemplars / Practical Applications, Usage: - Vibration analysis of mechanical structures and systems. - Stability analysis of electrical circuits and control systems. - Dimensionality reduction in data science using Principal Component Analysis (PCA). - Analysis of stress and strain in structural engineering problems. - Civil engineers use them in structural vibration and stress analysis. - Computer / Data engineers employ them in PCA for efficient data processing and dimensionality reduction in machine learning applications.			
Assignments: - Eigen Values, Eigen Vectors: Modal analysis in mechanical vibration problems. - Cayley Hamilton theorem: Reducing dimensionality of large datasets in machine learning using PCA.			
Unit 3	Functions of Several variables	10 Hrs.	CO3
Introduction to functions of several variables, Partial Derivatives, Euler's Theorem on Homogeneous functions, Partial derivative of Composite Function, Total Derivative, Change of Independent variables Branch-wise utilization of the unit.			
Exemplars / Practical Applications, Usage: - Thermal analysis of systems involving multiple variables (temperature, pressure, volume). - Stress-strain relationships and structural analysis in Civil and Mechanical engineering. - Optimization of engineering processes with multiple parameters. - Analysis of electrical systems with multiple interacting variables. - Computer engineers for optimization and modeling in simulations and machine learning.			
Assignments: Partial Derivatives: Assignment on Temperature gradient analysis in thermodynamics. & Euler's Theorem			

4/10/26

R. G. G. G.



2. PD of Composite Function & Total Derivative: Analyzing fluid flow with variable velocity and pressure.			
Unit 4	Applications of Functions of Several variables	10 Hrs.	CO4
Jacobian and its applications, Errors and Approximations, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers, Branch-wise applications of the unit.			
Exemplars / Practical Applications, Usage: - Jacobian determinants are used in coordinate transformations in mechanical and electrical systems. - Errors and approximations help in ensuring precision in measurements and simulations. - Maxima and minima analysis is crucial in optimizing engineering designs and processes. - Lagrange multipliers are widely used for constrained optimization in mechanical design, structural engineering, electrical systems, and resource management in various engineering disciplines.			
Assignments: - Jacobian: Assignment on Coordinate transformation in robotics and computer vision. - Errors & Approximations: Assignment on Minimizing material usage in civil engineering structures. - Maxima and Minima: Assignment on Energy minimization in mechanical systems.			
Unit 5	Expansion of Functions and Numerical Solutions	10 Hrs.	CO5
Expansion of Functions – Taylor's and Maclaurin's Expansions, Numerical Methods- Bisection, Regula Falsi, Newton-Raphson Methods to Find Roots of equation Branch-wise utilization of the unit.			
Exemplars / Practical Applications, Usage: - In Electrical Engineering, This is use for Solving nonlinear circuit equations, approximating complex signal functions, analyzing stability in control systems. - In Mechanical Engineering, This is use for Root-finding in vibration analysis, approximations in dynamics and thermodynamics, solving nonlinear motion equations. - In Civil Engineering, This is use for Structural analysis of nonlinear systems, load-deflection curve approximations, solving equilibrium equations. - In Computer Science, IT and AI&DS, This is use for Algorithm design for numerical approximations, solving equations in simulations, machine learning optimization.			
Assignments: - Expansion of functions: Assignment on Function expansions in control system analysis. - Finding the roots of equation: Assignment on Finding equilibrium points in mechanical systems. - Presentation: - How Engineers Approximate: Function Expansion and Numerical Solutions - Real-World Engineering Through Approximation: From Series to Solutions - Numerical Analysis in Engineering: From Mathematical Theory to Practical Computation			
Course Projects:			
1.---			
Textbooks:			
- Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Ltd. (10th Edition (2019)) - Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers. (45th Edition (2024–25))			
Reference Books:			
1. B. V. Ramana, Higher Engineering Mathematics. Tata McGraw Hill Education. (First Edition (2017))			

4/10/26

R. G. G. G.



2. M. D. Greenberg, Advanced Engineering Mathematics. Pearson Education. (2nd Edition (1998))
3. Peter V. O'Neil, Advanced Engineering Mathematics. Thomson Learning. (8th Edition (2018))
4. G. B. Thomas, Thomas' Calculus. Addison-Wesley, Pearson. (13th Edition (2018))
5. P. N. Wartikar, & J. N. Wartikar, Applied Mathematics (Vol. I & Vol. II). Vidyarthi Griha Prakashan, Pune. (9th Edition (2019))
6. Ron Larson, & David C. Falvo, Elementary Linear Algebra. Houghton Mifflin Harcourt Publishing Company. (7th Edition (2013))

MOOCs Links and additional reading material:

Unit -1: Matrices And System of Linear Equations

https://youtu.be/_RDF7My0Lfg?si=bGpMB1wF6_gMmXe6

<https://youtu.be/XLCEpW2A5wo?si=sZIYaett4aA22T1X>

<https://youtu.be/NEpvTe3pFIk?si=2lyJ82XROJfZRxl1v>

<https://youtu.be/89Z0tOvHjNU?si=Ri6WFQJgLKsDnv81>

Unit-2: Eigen Values, Eigen Vectors and Diagonalization

<https://youtu.be/h5urBuE4Xhg?si=3FNddmYuh8dKmSZL>

<https://youtu.be/k7rjICzxJ24?si=BxdqL0zUSIBcfVK7>

https://youtu.be/Vq0WMU_GeL4?si=b9ZqNH17PMVnHqQf

Unit-3: Functions of Several variables

<https://youtu.be/qCQQT2P5ojY?si=m-FFkVmAVmi5h1Ku>

https://www.youtube.com/watch?v=XzaeYnZdK5o&list=PLtKWB-wrvn4nA2h8TFxzWL2zy8O9th_fy

<https://www.youtube.com/watch?v=btLWNJdHzSQ>

https://www.youtube.com/watch?v=_1TNtFqiFQo&list=PLtKWB-wrvn4nA2h8TFxzWL2zy8O9th_fy&index=10

Unit-4: Applications of Functions of Several variables

<https://www.youtube.com/watch?v=jGwA4hknYp4&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&index=18>

<https://www.youtube.com/watch?v=ArkDa6d5h9I&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&index=19>

<https://www.youtube.com/watch?v=h23P5lrlrYU&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&index=20>

<https://www.youtube.com/watch?v=Qodww3BcZZs&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&index=21>

Unit-5: Function Expansions & Numerical Solutions

<https://youtu.be/LLHjZ5fhY4U?si=YvpDSnEOIxCOHgxX>

https://youtu.be/06VYX7XmvUY?si=LWR-_7lIDoWNYD0s

<https://youtu.be/YkmMLD8ze8A?si=Y4TIBq37mUuG1PsZ>

<https://youtu.be/wLl20WHPB-Y?si=f6XlgrAiwpQ9nQQx>

Amrutvahini

R. Amrutvahini



Strength of CO-PO Mapping											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	2	2	1	-	2
CO2	2	2	-	-	-	-	2	2	1	-	2
CO3	2	2	-	-	-	-	2	2	1	-	2
CO4	3	3	-	-	-	-	2	2	1	-	2
CO5	3	3	-	-	-	-	2	2	1	-	2
Avg.	2.6	2.4	-	-	-	-	2	2	1	-	2

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

Assessment Pattern							
BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / Presentation etc.	
K1	✓	✓	✓	-	✓	✓	✓
K2	✓	✓	✓	-	✓	-	✓
K3	✓	✓	✓	-	✓	-	✓
K4	-	-	-	-	-	-	-
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses:

1. **Finite Element Analysis (FEA):** Linear systems, matrix methods, interpolation
2. **Machine Learning:** Linear algebra, optimization, partial derivatives
3. **Robotics and Control Systems:** Jacobians, transformations, eigenvalues
4. **Data Science / Statistics:** Matrices, numerical methods, interpolation
5. **Simulation & Modeling:** Numerical methods, root finding, partial derivatives
6. **Digital Signal Processing:** Interpolation, approximations, transforms
7. **GATE Exam/ CAT Exam /Aptitude Tests**

Job Mapping:

Job opportunities that one can get after learning this course:

1. Applied Mathematician
2. Computational Scientist
3. Numerical Analyst
4. Tool Design Engineer

Amrutvahini

R. G. G. G.



Program:		F. Y. B. Tech		Semester:		I / II	
Course:		Engineering Physics		Course Code:		R26-SH-BSC-102	
Teaching Scheme (Hrs./week)				Examination Scheme			
Lecture	Practical	Tutorial	Credits (TH+PR)	CCE	ESE	TW	PR
03	02	-	03 + 01	40	60	25	-
Course Description This course introduces fundamental concepts of Engineering Physics essential for all branches of engineering. It covers modern optics, quantum mechanics, lasers, optical fibers, semiconductor physics, magnetism, superconductivity, and nanotechnology. The emphasis is on both theoretical understanding and practical applications, enabling students to connect physical principles with engineering innovations. Through lectures, laboratory work, and problem-solving sessions, students develop analytical, experimental, and critical thinking skills required for engineering practice.							
Course Relevance Engineering Physics provides the scientific foundation necessary for understanding and applying core engineering principles. The course bridges fundamental physics with real-world engineering applications, enabling students to analyze, design, and innovate across diverse technological domains. It emphasizes critical thinking, experimental skills, and problem-solving abilities that support advanced learning in engineering subjects. By integrating concepts of optics, quantum mechanics, semiconductors, magnetism, superconductivity, and nanotechnology, students gain the ability to connect theory with practice, paving the way for innovation in modern technology, sustainable energy, materials science, and emerging fields such as quantum computing and nanotechnology.							
Prerequisite: Students are expected to be familiar with: 1. Basic wave properties (superposition principle, wavefronts, total internal reflection). 2. Fundamentals of semiconductors (P-type and N-type). 3. Mathematics background in trigonometry and calculus.							
Bridge Content: To ensure smooth transition from school-level physics to advanced engineering applications, the following bridging topics are introduced: 1. Optics: Stokes’ law, Brewster’s law. 2. Atomic & Solid-State Physics: Atomic energy levels, magnetism (domains, hysteresis). 3. Electronics & Conductivity: Basics of electrical conduction, resistance, and carrier dynamics. 4. Radiation & Materials: Absorption/emission processes, origin of resistance in solids.							
Course Objectives: Develop the students with a strong foundation in physics fundamentals, complemented by hands-on experiments, and empower them to apply this knowledge in innovative ways to drive advancements in engineering and technology, fostering a culture of experimentation, innovation, and lifelong learning.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome					Bloom’s Level	
CO1	EXAMINE interference and polarization phenomena to identify their applications in engineering and technology.					3	
CO2	ILLUSTRATE the fundamentals of quantum mechanics using Schrödinger’s equations for basic bound state problems.					3	



CO3	CLASSIFY types of lasers and optical fibers to apply their principles to engineering applications.	3
CO4	CLASSIFY solids on the basis of band theory determine parameters of solar cells, and distinguish types of magnetic substances with their applications.	3
CO5	DEMONSTRATE the properties, applications, and synthesis methods of nanoparticles and superconductors in engineering contexts.	3
Course Contents		
Unit 1	Modern Optics	8 Hrs.
CO1		
INTERFERENCE: Introduction, Interference in thin parallel film due to reflected light, Interference in thin wedge-shaped film, formation of Newton's Rings, Diameters of bright and dark Newton's Rings, Numericals. Engineering applications of interference: Interferometry, Anti-reflection coating. Optical flatness of a surface. POLARISATION: Introduction, Unpolarized light, Plane Polarised light, Plane of vibration, Plane of polarization. Methods for producing plane polarised light, Law of Malus, Numericals. Double Refraction, Geometry of Calcite crystal, Huygen's theory of double re fraction. LCD, 3D movies. Exemplars / Practical Applications and usage: 1. Surface profile measurement: Light interferometry can be used to measure surface roughness and profile. 2. Anti-reflection coatings: Optical sensors and other devices like solar cells, camera, telescope use anti-reflection coatings to minimize reflection and maximize transmission. 3. Optical communication: Polarization is used in optical communication systems to transmit data. 4. 3D movies: Polarization is used to create 3D effects in movies. 5. LCD: use in screens of calculators, wristwatch, laptop, television, computer display etc. Assignment: 1. Illustrate how principle of interference of light is applied in everyday or engineering applications such as anti-reflection coatings, Newton's rings, interferometry, surface profile measurement, thickness measurement, and determination of unknown wavelength, giving suitable examples. 2. Illustrate how principle of polarization of light is applied in devices such as LCDs, polarized sunglasses, and 3D movie to explain its importance in engineering and technology.		
Unit 2	Wave Mechanics	8 Hrs.
CO2		
WAVE PARTICLE DUALITY: Basic of quantum mechanics and classical mechanics, De - Broglie's Hypothesis, De - Broglie's wavelength in terms of kinetic energy and potential of a particle, definitions of wave packet, group velocity and phase velocity of matter waves, properties of matter waves, Heisenberg's Uncertainty Principle [H.U.P.], Numericals. WAVE EQUATIONS: Concepts of wave function[ψ], physical significance of $\psi ^2$, Schrodinger's wave equations and its importance, Schrodinger's wave equations - time independent and time dependent, Numericals. Engineering application: Particle confined in one-dimensional infinite potential well [Rigid Box], Tunneling effect, Introduction to quantum computing, limitations of classical computing Vs advantageous of quantum computing, Qbit, superposition and entanglement, possible applications of quantum computing. Exemplars / Practical Applications and usage: 1. Quantum computing – Leverages superposition and tunneling for computation. 2. Scanning Tunneling Microscope (STM) – Images atomic surfaces using electron tunneling. 3. Semiconductor devices – Band theory explains diode and transistor behavior.		

**Assignments:**

1. Apply the concept of quantum tunneling to explain operations and characteristics of tunnel diode or Scanning Tunneling Microscope.
2. Apply the fundamental principles of quantum computing to analyze its working and real-world applications.

Unit 3	Laser And Optical Fibers	8 Hrs.	CO3
LASER: Introduction, Ground state, Unstable excited state, Metastable state, Induced absorption, Spontaneous emission, Stimulated emission, Population inversion, Active medium, Pumping, Resonant/optical cavity, characteristics of LASER, Semiconductor LASER, Gas LASER: CO₂ LASER, Applications: Holography, industry, medical field, Defense. OPTICAL FIBERS: Introduction, parameters of optical fibers: acceptance angle, numerical aperture, index difference, Numericals. Types of optical fibers: single mode step index, multi-mode step index, multi-mode graded index, attenuation and its reasons. Engineering application: Optical fiber communication with block diagram.			
Exemplars / Practical Applications and usage: 1. Holography – Laser record 3D images for security and artistic purposes. 2. Fiber-optic communication – Enables high-speed internet and telecommunication. 3. Optical sensors – Detect strain, temperature, and pressure in structural monitoring. 4. Industrial cutting & welding – High-power lasers precision-cut metals. 5. Medical lasers – Used in surgeries (e.g., eye surgery, tumor removal).			
Assignments: 1. Apply the principles of optical fiber technology to understand how fiber-optic sensors are used in monitoring and managing infrastructure, traffic, and environmental parameters in smart cities.			
Unit 4	Semiconductor Physics & Magnetism	8 Hrs.	CO4
SEMICONDUCTOR PHYSICS: Introduction, Energy band theory and classification of solids, Fermi – level, Fermi – energy, Fermi Dirac probability distribution function [Fermi function], Fermi level in semiconductors, position of fermi level in intrinsic and extrinsic semiconductors, Energy band structure of pn – junction diode in unbiased, forward biased and reverse biased mode, Hall effect with derivation for Hall voltage and Hall coefficient, applications of Hall effect, Numericals. RENEWABLE ENERGY DEVICE: Solar Cell - principle, construction and working, I-V Characteristics, parameters of solar cell (Open circuit voltage, short circuit current, Fill Factor & Efficiency). Ways to improve efficiency of solar cell, Applications of solar cell. MAGNETISM: Magnetic Properties: Magnetic Permeability, Magnetic Susceptibility, classification of magnetism on the basis of permeability, Soft and Hard Magnetic Materials, Applications of magnetic materials: Transformer cores, magnetic storage.			
Exemplars / Practical Applications and usage: 1. Hall effect sensors – Used in speedometers, current sensors, and brushless motors. 2. Solar cells – Convert sunlight into electricity (e.g., rooftop panels). 3. Magnetic storage – Hard drives use ferromagnetic materials for data storage. 4. Transformer cores – Soft magnetic materials (e.g., silicon steel) minimize energy loss.			
Assignments: 1. Apply Semiconductor Physics Concepts to Improve Solar Cell Efficiency. 2. Apply Magnetic Property Concepts to Select Materials for Engineering Devices.			



Unit 5	Superconductivity and Nanotechnology	8 Hrs.	CO5
SUPERCONDUCTIVITY: Introduction, superconductivity phenomenon, critical temperature, Properties: zero electrical resistance, Meissner's effect, critical magnetic field, Types of superconductors: Type - I and Type - II superconductors, Formation of Cooper pairs, AC and DC Josephson effect, Engineering Applications: SQUID, Maglev Train, hyperloop, High Power Transmission. NANOTECHNOLOGY: Introduction to nanotechnology, nanostructured materials, synthesis of nanoparticles: Mechanical Method - Ball Milling, Physical Vapor Deposition method. Properties of nanoparticles: optical, electrical, mechanical, magnetic. Applications of nanotechnology: electronics, automobile, energy, medical, Space and Defense, Environment.			
Exemplars / Practical Applications and usage: 1. Quantum dots – Used in displays (QLED TVs). 2. Drug delivery – Nanoparticles target cancer cells precisely. 3. SQUID (Superconducting Quantum Interference Device) – Detects tiny magnetic fields (e.g., brain scans). 4. Maglev trains – Superconducting magnets enable frictionless movement. 5. Electronics – Spin valves, Semiconductors, components, Flat monitors etc.			
Case Study: 1. Application of Superconductivity in Magnetic Levitation (Maglev) Trains, real-world example of superconductors in transport technology, Use of Gold Nanoparticles for Targeted Drug Delivery and Imaging in Cancer Therapy. Quiz: 1. Solve MCQs using basic concepts of superconductivity and nanotechnology.			
Course Projects: -			
Textbooks: 1. A Textbook of Engineering Physics, M. N. Avadhanulu, P. G. Kshirsagar & TVS Arun Murthy, S. Chand Publications. 2. Engineering Physics, R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications.			
Reference Books: 1. David Halliday, Robert Resnick, Jearl Walker, Fundamentals of Physics, Wiley, 10th Edition. 2. Ajoy Ghatak, Optics, Tata McGraw-Hill, 6th Edition. 3. Charles Kittel, Introduction to Solid State Physics, Wiley, 8th Edition. 4. A. K. Ghatak, S. Lokanathan, Quantum Mechanics, Laxmi Publications, 6th Edition. 5. Dr. S. K. Kulkarni, Nanotechnology: Principles and Practices, Capital Publishing, 3rd Edition. 6. Raymond A. Serway, John W. Jewett, Principles of Physics, Saunders College Publishing, 5th Edition.			
MOOCs Links : Optic Fibers 1. https://youtu.be/AdF5hFQ9P0o?si=uZrduczvXjhbtaPS 2. https://youtu.be/7Jo8svhWD7A?si=JOY5IkSClaa_gINy 3. https://youtu.be/ougKUUM3hJA?si=aOEO7Oc6H0AgsIyx LASER & Holography 4. https://youtu.be/zq_qFvvFLfY?si=d4T73v6johZ6jcpX 5. https://youtu.be/jbctJ0rVS6I?si=jDcl9QtQ91nfpbkH Semiconductor Physics: Hall Effect 6. https://www.youtube.com/watch?v=Tt8zwiniSPc&t=6s 7. https://www.youtube.com/watch?v=YpdQF6N9C1w&t=1s			



8. https://youtu.be/Pqxun4_nePo?si=bKB2WbLdFC5Mse0w Fermi energy, Level & function 9. https://youtu.be/knVD1AfiozA?si=vdLzevfpWYvPREu Magnetism 10. https://youtu.be/78raYFWv6s?si=VnvmpVWtwGrom2g9 Physics of nanoparticles 11. https://youtu.be/2dj7Y0Um4LE?si=_smjHbTbZzu_oHeS Superconductivity 12. https://youtu.be/QRvTAUjnb8?si=Y193SUOx8UaouSE3 Quantum Physics: Schrodinger's wave equation & applications 13. https://youtu.be/4BZ1IK_YIpM?si=ComqaepyR6AIAmXS https://youtu.be/O5hXpm_Sy6c?si=Fm35IKuJtXQ11OCK			
List of Practical			
Experiment No.1	Newton's Rings	2 Hrs.	CO1
Objective: To understand the formation of Newton's Rings Phenomenon and to determine wavelength of monochromatic light. Associated Tasks: - Set up the apparatus with a plano-convex lens and a glass plate, ensuring proper alignment. - Measure the diameters of the Newton's Rings at different points and calculate the wavelength of light using the ring diameters. Exemplars and Utility: - Surface roughness measurement in optical manufacturing. - Determine the refractive index of liquid.			
Experiment No.2	Numerical Aperture of optical fiber	2 Hrs.	CO3
Objective: To determine the numerical aperture [N.A.] of an optical fiber. Associated Tasks: - Launch light into the fiber and observe the acceptance angle using a protractor or angular measurement setup. - Measure the maximum acceptance angle to calculate the N.A. using the relation Numerical Aperture = $\sin \theta$. Exemplars and Utility: - Design of efficient optical communication systems. - Optimization of fiber optic sensors.			
Experiment No.3	Law of Malus	2 Hrs.	CO1
Objective: To verify cosine square law of Malus for plane polarized light using Photodiode. Associated Tasks: - Pass polarized light through a polarizer and rotate the analyzer to measure transmitted intensity at different angles. - Record the intensity values and plot the intensity versus angle to verify the cosine square law Exemplars and Utility: - Developing liquid crystal displays (LCDs). - Designing polarized sunglasses and filters.			
Experiment No.4	Diffraction due to plane diffraction grating using laser	2 Hrs.	CO3



Objective: To determine the number of lines per centimeter on a diffraction grating. Associated Tasks: 1. Direct the laser beam onto the diffraction grating and measure the angular positions of diffraction maxima. 2. Calculate the line density of the grating using the diffraction formula. Exemplars and Utility: 1. Wavelength calibration of spectrometers. 2. Laser tuning and wavelength selection.			
Experiment No.5	Energy gap of semiconductor	2 Hrs.	CO4
Objective: To determine the band gap in given semiconductor sample using pn - junction diode Associated Tasks: 1. Measure the reverse current with fall in temperature of the diode. 2. Plot the graph of $\ln(I)$ versus $1/T$ to extract the energy gap from the slope. Exemplars and Utility: 1. Development of semiconductor devices like LEDs and solar cells. 2. Material characterization in semiconductor manufacturing.			
Experiment No.6	Hall effect	2 Hrs.	CO4
Objective: To determine the Hall coefficients of given semiconductor sample. Associated Tasks: 1. Apply a magnetic field perpendicular to the current flow and measure the Hall voltage. 2. Calculate the Hall coefficient and carrier concentration from the measurements. Exemplars and Utility: 1. Material purity and doping level assessment 2. Magnetic field sensor development.			
Experiment No.7	Solar cell characteristics	2 Hrs.	CO4
Objective: To obtain I-V characteristics and determine fill factor of given solar cell. Associated Tasks: 1. Vary the load resistance and measure the corresponding current and voltage. 2. Plot the I-V curve and calculate the fill factor and efficiency. Exemplars and Utility: 1. Designing efficient photovoltaic systems. 2. Evaluating the impact of environmental conditions on solar cells.			
Experiment No.8	Ultrasonic Interferometer	2 Hrs.	CO1
Objective: Determination of compressibility of given liquid by using Ultrasonic Interferometer. Associated Tasks: 1. Measure the wavelength of ultrasonic waves in given liquid using stationary waves. 2. Calculate the speed of sound in the liquid and determine its compressibility. Exemplars and Utility: 1. Non-destructive testing of liquids and materials. 2. Medical ultrasonography advancements.			
Experiment No.9	Wavelength of Spectral lines	2 Hrs.	CO1



Objective: To determine wavelength of light by using diffraction grating.

Associated Tasks:

1. Record the positions of spectral lines on the screen at different diffraction angles.
2. Calculate the wavelength using the diffraction formula and known grating line density.

Exemplars and Utility:

1. Spectroscopic identification of elements.
2. Applying spectrometric techniques in optical analysis.

Experiment No.10	Determination of polarizing angle [Brewster's angle]	2 Hrs.	CO1
Objective: To determine polarizing angle by using prism. Associated Tasks: 1. Vary the angle of incidence on the prism and measure the reflected and transmitted intensities. 2. Find the angle at which reflected light is completely polarized, i.e., Brewster's angle. Exemplars and Utility: 1. Reducing glare in optical systems. 2. Optical communication systems using polarized light.			

Strength of CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	1	2	2	2	-	2
CO2	2	3	-	-	-	-	-	-	-	-	2
CO3	2	2	-	-	-	1	2	2	-	-	2
CO4	2	2	-	-	-	2	2	2	2	-	2
CO5	2	1	-	-	-	1	-	-	-	-	2
Avg.	2.00	2.00	-	-	-	1.25	2.00	2.00	2.00	-	2.00

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	✓	✓	-	-	✓	✓	✓
K2	✓	✓	-	-	✓	-	✓
K3	✓	✓	-	-	✓	-	✓
K4	-	-	-	-	-	-	-
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-



This course serves as a prerequisite for / maps with the following future courses:

Electronics, materials science, energy systems, communication and sensing technologies, modern electronic and photonic devices, energy applications, smart materials, advanced instrumentation, computing, healthcare, environment, and sustainable engineering solutions.

Job Mapping:

-



Program:		F. Y. B. Tech		Semester:		I / II	
Course:		Engineering Chemistry		Course Code:		R26-SH-BSC-103	
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit (TH+PR)	CCE	ESE	TW	PR
03	02	-	03 + 01	40	60	25	-
Course Description: This course introduces the fundamental principles of chemistry essential for engineering students and emphasizes their direct applications in various technological and industrial fields. It covers water quality analysis, electroanalytical techniques, batteries, polymers, nanomaterials, fuels, and corrosion science. Through theory, practical sessions, and problem-solving, students gain the ability to analyse chemical processes, understand material behaviour, and apply chemistry-based solutions to engineering challenges.							
Course Relevance The course is highly relevant as it bridges core chemical concepts with real-world engineering applications. Knowledge of water treatment, corrosion prevention, electrochemistry, fuel technology, and advanced materials plays a crucial role in industries such as energy, environment, manufacturing, and materials engineering. By integrating chemistry with engineering practices, this course prepares students to design sustainable processes, develop innovative materials, and contribute to advancements in technology and society.							
Prerequisite: Students are expected to be familiar with: 1. Fundamental knowledge of basic chemistry concepts studied at higher secondary level. 2. Understanding of atomic structure, periodic classification, and types of chemical bonding. 3. Familiarity with common chemical reactions, states of matter, and basic solution chemistry. 4. Ability to perform simple chemical calculations and interpret experimental observations.							
Bridge Content: 1. Atomic Structure and Chemical Bonding – fundamental understanding of atoms, molecules, orbitals, and types of bonds to explain material properties. 2. Electrochemistry – basic electrochemical principles required for batteries, corrosion studies, and analytical techniques. 3. Basic Organic Chemistry – introduction to functional groups, polymerization, and reaction mechanisms relevant for materials and industrial applications. 4. Analytical Chemistry – fundamental techniques of qualitative and quantitative analysis that form the basis for water quality testing, fuel analysis, and material characterization.							
Course Objectives: 1. ACQUIRE knowledge of water quality analysis technology. 2. ACQUIRE the knowledge of electro-analytical techniques for chemical analysis and precise and fundamentals of battery. 3. RELATE basic knowledge of polymers, nanomaterials and their application in engineering. 4. STUDY conventional and alternative fuels. 5. UNDERSTAND corrosion mechanisms and prevention methods.							
Course Outcomes: After successful completion of the course, learner will be able to:							
CO	Course Outcome					Bloom's Level	
CO1	ILLUSTRATE the technology involved in analysis, improving quality of water as commodity and its implementation.					3	



CO2	APPLY appropriate electro analytical techniques for analysis of materials and demonstrate different types of batteries.	3
CO3	DESCRIBE the structure and properties of advanced engineering materials for various technological applications.	3
CO4	ANALYZE different types of conventional and alternative fuels with respect to their properties and applications.	3
CO5	EXPLAIN causes of corrosion and methods for minimizing corrosion.	3
Course Contents		
Unit 1	Water Technology	8 Hrs.
CO1		
Impurities in water, hardness of water: Types, Units and Numerical. Determination of hardness by EDTA method and alkalinity, numerical. Chemical oxygen demand (COD) of water and biological oxygen demand (BOD) of water. Ill effects of hard water in boilers and heat exchangers: Boiler corrosion, scale and sludge. Water treatment: (i) Zeolite method and numerical (ii) Demineralization method. (iii) Reverse osmosis. Modern technique for atmospheric water generation. (i) Using Dew point method (ii) Using heat exchanger technology.		
Exemplars / Practical Applications and usage:		
1. Industrial water treatment 2. Environmental monitoring 3. Public health and domestic use 4. Agricultural applications 5. Modern innovations for atmospheric water generation		
Assignments:		
1. Collect a local water sample and determine parameters such as hardness and alkalinity prepare a short report. 2. Visit a nearby water treatment or wastewater plant and prepare a case study report on the treatment processes used.		
Unit 2	Electroanalytical Techniques and Batteries	8 Hrs.
CO2		
Electrode potential, Nernst equation, Reference Electrode-Calomel electrode, Indicator electrode- Glass electrode, Conductometry: Conductometric titration of strong acid vs strong base. pH metry: pH metric titration of strong acid vs strong base. Batteries: Construction, working and applications of Li-ion battery and Na-ion battery. Fuel Cells: PAFC and PEMFC. UV-Visible spectroscopy: Lamberts-Beers Law. Terms in UV-visible spectroscopy. Electronic transitions. Instrumentation in UV-visible spectrophotometer. Applications of UV-visible spectroscopy.		
Exemplars / Practical Applications and usage:		
1. pH measurement used in pharmaceutical, food, and environmental industries. 2. Conductometry used in water quality testing, and monitoring ionic strength in industrial processes. 3. A battery is core technology in mobile phones, laptops, electric vehicles (EVs), and renewable energy storage systems. 4. Fuel Cells provide clean energy in automobiles. 5. UV-Visible Spectroscopy used chemical and material analysis.		
Assignments:		
1. Collect a local water sample and determine parameters such as conductance and pH. 2. Create a comparison table showing the characteristics (voltage, efficiency, cost, and applications) of a Li-		



ion battery and Na-ion battery.			
Unit 3	Advanced Engineering Materials	8 Hrs.	CO3
Polymers: Introduction, Definition Polymer, Monomer, Functionality of monomers, Classification of polymer (Thermal Behavior-Thermoplastics and Thermosetting). Specialty polymers: Introduction, preparation, properties and applications of the following polymers: 1. Engineering Thermoplastic: Polycarbonate, 2. Bio-degradable polymers (PHBV) 3. Conducting Polymer: Polyacetylene. Polymer composites- Classification and Preparation. Ex. Carbon fiber reinforced composite. Nanomaterials: Introduction, classification of nanomaterials based on dimensions (zero dimensional, one-dimensional, two-dimensional and three-dimensional). Structure, properties and applications of graphene and carbon nanotubes, quantum dots (semiconductor nanoparticles).			
Exemplars / Practical Applications and usage: 1. Polymer used in plastic packaging, pipes, and containers. 2. Polymer composites aerospace components, sports equipment, automotive panels. 3. Nanomaterials in the solar cells, transistors, electronics and various engineering field.			
Assignments: 1. Prepare a case study on the use of advanced materials in electric vehicles, aerospace components, or biomedical implants. 2. Collect and analyze material property datasets (e.g., tensile strength, conductivity, density etc.)			
Unit 4	Fuels	8 Hrs.	CO4
Introduction (definition, classification of fuel based on chemical reactions and characteristics of an ideal fuel), Calorific value, Higher calorific value and Lower calorific value, Determination of calorific value of fuel using Bomb calorimeter and Boy's gas calorimeter and numerical. Alternative fuels: Power alcohol and biodiesel. Hydrogen gas as a future fuel: Preparation hydrogen by steam reforming of methane and coke. Difficulties in storage and transportation of hydrogen. Composition, properties and applications of CNG.			
Exemplars / Practical Applications and usage: 1. Transportation 2. Power Generation 3. Industrial Processes 4. Domestic Use 5. Emerging Clean Energy			
Assignments: 1. Explore the role of emerging fuels (such as green hydrogen, ammonia, or synthetic fuels) in meeting future energy demands. 2. Prepare a case study on the transition from conventional to renewable fuels (e.g., bioethanol blending in petrol or biodiesel in diesel engines).			
Unit 5	Corrosion And Its Prevention	8 Hrs.	CO5
Introduction, Types of corrosion – Dry and Wet corrosion, mechanism of dry corrosion, nature of oxide films and Pilling-Bedworth's rule, wet corrosion – mechanism: hydrogen evolution and oxygen absorption, Factors influencing rate of corrosion. Methods of corrosion control and prevention: Cathodic Protection (Sacrificial Anode and Impressed Current), metallic coatings and its types, surface preparation, methods to apply metallic coatings-hot dipping, electroplating. Anti corrosive paints.			

**Exemplars / Practical Applications and usage:**

1. Construction
2. Automobile
3. Marine Industry
4. Metallic pipelines
5. Chemical Industry

Case Study:

1. Prepare a case study on corrosion prevention in industries such as oil & gas, marine, or infrastructure sectors.

Quiz:

1. Solve the MCQ quiz on Corrosion and its prevention.

Course Projects:

-

Textbooks:

1. Dr. S. S. Dara, Dr. S. S. Umare, Textbook of Engineering Chemistry, S. Chand & Company Ltd. 2nd edition.
2. O. G. Palanna, Engineering Chemistry, Tata Magraw Hill Education Pvt. Ltd., 2nd edition.
3. Dr. Sunita Rattan, Textbook of Engineering Chemistry, S. K. Kataria & Sons Publisher, 3rd edition.

Reference Books:

1. S. M. Khopkar, *Basic Concept of Analytical Chemistry*, New Age-International Publisher, 2nd edition.
2. G. R. Chatwal & S. K. Anand, *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House, 5th edition.
3. P. S. Kalsi, *Spectroscopy of organic compounds*, New Age-International Ltd., Publisher, 2nd edition.
4. V. R. Gowarikar, N. V. Viswanathan, Jayadev Sreedhar, *Polymer Science*, Wiley Eastern Limited, 5th edition.
5. Shriver and Atkins, *Inorganic Chemistry*, Oxford University Press, 5th edition
6. G. L. Hornyak, J. J. Moone, G. L. Hornyak, J. J. Moone, *Fundamentals of Nanotechnology*, CRC press, 1st edition.
7. Kirby W. Beard, Linden's Handbook of Batteries, McGraw Hill, 5th edition.

MOOCs Links and additional reading material:**Water Technology**

1. https://www.youtube.com/results?search_query=water+technology+engineering+chemistry+sppu

Electroanalytical techniques

2. https://www.youtube.com/results?search_query=electroanalytical+techniques+and+batteries+engineering+chemistry

Polymers

3. https://www.youtube.com/results?search_query=polymer+technology+engineering+chemistry+sppu

Fuels

4. https://www.youtube.com/results?search_query=fuels++engineering+chemistry

Corrosion

5. https://www.youtube.com/results?search_query=corrosion+engineering+chemistry



List of Practical			
Experiment No.1	To determine hardness of water by EDTA method	2 Hrs.	CO1
Objective: To understand the concept of water hardness and its importance in daily life and industry. Associated Tasks: 1. Collect water from various regions. 2. Analysis of water. Exemplars and Utility: 1. Industrial Water Treatment: Monitoring hardness helps in scaling prevention in boilers and cooling systems. 2. Environmental Monitoring: Assessing water quality in natural bodies and wastewater treatment.			
Experiment No.2	To determine alkalinity of water	2 Hrs.	CO1
Objective: To understand the concept of alkalinity in water and its significance in water quality. Associated Tasks: 1. Collect water from various regions. 2. Analysis of water. Exemplars and Utility: 1. Industrial Process Control: Monitoring alkalinity is essential in industries like brewing, chemical manufacturing, and paper production to ensure product quality and prevent equipment scaling. 2. Water Quality Assessment: Determining alkalinity helps in evaluating the buffering capacity of water, which is crucial for maintaining stable pH levels in various applications.			
Experiment No.3	Titration of a mixture of weak acid and strong acid with strong base using conductometer	2 Hrs.	CO2
Objective: To learn how to perform titration of a mixture containing both weak and strong acids using a strong base. Associated Tasks: 1. Preparation of acids or base solutions of different concentrations. 2. Measurement of conductance of various solutions. Exemplars and Utility: 1. Accurate determination of acid concentrations 2. Study of Acid-Base strength and behavior			
Experiment No.4	To determine strength of strong acid using pH meter	2 Hrs.	CO2
Objective: To calculate the molarity (strength) of the acid solution from the pH data. Associated Tasks: 1. Preparation of acids or base solutions of different concentrations. 2. Measurement of pH of various solutions. Exemplars and Utility: 1. Monitoring Acid-Base reactions 2. Educational demonstrations			



Experiment No.5	To determine maximum wavelength of absorption of CuSO ₄ verify Beer's law and find unknown concentration of given sample	2 Hrs.	CO2
Objective: To understand and verify Beer's Law by studying the relationship between absorbance and concentration. Associated Tasks: 1. Prepare a standard solution of CuSO₄ with known concentration. 2. Record the absorbance values across this range. Exemplars and Utility: 1. Quantitative analysis of concentration of solutions. 2. Determining the maximum absorption wavelength of given solution.			
Experiment No.6	Preparation of phenol-formaldehyde/urea-formaldehyde resin	2 Hrs.	CO3
Objective: To gain hands-on experience in handling chemicals and controlling reaction parameters safely. Associated Tasks: 1. Compare the two types of resins in terms of applications and chemical structure. 2. Identify the type of polymerization involved. Exemplars and Utility: 1. Used in the manufacturing of molded products such as electrical insulators, handles, and automotive parts. 2. Predominantly used as a binder in the production of particleboard and plywood.			
Experiment No.7	To determine molecular weight of polyvinyl alcohol by viscosity measurement	2 Hrs.	CO3
Objective: To understand the relationship between viscosity and molecular weight of polymers. Associated Tasks: 1. Study and summarize the concept of viscosity and its relation to molecular weight. 2. Calculate the relative viscosity and specific viscosity for each concentration. Exemplars and Utility: 1. Determining molecular weight 2. Quality Control			
Experiment No.8	To coat copper, nickel and zinc on an iron plate using electroplating	2 Hrs.	CO5
Objective: To study the effect of process parameters like current, time, and electrolyte concentration on plating quality. Associated Tasks: 1. Study the electrochemical reactions for plating copper, nickel, and zinc. 2. Set up the electroplating cell with power supply, electrodes, and electrolyte. Exemplars and Utility: 1. Corrosion protection 2. Enhanced durability			
Experiment No.9	Proximate analysis of fuel	2 Hrs.	CO4



Objective: This analysis is essential for evaluating fuel quality, optimizing combustion processes, and ensuring efficient energy production.

Associated Tasks:

1. Sample Preparation
2. Determination of various content

Exemplars and Utility:

1. Process optimization & control
2. Environmental impact & compliance

Experiment No.10	Determination of Chemical oxygen (COD) demand of water sample	2 Hrs.	CO1
Objective: COD measures the total amount of oxygen required to oxidize both biodegradable and non-biodegradable organic substances in a water sample, reflecting the overall organic pollutant load. Associated Tasks: 1. Reagent & solution preparation 2. Sample digestion Exemplars and Utility: 1. Pollution assessment & environmental protection 2. Regulatory compliance & discharge management			

Strength of CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	-	3	1	2	1	-	2
CO2	2	3	2	1	-	2	1	1	1	-	2
CO3	3	2	2	-	-	2	-	2	-	-	2
CO4	2	3	1	-	-	2	1	2	-	-	2
CO5	3	3	2	1	-	2	-	1	-	-	2
Avg.	2.60	2.80	1.80	1.00	-	2.20	1.00	1.60	1.00	-	2.00

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	✓	✓	-	-	✓	✓	✓
K2	✓	✓	-	-	✓		✓
K3	✓	✓	-	-	✓		✓
K4		-	-	-	-	-	-
K5		-	-	-	-	-	-
K6		-	-	-	-	-	-



This course serves as a prerequisite for / maps with the following future courses:

Engineering Chemistry forms a vital foundation for all branches of engineering by linking basic chemical principles with technological applications. In Mechanical and Automation & Robotics Engineering, it aids in understanding fuels, lubricants, corrosion prevention, and materials used in engines and vehicles. For Civil Engineers, it provides insights into cement chemistry, water treatment, corrosion of steel reinforcement, and modern construction materials. In Electrical, Electronics & Telecommunication and Electronics & Computer Engineering, it supports the study of electrochemical cells, batteries, semiconductors, and corrosion control of conductors. Engineering Chemistry is fundamentally connected with every branch of engineering, including Computer Engineering, Artificial Intelligence & Data Science and Information Technology. It provides the scientific basis for understanding materials, energy systems, and environmental sustainability relevant to computational and intelligent technologies.

Job Mapping: -



Program:		F. Y. B. Tech				Semester:		I	
Course:		Basic Mechanical Engineering				Course Code:		R26-ME-ESE-121	
Teaching Scheme					Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR		
02	02		3	40	60	50	--		

Course Description and Relevance:

This course introduces students to the foundational concepts of mechanical engineering systems, providing a broad understanding of key domains such as design engineering, thermal systems and heat transfer, manufacturing processes, automobile systems, and power plant engineering. Through conceptual learning, real-life examples, and system-level thinking, students will explore how mechanical components and subsystems function individually and in integration. The course not only lays the groundwork for advanced engineering subjects but also helps students appreciate the interdisciplinary nature of modern engineering solutions.

Mechanical engineering plays a pivotal role in the design and operation of physical systems that underpin all branches of engineering. A basic understanding of these systems benefits students from all disciplines by enhancing their ability to analyze and contribute to the development of physical and integrated systems. This foundational knowledge supports participation in interdisciplinary work involving technologies like IoT, automation, and robotics, while also nurturing problem-solving skills and engineering intuition. The course highlights mechanical engineering's critical role in industries such as aerospace, energy, healthcare, construction, and product development, preparing students to collaborate and innovate across diverse engineering domains.

Prerequisite:

1. Basic Physics for understanding mechanics, energy systems, and machine elements.
2. Basic Mathematics for analyzing motion, forces in mechanisms, and solving simple design problems.
3. Understanding of 2D/3D views, simple orthographic projections to visualize mechanisms, assemblies, machine elements and mechanical systems.

Bridge Content: Basic concepts of physics, mathematics, and engineering drawing will be reinforced to help students understand mechanics, energy systems, machine elements, and visualize mechanical systems.

Course Objectives:

1. **To introduce** the classification, functions, working principles, and practical applications of basic machine elements and power transmission systems used in mechanical and automotive engineering.
2. To enable students to understand the fundamentals of thermal systems by exploring the core principles of thermodynamics, heat transfer, refrigeration, and air conditioning, with an emphasis on their practical applications in various engineering fields.
3. **To develop an understanding** of conventional and renewable energy resources, power generation technologies, their environmental impacts, and emerging sustainable energy solutions.
4. **To introduce** the fundamentals of IC engines, automobile systems, electric and hybrid vehicles, and emerging smart mobility technologies such as autonomous vehicles and ADAS.
5. To equip students with fundamental knowledge of conventional and unconventional manufacturing processes and their applications.

Course Outcomes: After learning the course, students will be able to

CO	Course Outcome	Bloom's Level
CO1	EXPLAIN the functions of basic machine and power transmission elements such as shafts, keys, bearings, couplings, and drives.	2
CO2	DESCRIBE the fundamental principles of thermal systems, encompassing thermodynamic concepts, heat transfer modes, and the operation of basic refrigeration and air conditioning systems.	2
CO3	IDENTIFY various energy sources, their working principles, environmental impacts, and emerging trends in sustainable power generation.	2



CO4	UNDERSTAND the basic working principles and classifications of IC engines and automobiles, and DEMONSTRATE awareness of emerging vehicle technologies.	2
CO5	DEMONSTRATE an understanding of conventional and unconventional manufacturing processes.	2
Course Content		
Unit 1	Machine Elements	6 Hrs.
		COs Mapped CO1
Machine and Power Transmission Elements: Classification, functions, and practical applications of fundamental machine elements such as shafts, axles, keys, bearings, and couplings. Types of drives: Belt, Chain and Gear drives. Gear box (Sliding mesh & Synchromesh). Introduction to clutch and brakes.		
Exemplars / Practical Applications and usage: Shafts, Axles, Keys, Bearings and Couplings: Used in automobiles, industrial machines, pumps, and gearboxes to transmit power, support rotating components, and connect shafts safely. Drives: Commonly used in fans, conveyors, washing machines, and agricultural machinery for smooth and economical power transmission. Clutches: Used in automobiles and machines to engage or disengage power transmission between the driving and driven shafts. Brakes: Used in automobiles, elevators, cranes, and industrial machines to reduce speed or stop motion safely and effectively.		
Assignments: 1. Prepare a comparative study of Belt, Chain, and Gear Drives based on construction, working principle, advantages, disadvantages, and practical applications with suitable sketches. 2. Study and prepare a short report on Machine Elements (shaft, axle, key, bearing, coupling, clutch, and brake), explaining their functions and applications in an automobile or industrial machine. 3. Study and identification of machine elements (shaft, axle, key, bearing, coupling, clutch and brake) using actual components. Understand function, classification and industrial applications of machine elements.		
Unit 2	Thermal Systems	6 Hrs.
		COs Mapped CO2
Concept of a system, types of systems, energy interactions: heat and work, First law of thermodynamics & its limitations. Second laws of thermodynamics (simple numerical). Modes of Heat Transfer, Basic Terminology: Heat, temperature, thermal conductivity, heat flux, etc. Fourier's Law, Thermal conductivity: concept and examples of materials; Newton's Law of Cooling, Basic concept of thermal radiation and Stefan-Boltzmann Law. Definition of Refrigeration, Concept of COP, Simple Refrigeration Cycle (vapor compression), Common refrigerants, Insulating materials. Basics of Air Conditioning: Definition and necessity, Comfort conditions, Types of Air Conditioning Systems (central, split, window),		
Exemplars / Practical Applications and usage: Applications of heat transfer in daily life and engineering (e.g., heat exchangers in process industries, cooling of electronics components, building insulation, thermal management of batteries, radiators in cars for engine cooling, thermal protection systems. Applications of Refrigeration like Domestic refrigerator, Cold storage and Industrial and transport refrigeration Applications: homes, offices, vehicles, data centers.		
Assignments: 1. Choose any one application (from the listed exemplars) and explain how heat transfer is involved in its operation or design. 2. Measurement of temperature using thermocouple, RTD and infrared thermometer. Develop understanding of temperature measurement and instrumentation. 3. Compare central, split, and window-type air conditioning systems in terms of application, cost, and efficiency.		



4. Explain the role of air conditioning in thermal management in data centers or electric vehicles. 5. Select any household device such as a refrigerator or a split/window air conditioner and describe its working cycle with the help of a simple diagram and explanation of key components.			
Unit 3	Energy resources and Power plants	6 Hrs.	COs Mapped CO3
Classification: Renewable vs Non-Renewable, Global and national energy scenario, Need for sustainable energy solutions. Introduction, components, working, environmental impact of conventional power plants such as thermal power plant, hydroelectric power plant, nuclear power plant. Introduction, components, working of renewable and green energy technologies such as solar energy, wind energy, biomass and bioenergy & geothermal and tidal energy. Environmental Impact (emission and carbon foot print) and Energy Conservation, climate change Future trends in green energy: Carbon capture and storage.			
Exemplars / Practical Applications and usage: Power generation for cities and industries (e.g., Eklahare Thermal Power Station, SMBST Sugar Factory Co-generation power plant); hydro dams (e.g., Bhandardara, Koyana, Bhakra Nangal Dam), Large-scale nuclear power plants (Tarapur, Kakrapar, Kaiga, Kudankulam Atomic Power Station), Rooftop solar panels in residential buildings and agriculture purpose; Wind farms, hybrid solar-wind systems in coastal and desert regions; Bio-digesters and Biomass power plants (Rajhans).			
Assignments: 1. Prepare a comparative analysis of at least one conventional power plant (e.g., thermal, nuclear, hydroelectric) and one renewable/green energy systems (e.g., solar, wind, biomass) considering basic components and working principles of each system, fuel sources and energy conversion process, efficiency and operational characteristics, environmental impacts (e.g., emissions, land use, waste) and future potential and role in sustainable energy transition. 2. Energy audit of classroom/laboratory and identification of energy conservation opportunities. Develop awareness of energy efficiency and carbon footprint reduction. 3. Visit to Roof Top Solar Power Plant / Cogeneration Power Plant.			
Unit 4	Automobile Engineering	6 Hrs.	COs Mapped CO4
Introduction to Internal Combustion (IC) engines, Engine terminology, including the working principles of Spark Ignition (SI) and Compression Ignition (CI) engines (Two stroke & Four stroke), along with their classifications. Overview of automobile classifications and specifications of two-wheelers, four-wheelers, and multi-axle vehicles. Chassis layouts and types of drive systems. Fundamental concepts of electric vehicles (EVs), their environmental significance, construction, and working principles. Introduction to hybrid electric vehicles, autonomous vehicles.			
Exemplars / Practical Applications and usage: Two-wheelers: Scooters and Motorbikes used for personal and delivery transport; Four-wheelers: Hatchbacks, sedans, SUVs for private, commercial, and utility purposes; Multi-axle Vehicles: Transport of heavy goods (e.g., 10-wheeler trucks used in logistics and mining). Front Engine Front Wheel Drive (FF-FWD), Front Engine Rear Wheel Drive (FR-RWD), Rear Engine Rear Wheel Drive (RR-RWD), All-Wheel Drive (AWD) / Four-Wheel Drive (4WD) Passenger EVs, Electric Two-Wheelers, Electric Buses and Delivery Vans, Charging Infrastructure. Self-driving Cars and ADAS Systems.			
Assignments: 1. Study and analyze various types of vehicles commonly used in real life. Select one two-wheeler, one four-wheeler, and one multi-axle commercial vehicle (e.g., scooter, SUV, and transport truck). Identify and describe their: classification (passenger, commercial, utility, etc.), key specifications (engine type, fuel type, capacity, etc.), type of chassis layout and drive system (e.g., FF-FWD, AWD, etc.) and real-world usage scenario (e.g., delivery services, long-distance transport, daily commuting)			



2. Demonstration of ADAS features and autonomous vehicle technologies through simulation/videos. Introduce emerging automotive technologies and intelligent transportation systems. 3. Write a report on "The shift toward sustainable and smart mobility: a case study on EVs and autonomous vehicles".			
Unit 5	Manufacturing Processes	6 Hrs.	COs Mapped:CO5
Introduction to manufacturing processes and their importance in engineering and industry, Classification and applications. Introduction to Conventional Manufacturing Techniques such as Casting Processes, Forging, Metal Joining Techniques (Welding, soldering, brazing). Introduction to Lathe machine and its operations. Introduction to Drilling machine (Radial drilling machine) and its classification. Definition and need for non-conventional manufacturing processes and Comparison with conventional manufacturing techniques; Introduction to CNC and concept of Industry 4.0.			
Exemplars / Practical Applications and usage: Use of casting process in automobile engine blocks, pumps, and valve bodies manufacturing; use of Metal Forming Processes (e.g., forging, rolling, extrusion) in rail, construction, and automotive industries, use of machining in precision components such as gears, tool dies, and aerospace parts; use of metal joining in automobile body assembly, pipeline construction, bridge fabrication, electronics assembly; prototyping for rapid development of design concepts, Customized prosthetics and implants			
Assignments: 1. After visiting the central workshop, prepare a detailed report on the machine tools available. Your report should include the names and types of machines observed, their key components, and the various operations that can be performed using each machine tool. Highlight at least one practical application or use-case for each tool based on your observations during the visit. 2. Demonstration of CNC Machine and comparison with conventional machining. Understand automation, CNC programming concepts and productivity improvement. 3. Demonstration of Additive Manufacturing (3D Printing) and Industry 4.0-enabled manufacturing. Introduce smart manufacturing and digital production systems.			
Textbooks:			
1. V B Bhandari, "Design of machine elements", Tata McGraw-Hill Publisher Co. Ltd. 2. R.S. Khurmi & J.K. Gupta, "Machine Design", S. Chand Publishing. 3. Nag P. K., "Engineering Thermodynamics", Tata McGraw-Hill Publisher Co. Ltd. 4. Khurmi, R.S., and Gupta, J. "A Textbook of Thermal Engineering", K, S. Chand & Sons 5. P. K. Nag., "Basic and Applied Thermodynamics" (Different edition focused more on applications), Tata McGraw-Hill Publisher Co. Ltd. 6. Chaudhari and Hajra, "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers, Mumbai3. 7. P.N. Rao, "Manufacturing Technology" – Vol-I &II, McGraw Hill Education. 8. Kripal Singh, "Automobile Engineering" Vol-I &II, Standard Publishers Distributors. 9. M.L. Mathur & R.P. Sharma, "Internal Combustion Engines", Dhanpat Rai & Sons. 10. G D Rai, "Non-conventional energy sources", Khanna publication, New Delhi. 11. D.P. Kothari, K.C. Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI Learning.			
Reference Books:			
1. Richard G. Budynas & J.K. Nisbett, "Shigley's Mechanical Engineering Design", Tata McGraw-Hill Publisher Co. Ltd. 2. Robert C. Juvinall & Kurt M. Marshek, "Machine Component Design", Wiley India. 3. Ganeshan, V., "Internal Combustion Engines", McGraw Hill 4. Jack Erjavec, "Automotive Technology – A Systems Approach", Cengage Learning.			



5. R.K. Rajput, “Manufacturing processes”, Laxmi Publications Pvt. Ltd.
6. P.C. Sharma, “Production Technology”, S. Chand Publishing.
7. Anderson, Curtis Darrel and Anderson, Judy, “Electric and Hybrid Cars: A History”, 2nd Ed., McFarland.
8. Boyle, Godfrey, “Renewable Energy”, 2nd Ed., Oxford University Press
9. S.P. Sukhatme, “Electric Vehicles and Renewable Energy”, Universities Press

MOOCs Links and additional reading material:

1. Design engineering <https://www.nptel.ac.in/courses/112105124>
2. Thermodynamics <https://www.nptel.ac.in/courses/127106135>
3. Renewable energy sources <https://www.nptel.ac.in/courses/127107001>
4. Fundamental of electrical vehicles <https://www.nptel.ac.in/courses/108106170>
5. Fundamental of manufacturing process <https://www.nptel.ac.in/courses/112107219>
6. Electric vehicles https://onlinecourses.swayam2.ac.in/ntR26_ed127/preview

CO-PO-PSO Mapping

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PSO1	PSO2	PSO3
CO1	2										1	2		
CO2	2	1			1	2	2				1		2	
CO3	2				2	2	2				1		2	
CO4	2	1	1	1	2	2	2			1	1		3	
CO5	2				2	2	2		1	1	1			2
Avg.	2	1	1	1	2	2	2		1	1	1	2	2	2

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

Assessment Table:

EXAM	Particular	CO1	CO2	CO3	CO4	CO5
Knowledge and Attitude Profile (WK)						
CCE	CT1	8	8			
	CT2					
	Assignments				8	
	Course Project					
	Field Activity / Case Study					8
	Quiz / presentation etc.			8		
ESE		12	12	12	12	12
Total		20	20	20	20	20

Unit wise Weightage:

Exam	Unit1	Unit2	Unit3	Unit4	Unit5
CT1	8	8			
CT2					
CCE Assessment by Teacher			8	8	8



ESE	12	12	12	12	12
Total	20	20	20	20	20

This course serves as a prerequisite for / maps with the following future courses:

Machine Design, Strength of Materials, Engineering Thermodynamics, Applied Thermodynamics, HVAC, Advanced Manufacturing Processes, IC Engines and Automobile engineering, Power Plant Engineering.

Job Mapping:

Job opportunities that one can get after learning this course:

1. Technical Assistant / Technician Trainee: Basic machine operations, CAD drawing support, Workshop/lab assistant roles
2. Manufacturing/Production Helper: Roles in small manufacturing firms, Machine shop assistant, Assembly line work
3. Apprenticeships / Internships: Many industries offer ITI-level apprenticeships for candidates with basic technical knowledge, PSU apprentice schemes under the National Apprenticeship Promotion Scheme (NAPS)
4. Field Technician: Jobs in installation and maintenance of machinery, HVAC, plumbing, or mechanical services for buildings.
5. Customer Service Support (Technical): Call center support for mechanical tools or software, Sales assistant in hardware/tool shops.



Course:	Engineering Graphics			Course Code:			R26-ME-ESC-120
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
3 hrs.	02 hrs.	--	04	40	60	50	--

Course Description and Relevance:

Engineering Graphics is a foundational technical course essential for students across all branches of engineering, including mechanical, civil, electrical, electronics, and computer science. It serves as the basis for engineering communication, visualization, and design documentation. The course introduces first-year students to the core principles of engineering drawing through manual drafting. Students will learn to use drawing instruments, understand sheet layouts and standard line types, apply correct dimensioning methods, and construct basic geometric shapes. The curriculum includes detailed study and practice in orthographic and isometric projections to build spatial visualization skills and accurately interpret engineering objects and assemblies.

Engineering Graphics is crucial for effective visual communication in the engineering domain. A key learning outcome is the ability to interpret and analyze engineering drawings, mechanical systems, and assemblies. Through projection techniques and visualization exercises, students enhance their analytical thinking, creativity, and spatial reasoning. This course lays the groundwork for advanced learning in areas such as product design, computer graphics, and manufacturing. Moreover, early exposure to industry-standard, students with practical, job-relevant skills, making them better prepared and more confident as they progress through their engineering education and careers.

Prerequisite:

1. Basic knowledge of geometry and mathematics
2. Spatial visualization ability
3. Basic computer skills
4. Logical thinking and attention to details
5. High school-level drawing or technical drawing (preferred but not mandatory).

Bridge Content:

1. Introduction to drawing instruments: pencils (grades), set squares, T-square, compass, divider, scales, erasers, protractors; Drawing sheet sizes and title block; setting up a drawing sheet (border, margins, title block, scale).
2. Guidelines for engineering lettering and numerals (standard styles and heights)
3. Dimensioning basics: size and location dimensions, placement rules, units.

Course Objectives:

1. To introduce the fundamentals of engineering drawing using manual drafting techniques and familiarize students with drawing instruments, sheet layouts, and standard practices and introduce the students for projections of point and projections of lines.
2. To introduce the students to different planes and their projections in first quadrant.
3. To train the students for Construct the various engineering curves and illustrate the application of various engineering curves and draw the development of the lateral surfaces of solids.
4. To develop students understanding of orthographic projections, using first angle method of projection and enable them to interpret and draw multiple views of mechanical components.
5. To train students in isometric projection techniques and help them visualize and represent 3D objects accurately using 2D orthographic views

Course Outcomes: After learning the course, students will be able to

CO	Course Outcome	Bloom's Level
CO1	EXPLAIN the fundamentals of Engineering Graphics and basic	3



	principles of geometric construction and apply the knowledge of Projections for points and lines.	
CO2	Apply the types of Projections, Methods to prepare the drawings for planes.	3
CO3	CONSTRUCT the various engineering curves and illustrate the application of various engineering curves and draw the development of the lateral surface of solid	3
CO4	CONSTRUCT orthographic projections using first angle method from given pictorial views and understand the application of different types of projections	3
CO5	CONSTRUCT accurate isometric projections of machine components from orthographic views, demonstrating an understanding of isometric principles	3
Course Content		
Unit No.1	Introduction to Drawing and Theory of Projections	COs Mapped CO1
		Hrs. 08
Fundamentals of Engineering Drawing: Introduction to drawing instruments and their uses, Drawing sheets, sizes and their layouts, Types of Lines, Dimensioning methods, General rules of dimensioning. Theory of Projection - Projection of points in all possible quadrants. Projection of line when parallel to both the reference planes, Projections of lines when it is perpendicular to one of the reference planes, when line is inclined to one and parallel to other reference plane, Line inclined to both reference planes (First angle projection)		
Unit No.2	Projection of Planes	COs Mapped CO2
		Hrs. 06
Introduction, Projection of plane when plane is Parallel to one and perpendicular to other, Projection of plane when plane is inclined to one plane and perpendicular to other Projections of planes when it is inclined to both reference planes.		
Unit No.3	Developments of lateral surfaces and Engineering Curves	COs Mapped CO3
		Hrs. 08
Development of Lateral Surfaces: Introduction to regular solids, classifications. Methods of development, development of lateral surfaces of right solids, cube, prisms, cylinder, pyramids, and cone.(No sectioned solids) Engineering Curves: Conic Sections- Ellipse, Parabola and Hyperbola by directrix focus method and rectangle method, Helix (one convolution) on Cylinder and Cone, Cycloid, Involute of a circle, Archimedean spiral (one convolution)		
Unit No.4	Orthographic Projections	COs Mapped CO4
		Hrs. 06
Introduction, Principle of projection, Planes of Projection, Method of Projection, Orthographic Projection First and Third angle method of projection, Sectional orthographic projections (full section only) Hidden features, curved features, and circular features etc. Typical problems by first angle projection method only.		
Unit No.5	Isometric Projections	COs Mapped CO5
		Hrs. 06
Introduction of isometric projection, Isometric planes, non-isometric lines and planes, Isometric scale, Isometric projection and view. Construction of isometric view from given orthographic views of simple mechanical components.		
Textbooks:		



1. Bhatt, N. D. and Panchal, V. M., (2016), “Engineering Drawing”, Charotar Publication, India
2. Venugopal, K, (2015), “Engineering and Graphics”, New Age International, New Delhi
3. Rathnam, K., (2018), “A First Course in Engineering Drawing”, Springer Nature Singapore
4. P.S. Gill ,”Text Book of Engineering Graphics” S.K. Kataria & Sons Publications.
5. K.L. Narayana and P. Kannaiah,”Engineering Drawing and Graphics”,New Age International
6. Jolhe D. A (2015), “Engineering Drawing with introduction to AutoCAD”, Tata McGraw Hill.
7. Munir Hamad,”AutoCAD 2014: Beginning and Intermediate”, Mercury Learning and Information.
8. Elise Moss ,”AutoCAD 2014 Fundamentals ,SDC Publications
9. Coimbtore PSG College of Technology,”Design Data Handbook - Data Book of Engineers”,Kalaikathir Achchagam -Coimbatore Publication

Reference Books:

1. Madsen, D. P. and Madsen, D. A., (2016), “Engineering Drawing and design”, Delmar Publishers Inc., USA
2. Bhatt, N. D., (2018), “Machine Drawing”, Charotar Publishing House, Anand, India
3. Dhawan, R. K., (2000), “A Textbook of Engineering Drawing”, S. Chand, New Delhi
4. Basant Agrawal and C. M. Agrawal ,”Engineering Graphics , McGraw Hill Education
5. Maheshwari Pradeep Jain, A.P. Gautam, and Anita ,” Engineering Graphics and Design,Khanna Publishing House
6. Mastering AutoCAD 2014 by G.Omura Autodesk Official press

MOOCs Links and additional reading material:

1. Line - <https://youtu.be/r0ZSJfDL-Fo?si=QUIDATzvKGKvcVtU>
2. Plane - <https://youtu.be/nfbiVNNYdOY?si=4ZR5qcozOVY6zePt>
3. Curves- https://youtu.be/L8FDY_GsfB4?si=Lk5_FUe-ko158hBl
4. Development - <https://youtu.be/KJd-7xuMcFU?si=vHT7MWRr6uyrB7JR>
5. Isometric projections - <https://youtube.com/playlist?list=PLDN15nk5uLiCf-raL06kSCeqR8h61eYIC&si=1Bf2hNSMP2GWfmbU>
6. Orthographic Projections <https://nptel.ac.in/courses/124107157>
7. Engineering Graphics (Graphical Representation, Projection Basics, Orthographics Projections, Auxilary And Sectional Projections, Isometric Projections, Working Drawings, Introduction To CAD, Part Modelling, Assembly) https://onlinecourses.nptel.ac.in/noc21_me128/preview
8. AutoCAD <https://nptel.ac.in/courses/112102101>
9. AutoCAD <https://www.youtube.com/watch?v=a4jW2J8wnzI>

*Add additional rows as per requirement

Strength of CO-PO-PSO Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1								1	3		1	1		1
CO2	2	2	2	1	2				1	2	1	1	3		2
CO3	3	2	2	1	2				1	2	1	1	3		2
CO4	3	3	2	2	3	1	1		1	2	3	1	3		2
CO5	3	3	2	2	3	1	1		1	2	3	1	3		2
Avg.	3	3	2	2	3	1	1		1	3	2	1	3		2

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

**Assessment Table:**

EXAM	Particular	CO1	CO2	CO3	CO4	CO5
Knowledge and Attitude Profile (WK)						
CCE	CT1	8	8			
	CT2					
	Assignments			8	8	8
	Course Project					
	Field Activity / Case Study					
	Quiz / presentation etc.					
ESE		12	12	12	12	12
Total		20	20	20	20	20

This course serves as a prerequisite for / maps with the following future courses:

This course will be prerequisites typically for mathematics (geometry), computer graphics, engineering and machine drawing, Computer Aided Design and drafting (AutoCAD, Solid works, Fusion software's), Design engineering courses, Building Design and drawing, Electrical and circuit drawing, Surveying, ARVR etc.

Job Mapping:

Job opportunities that one can get after learning this course:

Job opportunities that one can get after learning this course:

Draftsman, Architectural visualizer



Program:	F. Y. B. Tech				Semester:		I / II
Course:	Engineering Graphics Lab				Course Code:		R26-ME-ESC-120-TW
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
--	02 hrs.	--	01	--	--	50	--

Course Description and Relevance:

Engineering Graphics is a foundational technical course essential for students across all branches of engineering, including mechanical, civil, electrical, electronics, and computer science. It serves as the basis for engineering communication, visualization, and design documentation. The course introduces first-year students to the core principles of engineering drawing through both manual and computer-aided drafting (CAD). Students will learn to use drawing instruments, understand sheet layouts and standard line types, apply correct dimensioning methods, and construct basic geometric shapes. The curriculum includes detailed study and practice in orthographic and isometric projections to build spatial visualization skills and accurately interpret engineering objects and assemblies. Alongside traditional drawing techniques, the course emphasizes the use of modern CAD software, enabling students to create and modify 2D and 3D engineering drawings in line with current industry standards.

Engineering Graphics is crucial for effective visual communication in the engineering domain. It trains students to clearly and accurately express complex ideas using standardized graphical language, a vital skill for technical collaboration and documentation. A key learning outcome is the ability to interpret and analyze engineering drawings, mechanical systems, and assemblies. Through projection techniques and visualization exercises, students enhance their analytical thinking, creativity, and spatial reasoning. This course lays the groundwork for advanced learning in areas such as CAD modeling, product design, computer graphics, manufacturing, AR/VR applications, and simulations. Moreover, early exposure to industry-standard CAD tools equips students with practical, job-relevant skills, making them better prepared and more confident as they progress through their engineering education and careers.

Prerequisite:

6. Basic knowledge of geometry and mathematics
7. Spatial visualization ability
8. Basic computer skills
9. Logical thinking and attention to details
10. High school-level drawing or technical drawing (preferred but not mandatory).

Bridge Content:

4. Introduction to drawing instruments: pencils (grades), set squares, T-square, compass, divider, scales, erasers, protractors; Drawing sheet sizes and title block; setting up a drawing sheet (border, margins, title block, scale).
5. Guidelines for engineering lettering and numerals (standard styles and heights)
6. Dimensioning basics: size and location dimensions, placement rules, units.

Course Objectives:

1. To introduce the fundamentals of engineering drawing using manual drafting techniques and familiarize students with drawing instruments, sheet layouts, and standard practices.
2. To develop students' understanding of orthographic projections, including first angle projection, and enable them to interpret and draw multiple views of mechanical components.
3. To train students in isometric projection techniques and help them visualize and represent 3D objects accurately using 2D orthographic views.
4. To provide hands-on experience in CAD software, enabling students to use digital tools for drafting and



dimensioning.

5. To enhance students’ visualization and technical communication skills, preparing them for interpreting and creating engineering drawings in academic and professional settings.

Course Outcomes: After learning the course, students will be able to

CO	Course Outcome	Bloom’s Level
CO1	APPLY drawing instruments and standard drawing conventions including types of lines, dimensioning methods, and lettering in technical drawings	3
CO2	CONSTRUCT orthographic projections using first angle method from given pictorial views and understand the application of different types of projections.	3
CO3	CREATE accurate isometric projections of machine components from orthographic views, demonstrating an understanding of isometric principles.	3
CO4	USE CAD software to produce and modify 2D engineering drawings, including orthographic and isometric projections with appropriate dimensioning.	3
CO5	INTERPRET and VISUALIZE basic engineering components and assemblies from given views, applying graphical methods for effective technical communication.	2

Course Content

List of Practical:

Experiment No.1	Introduction to Engineering Drawing	COs Mapped CO1	Hrs. 04
-----------------	-------------------------------------	-------------------	------------

Objective:

To introduce students to the fundamental concepts and practices of engineering drawing, including the proper use of drawing instruments, drawing sheet layout, types of lines, lettering, dimensioning techniques, scales, and standard geometrical constructions.

Associated Tasks:

1. Demonstrate different types of lines (e.g., visible, hidden, center, cutting-plane) and their appropriate applications.

2. Apply correct dimensioning methods and terminology (e.g., size dimension, location dimension, aligned and unidirectional systems).

3. Draw a simple standard machine component integrating types of lines and dimensioning principles.

Exemplars and Utility:

1. Draw and label at least five standard line types with a note on their usage.

2. Practice dimensioning a simple rectangular block using both aligned and unidirectional methods.

3. Draw a standard machine component, such as a square nut or washer, showing correct lines, dimensioning, and scale.

Experiment No.2	Projection of Line and Planes	COs Mapped CO2	Hrs. 04
-----------------	-------------------------------	-------------------	------------

Objective:

To understand and accurately draw the projections of lines and planes using the principles of orthographic projection

Associated Task-

1. Draw projections of a line inclined to HP and VP.

2. Determine true length and true inclinations.



3. Draw projections of a plane surface inclined to HP/VP.

4. Apply auxiliary projection methods where required.

Exemplars and Utility:

1. Draw three problems on Projection of lines using the first angle method.
2. Draw three problems on Projection of Planes using the first angle method.

Experiment No.3

Development of Lateral Surfaces and Engineering curves

COs Mapped
CO3

Hrs.
04

Objective-

Understand development of surfaces and construction of basic engineering curves.

Associated Tasks

Associated Task-

Develop surfaces of prism, pyramid, cylinder and cone; construct ellipse, parabola, hyperbola, helix, involute cycloid, and spiral.

Exemplars and Utility:

1. Draw three problems on Development of Lateral Surfaces using the first angle method.
2. Draw three problems and Engineering curves using the first angle method.

Experiment No.4

Orthographic Projections

COs Mapped
CO4

Hrs.
04

Objective:

To develop the ability to visualize and represent 3D objects through 2D orthographic projections using the first angle method. This includes understanding the theory of projection, types of projection systems, and the generation of multiple views from a pictorial representation.

Associated Tasks:

1. Understand the theory of projection and quadrant system used in technical drawing.
2. Differentiate between types of projections: Orthographic, and isometric projection.
3. Interpret and apply the first angle projection method based on BIS standards.
4. Identify and construct front, top, and side views of a given pictorial or isometric object.
5. Understand and apply sectional views to represent internal features (full sectional view only).
6. Draw TWO orthographic projection problems with correct line types, layout, and dimensioning using the first angle method.

Exemplars and Utility:

3. Draw orthographic views (front, top, side) of a given simple mechanical component using the first angle method.
4. Create orthographic projections of a simple machine component like a flange or bracket.
5. Produce a sectional orthographic projection of a simple mechanical component like a bush or hollow cylinder to show hidden internal details..

Experiment No.5

Isometric Projections

COs Mapped
CO5

Hrs.
04

Objective:

To develop students' ability to visualize and construct isometric projections of engineering objects using orthographic views, including the understanding of isometric axes, scaling, and conventions for isometric and non-isometric lines.

Associated Tasks:

1. Understand the principles of isometric projection, including the use of isometric axes and isometric scale.
2. Identify and correctly draw isometric and non-isometric lines.



3. Construct standard geometric shapes (e.g., circles, squares) on isometric planes using appropriate methods (like ellipse construction for circles).
4. Convert orthographic views into an isometric projection of an object or component, ensuring proper visualization and proportion.
5. Complete TWO isometric projection problems based on orthographic views of simple machine components.

Exemplars and Utility:

1. Draw an isometric projection of a cube, cylinder, and cone using proper isometric angles (30° to horizontal).
2. Convert orthographic views (front, top, side) of a simple mechanical component into an isometric projection.
3. Construct isometric view of a square / hex nut or a washer, showing internal features with proper dimensions

Experiment No.6**Computer-Aided Drafting (CAD)****COs Mapped
CO6****Hrs.
08****Objective:**

To introduce students to the fundamentals of Computer-Aided Drafting (CAD) using industry-standard software (such as AutoCAD), and to enable them to create accurate orthographic projections through digital tools, enhancing their drawing speed, precision, and industry readiness.

Associated Tasks:

1. Understand the basic interface and workspace of CAD software (AutoCAD or equivalent).
2. Learn the fundamental operations of CAD: creating, saving, and opening of drawing files.
3. Use basic drawing commands such as LINE, CIRCLE, POLYGON, ARC etc.
4. Apply dimensioning commands to annotate objects according to standard practices.
5. Utilize editing and modifying commands: MOVE, COPY, OFFSET, MIRROR, TRIM, EXTEND, etc.
6. Draw Orthographic projections (front, top, and side views) of a given object using the AutoCAD.
7. Set up the isometric environment in AutoCAD (snap/grid settings, isometric plane selection).
8. Complete the isometric projection of a machine component using given orthographic views.
9. Introduction to Solid Modeling Software.

Exemplars and Utility:

1. Launch AutoCAD and set up a new drawing with proper units and limits.
2. Draw a 2D orthographic projection (front, top & side) of a simple object using AutoCAD tools.
3. Apply dimensioning and text annotation using standard dimension styles and settings.
4. Use layers to separate views or drawing elements like object lines, hidden lines, and center lines.
5. Plot or print the final drawing as a hard copy or PDF with a title block using standard sheet size (A3/A4).
6. Create an isometric view of a stepped block or machine bracket based on orthographic projections.
7. Construct isometric circles (e.g., holes or cylindrical features) using isocircle option

Textbooks:

1. Bhatt, N. D. and Panchal, V. M., (2016), Engineering Drawing, Charotar Publication, India
2. Venugopal, K., (2015), Engineering and Graphics, New Age International, New Delhi
3. Rathnam, K., (2018), A First Course in Engineering Drawing, Springer Nature.
4. P.S. Gill, Text Book of Engineering Graphics S.K. Kataria & Sons Publications.
5. K.L. Narayana and P. Kannaiah, Engineering Drawing and Graphics, New Age International.
6. Jolhe D. A (2015), Engineering Drawing with introduction to AutoCAD, Tata McGraw Hill.
7. Munir Hamad, AutoCAD 2014: Beginning and Intermediate, Mercury Learning.
8. Elise Moss, AutoCAD 2014 Fundamentals, SDC Publications



9. PSG College of Technology, "Design Data Handbook - Data Book of Engineers", Kalaikathir Achchagam -Coimbatore Publication

Reference Books:

7. Madsen, D. P. and Madsen, D. A., (2016), Engineering Drawing and design, Delmar Publishers Inc., USA
8. Bhatt, N. D., (2018), Machine Drawing, Charotar Publishing House, Anand, India
9. Dhawan, R. K., (2000), A Textbook of Engineering Drawing, S. Chand, New Delhi
10. Basant Agrawal and C. M. Agrawal, Engineering Graphics, McGraw Hill Education
11. Maheshwari Pradeep Jain, A.P. Gautam, and Anita, Engineering Graphics and Design, Khanna Publishing House
12. G. Omura, Mastering AutoCAD, 2014, Autodesk Official press.

MOOCs Links and additional reading material:

8. Line - <https://youtu.be/r0ZSJfDL-Fo?si=QUIDATzvKGKvcVtU>
9. Plane - <https://youtu.be/nfbiVNNYdOY?si=4ZR5qcozOVY6zePt>
10. Curves - https://youtu.be/L8FDY_GsfB4?si=Lk5_FUe-ko158hBl
11. Development - <https://youtu.be/KJd-7xuMcFU?si=vHT7MWRr6uyrB7JR>
12. Isometric projections - <https://youtube.com/playlist?list=PLDN15nk5uLiCf-raL06kSCeqR8h61eYIC&si=1Bf2hNSMP2GWFmBU>
13. Orthographic Projections <https://nptel.ac.in/courses/124107157>
14. Engineering Graphics (Graphical Representation, Projection Basics, Orthographics Projections, Auxiliary And Sectional Projections, Isometric Projections, Working Drawings, Introduction To CAD, Part Modelling, Assembly) https://onlinecourses.nptel.ac.in/noc21_me128/preview
8. AutoCAD <https://nptel.ac.in/courses/112102101>
9. AutoCAD <https://www.youtube.com/watch?v=a4jW2J8wnzI>

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1								1	3		1	1		1
CO2	2	2	2	1	2				1	2	1	1	3		2
CO3	3	2	2	1	2				1	2	1	1	3		2
CO4	3	3	2	2	3	1	1		1	2	3	1	3		2
CO5	3	2	2	1	2				1	2	1	1	3		2
CO6	3	3	2	2	3	1	1		1	2	3	1	3		2
.Avg.	3	3	2	2	3	1	1		1	3	2	1	3		2

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

This course serves as a prerequisite for / maps with the following future courses:

This course will be prerequisites typically for mathematics (geometry), computer graphics, engineering and machine drawing, Computer Aided Design and drafting (AutoCAD, Solid works, Fusion software's), Design engineering courses, Building Design and drawing, Electrical and circuit drawing, Surveying, ARVR etc.

Job Mapping:

Job opportunities that one can get after learning this course:

Draftsman, Architectural visualizer



Program:	F. Y. B. Tech			Semester:	I/II		
Course:	Engineering Mechanics and Civil Engineering Systems			Course Code:	R26-CE-ESC-105		
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
03	-	-	3	40	60	-	-
Course Description: This course introduces the foundational concepts of Engineering Mechanics and Civil Engineering systems essential for all branches of Engineering. The Engineering Mechanics component covers principles related to force systems, equilibrium, structural analysis, friction, and dynamics. The Civil Engineering Systems component provides a broad overview of infrastructure systems such as transportation networks, water supply, waste management, and structural systems. It emphasizes the role of systems thinking in planning, designing, and managing civil engineering projects, integrating multidisciplinary approaches.							
Course Relevance: The Engineering Mechanics component provides the fundamental analytical skills required across Civil and Mechanical Engineering disciplines. The Civil Engineering Systems component broadens the student's perspective beyond their specific discipline, emphasizing context and integration.							
Prerequisite: Basic calculus, Trigonometry, Geometrical expressions, Laws of motion, Concept of mass and acceleration, fundamental knowledge of Engineering Mathematics, Physics and environmental studies.							
Bridge Content: Newton's First law, Newton's second law of motion.							
Course Objectives: 1. To ENABLE students to understand and apply the fundamental principles of statics by analyzing force systems, their resolutions, compositions and resultant; to develop the ability to determine moments, couples and centroids and to gain theoretical knowledge of moment of inertia. 2. To DEVELOP the ability to analyze and apply fundamental principles of equilibrium in engineering systems and to build competence in solving problems related to friction and truss. 3. To DEVELOP fundamental understanding of the motion of particles and the forces governing them by studying the principles of kinetics and kinematic. 4. To PROVIDE students with a comprehensive understanding of various Civil Engineering systems and to familiarize students with modern surveying technologies. 5. To INTRODUCE students a smart city concept, modern technologies and essential Civil Engineering software for efficient planning, design, and management of infrastructure projects.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome					Bloom's Level	
CO1	UNDERSTAND the principles of statics to determine the resultant of different force systems and understand the concepts of moment, couple, centroid, and moment of inertia of plane areas					2	
CO2	EXPLAIN the conditions of equilibrium for different force systems, types of supports and beams, and demonstrate understanding of basic friction and truss analysis concepts.					2	
CO3	ANALYZE rectilinear motion and Projectile motion of particles, apply					3	



	Newton's second law, impulse momentum principles for particles	
CO4	EXPLAIN various civil engineering systems such and explain the working principles and applications of smart surveying technologies like Total Station, GPS, drones, and LIDAR.	2
CO5	UNDERSTAND the concept of smart cities and emerging technologies in civil engineering, including AI, BIM, IoT, and 3D printing, and describe the basic applications of civil engineering software such as AutoCAD, REVIT, STAAD Pro, ETABS, and Tekla Structures.	2
Course Contents		
Unit 1	Force Systems, Centroid and Moment of Inertia	8 Hrs. CO1
Force and Force System: Introduction, fundamental concepts and principles of statics, force and force system, resolution and composition of forces, resultant of concurrent force system, moment of a force, Varignon's theorem, resultant of parallel force system, couple and resultant of general force system. Centroid and MI: Moment of area, centroid of plane lamina, Moment of Inertia (only theory).		
Exemplars / Practical Applications and usage: The above content is practically used to analyze and design stable structures by determining force effects, locating centroids, and estimating resistance to bending in beams and other structural elements.		
Assignments: <u>Theory questions :</u> Example: 1) Explain different types of force systems 2) State and explain Varignon's theorem with neat sketch 3) Identify two real-life engineering structures (bridges, cranes, towers, etc.) where: 4) a) Force systems are applied b) Centroid and Moment of Inertia concepts are important <u>Numerical Examples:</u> 1) Three coplanar forces of 100 N, 150 N, and 200 N act at a point with mutual angles of 120° . Find the resultant force. 2) A horizontal beam 6 m long carries two parallel forces: 40 N upward at one end and 60 N downward at the other. Determine the resultant force and its position on the beam.		
Unit 2	Equilibrium, Friction and Analysis of Truss	8 Hrs. CO2
Equilibrium: Introduction, free body diagram, equilibrium of coplanar forces, equilibrium of two forces, three force principle, equilibrium of concurrent, parallel and general force system, type of load, type of support, type of beam and support reaction. Friction and Analysis of Truss: Friction, Block and Belt friction, two force member, Analysis of truss by method of joint and Method of section.		
Exemplars / Practical Applications and usage: The concepts of equilibrium, friction, and truss analysis are practically used to determine support reactions, ensure structural stability		
Assignments: <u>Theory questions:</u> Example: 1) What is a Free Body Diagram (FBD)? Why is it important in solving mechanics problems? 2) What are different types of loads acting on beams? Explain with neat sketches. 3) Explain the role of friction in engineering systems with examples 4) Write down the rules to identify zero force members of truss.		



Numerical Example: 1

- 1) A beam of 6 m span is simply supported at both ends and carries a point load of 20 kN at midspan. Find the support reactions.
- 2) A smooth block of weight 100 N rests on a horizontal surface. A horizontal force of 30 N is applied. If the coefficient of friction is 0.3, determine whether the block will move.
- 3) Numerical based on method of joint and method of section.

Unit 3	Kinematics and Kinetics of Particles	8 Hrs.	CO3
Kinematics of Particles: Introduction, basic concept, rectilinear motion: motion with uniform acceleration, gravitational acceleration and variable acceleration, projectile motion, curvilinear motion Normal and Tangential, Radial and transverse coordinate system (only concept). Kinetics of particle: Introduction, Newton's second law of motion, application of Newton's second laws to rectilinear motion, curvilinear motion, law of conservation of momentum, impulse momentum principle and impact, work energy principle.			
Exemplars / Practical Applications and usage: These concepts are practically used to analyze the motion of vehicles, projectiles, and mechanical components for safe and efficient design.			
Assignments: Theory questions: Example: 1) State the equations of motion for a particle under constant acceleration. 2) What is uniform acceleration? How does it differ from variable acceleration? 3) Define impulse and impulse-momentum principle. Numerical Examples: 1) A particle of mass 1.5 kg moves under a variable force $F=6t^2 = 6t^2 = 6t$ N. Find the work done by the force from $t = 0$ to $t = 4$ s. 2) A particle is projected at 20 m/s at an angle of 30° to the horizontal. Find: Time of flight, Maximum height, Horizontal range			
Unit 4	Civil Engineering Systems	8 Hrs.	CO4
Types of Civil Engineering Systems: Introduction to systems in Civil engineering, definition, importance, Structural Systems (beams, columns, and frames), Transportation Systems (road networks, traffic flow), Water & Environmental Systems (water supply, drainage, and wastewater), and Geotechnical Systems (foundations and its types). Smart Surveying Technology: Introduction, components and applications of Auto level, Total Station, GPS surveying, Drone surveying, 3D Laser scanner (LIDAR).			
Exemplars / Practical Applications and usage: The knowledge of civil engineering systems and smart surveying technologies is practically used to plan, design, and manage infrastructure projects accurately and efficiently using advanced tools			
Assignments: Example: 1) Enlist various systems in Civil Engineering and explain its importance. 2) Explain the working principle of a Total Station. 3) How is GPS used in Civil Engineering surveying? 4) Describe the applications of Drone surveying and 3D Laser Scanner (LIDAR).			
Unit 5	Emerging Trends in Civil Engineering	8 Hrs.	CO5



Smart cities: Introduction, definition, Concept of smart Cities, AI in Civil engineering, Building Information modeling (BIM), IOT in infrastructure, 3D printing in Civil engineering.

Software in Civil Engineering: Basics of software, classification and applications of Auto CAD, REVIT architecture, STADD Pro, ETABS, TEKLA Structure.

Exemplars / Practical Applications and usage:

The concepts of smart cities and civil engineering software are practically used to design intelligent infrastructure, enhance construction efficiency, and improve project management through tools like BIM, IOT, AI, and CAD-based applications

Assignments:

Example: 1) Classify Civil Engineering software based on their applications.

2) Define a smart city and explain its importance in modern infrastructure development.

3) What are the key concepts and components of a smart city?

Course Projects:

-

Textbooks:

1. Ferdinand Singer, "Engineering Mechanics", Harper and Row, 3rd edition.

2. Hibbeler R.C., "Engineering Mechanics (Statics and Dynamics)", Pearson Education, 15th edition.

Reference Books:

1. S Timoshanko and Young, "Engineering Mechanics", Tata McGraw Hill Education Pvt. Ltd. New Delhi, 5th edition.

2. Beer and Johnston, "Vector Mechanics for Engineers – Statics", Tata McGraw Hill Education Pvt. Ltd. New Delhi, 12th edition.

3. Beer and Johnston, "Vector Mechanics for Engineers – Dynamics", Tata McGraw Hill Education Pvt. Ltd. New Delhi, 12th edition.

4. Meriam J. L. and Kraige L.G, "Engineering Mechanics - Statics and Dynamics", John Wiley and Sons publication, 9th edition (Global/Indian Adaptation).

5. Dr. L. R. Kadiyali, "Transportation Engineering: Planning, Design, and Operations", Khanna Publishers, 1st edition.

6. Dr. B. C. Punmia & Dr. Ashok Kumar Jain, "Water Supply Engineering", Laxmi Publications, 2nd edition.

7. Dr. K. R. Arora, "Soil Mechanics and Foundation Engineering". Bharatiya Book Corporation, 7th Edition.

1. Dr. R.N. Tiwari & A.K. Jain, "Smart Cities: Vision and Action", Discovery Publishing House, 1st edition.

2. Sham Tickoo, "AutoCAD 2024 for Engineers and Designers", Purdue Univ. Dreamtech Press India, 1st edition.

3. S.S. Bhavikatti, "Structural Analysis Vol. II", Vikas Publishing House, 5th edition

MOOCs Links and additional reading material:

1. https://onlinecourses.nptel.ac.in/noc21_me70/preview.

2. https://onlinecourses.nptel.ac.in/noc24_me148/preview.

3. Smart city- Sarvansathi (Marathi Edition Nov. 2016) by Sulakshana Mahajan.

4. Asavi Sundar Shahare Apuli Chan (Marathi Edition Jan. 2015) by Sulakshana Mahajan.



Strength of CO-PO Mapping											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	1	-	-	-	-	-	1
CO2	3	3	2	2	1	-	-	-	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	1
CO4	3	2	2	2	3	1	-	-	-	-	2
CO5	3	2	3	2	3	2	-	1	1	2	3
Avg.	3	2.4	2	1.8	1.8	1.5	-	1	1	2	1.6

Note : Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern							
BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz/ presentation	
K1	√	√	√	-	-	-	√
K2	√	√	√	-	-	-	√
K3	√	√	√	-	-	-	√
K4	-	-	-	-	-	-	-
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-



This course serves as a prerequisite for / maps with the following future courses:

Engineering Mechanics and Civil Engineering Systems course forms the foundation for several advanced and applied Engineering courses. Here is a list of future courses.

1. Mechanics of Structures: Applies concepts of force, stress, moment, and equilibrium to material behavior.
2. Theory of Machines: Builds on kinetics and kinematics of particles for mechanisms and linkages.
3. Machine Design: Uses principles of static and dynamic equilibrium to design machine elements.
4. Dynamics of Machinery: Directly extends particle motion concepts to rotating and oscillating systems.
5. Structural Analysis: Understanding of structural systems (beams, columns, frames).
6. Construction Technology: Role of 3D printing, BIM, and smart planning tools.

Job Mapping:

Job opportunities that one can get after learning this course:

1. Design Engineer / Structural Engineer: Apply Mechanics principles to analyze loads, forces, and stresses in structures and components.
2. Construction Engineer / Site Engineer: Use Mechanics to understand stability, safety, and material behavior in real-world construction.
3. CAD/CAE Analyst: Use Mechanics knowledge with simulation software for structural and motion analysis.
4. Research and Development Engineer: Develop innovative solutions by applying Mechanics to new materials and systems.



Program:		F. Y. B. Tech		Semester:		I / II	
Course:		Fundamentals of Electrical Engineering		Course Code:		R26-EE-ESE-106	
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credits (TH+PR)	CCE	ESE	TW	PR
02	02	-	2 + 1	40	60	25	-
Course Description: This course provides foundational knowledge in electrical engineering, covering the basic principles of DC and AC circuits, magnetism, electromagnetic induction, transformers, and electric vehicles. It also introduces students to practical aspects such as domestic wiring, protection devices, and earthing, enabling a strong understanding of how theoretical principles are applied in real-world electrical systems.							
Course Relevance: The course is essential for building a solid base in core electrical concepts that are fundamental to all branches of engineering. By connecting classical electrical theory with modern applications like electric vehicles and energy systems, it prepares students to understand, analyze, and apply electrical engineering principles in both traditional and emerging technological contexts.							
Prerequisite: Atomic structure, Electric charges, Coulomb’s laws.							
Bridge Content: Basic knowledge of physics (current, voltage, resistance, magnetism) and mathematics (algebra, trigonometry) for circuit analysis. Familiarity with simple DC circuits, household electrical systems, and basic electrical safety practices.							
Course Objectives: 1. EQUIP the students with essential knowledge in electrical engineering and emphasizing on analysis of DC circuits 2. UNDERSTAND the basic principles of magnetism and electromagnetic induction. 3. INCULCATE the fundamental knowledge of AC circuit. 4. DISPENSE basics of transformer and electric vehicles. 5. FAMILIARIZE students with domestic electrical wiring system, protection devices and earthing.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom’s Level
CO1	APPLY Kirchhoff's Laws and network simplification techniques for DC circuit analysis.						3
CO2	UNDERSTAND the magnetic circuit parameters, self-Inductance, mutual Inductance and Electromotive Forces						2
CO3	COMPUTE the fundamental parameter of AC circuits.						3
CO4	UNDERSTAND the basics of single-phase transformers and key concepts of electric vehicles						2
CO5	UNDERSTAND different wiring systems along with their safety devices.						2
Course Contents							
Unit 1	Fundamental Concepts and DC Circuits				5 Hrs.	CO3	
Fundamental concepts: Resistance, EMF, current, Electric potential, potential difference, Ohm’s law, Effect of temperature on resistance of various materials, RTC.							
DC Circuits: Classification of electrical networks, simplifications of networks using series-parallel							



Combinations and star delta transformation technique, current division rule, KVL, KCL and their applications for network analysis.			
Exemplars / Practical Applications and usage: Electrical Power System, Electrical and electronics circuits			
Unit 2	Electromagnetism	6 Hrs.	CO2
Magnetic Circuit: Magnetic material, Concept of flux density, field strength, permeability, MMF, reluctance, their units, and relationships. Simple series magnetic circuit, comparison of electric and magnetic circuit, B-H curve. Electromagnetic Induction: Faradays Laws of electromagnetic induction, Fleming's right-hand rule, Fleming's left-hand rule statically and dynamically induced emf, self and mutual inductance, coefficient of coupling. Energy stored in magnetic field.			
Exemplars / Practical Applications and usage: Motor, Generator, Loudspeaker, Magnetic levitation and Transformer			
Unit 3	Single Phase and Three phase AC Circuits	7 Hrs.	CO3
Representation of sinusoidal waveforms, Concept of cycle, period, frequency, instantaneous, peak, average and RMS values, peak factor and form factor. Phase difference, lagging, leading and in-phase quantities and phasor representation, rectangular and polar representation of phasor. Behavior of circuit elements (R, L,C) under AC supply Concept of three-phase AC symmetrical system, phase sequence, balanced and unbalanced load, Voltage, current and power relations in three phase balanced star and delta connected loads along with phasor diagrams.			
Exemplars / Practical Applications and usage: Induction machines, Electrical Power System, Transformer			
Unit 4	Introduction to Electrical Machine	6 Hrs.	CO2
Overview of Transformer Construction, working principle, EMF equation, transformation ratio, rating, types, losses, Transformer cooling, regulation and efficiency at direct loading conditions. Introduction of autotransformers. Overview of three phase transformer, types, connection and applications. Study of 12-0-12 volt. Center tapped Step down transformer. Basic of Electric Motor Electrical Motors: D.C. Motors: Construction, working principle, types and Applications. Three Phase Induction Motor: Working principle using rotating magnetic field theory, types and applications.			
Exemplars / Practical Applications and usage: Electrical and Electronics appliances, Electric vehicle.			
Unit 5	Electrical Installations and Safety	6 Hrs.	CO2
Introduction of wiring, selection of wiring, types of wiring, Introduction of Indian Standards, I.E. (Indian Electricity) rules of domestic wiring, testing and installation of domestic wiring. Insulating material Components of LT Switchgear: Switch Fuse Unit (SFU), ELCB, MCB, MCCB, RCCB Earthing: Purpose of earthing in electrical safety, Types of earthing: Plate, Pipe.			
Exemplars / Practical Applications and usage: Residential wiring, Maintenance and troubleshooting of power systems in domestic wiring.			
Course Projects:			

Textbooks:			
1. B.L. Theraja, A K Theraja "Electrical Technology Volume I and II", S Chand Publications, 2012			



2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill Education, 2nd edition 2019.
3. Mittle and V. N. Mittle, “Basic Electrical Engineering”, McGraw Hill Education, 2nd edition, 2005.
4. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2010.

Reference Books:

1. C. L. Wadhwa, “Basic Electrical Engineering”, New Age International (P) Limited 5th edition 2024.
2. S K Bhattacharya, “Electrical Machines”, McGraw Hill Education, 2nd edition, 2008.
3. T. K. Nagsarkar, M. S. Sukhija, “Basic Electrical Engineering”, Oxford University Press, 2nd edition 2018.

MOOCs Links and additional reading material:**MOOC links**

1. https://onlinecourses.nptel.ac.in/noc25_ee158/preview
2. https://onlinecourses.nptel.ac.in/noc25_ee160/preview
3. https://onlinecourses.nptel.ac.in/noc25_ee124/preview

Additional reading material

1. <https://www.schandpublishing.com/books/tech-professional/electrical-engineering-electronics/abc-electrical-engineering/9788121939096/>

List of Practical:

Experiment No.1	To examine and comprehend the critical safety protocols and precautionary measures essential for operating within electrical system.	2Hrs	CO5
------------------------	---	-------------	------------

Objective:

Analyze and understand essential safety protocols and precautionary measures required for safe operation within electrical systems.

Associated Tasks:

1. Demonstrate proper use of personal protective equipment (PPE) in electrical work.
2. Respond appropriately to electrical emergencies or faults following safety guidelines.

Exemplars and Utility:

Helps prevent electrical accidents and injuries in workplaces.

Experiment No.2	Determination of temperature coefficient of resistance of motor winding.	2Hrs	CO2
------------------------	---	-------------	------------

Objective:

Determine the temperature coefficient of resistance of a motor winding by measuring its resistance variation with temperature.

Associated Tasks:

1. Investigate how different winding materials affect the temperature coefficient by comparing multiple samples
2. Plot resistance versus temperature graph.

Exemplars and Utility:

Helps in predicting motor behavior under varying temperature conditions.



Experiment No.3	Circuit response analysis by Kirchhoff's law for controller.	2Hrs	CO1
Objective: To analyze and understand the response of electrical circuits using Kirchhoff's Voltage and Current Laws. Associated Tasks: Identify all loops and junctions in a given electrical circuit. 1. Apply Kirchhoff's Current Law (KCL) at the nodes to set up current equations. 2. Apply Kirchhoff's Voltage Law (KVL) around loops to set up voltage equations. 3. Solve simultaneous equations to find unknown currents and voltages. 4. Verify the results by comparing with circuit simulation tools or measurements. Exemplars and Utility: Solving simple DC circuits with multiple loops and nodes using Kirchhoff's laws			
Experiment No.4	Design of single turn alternator by using electrical components for generation of emf.	2Hrs	CO2
Objective: To design and construct a single-turn alternator using electrical components to generate and observe electromotive force (emf). Associated Tasks: 1. Identify and gather the necessary electrical components such as coils, magnets, and shafts. 2. Assemble the single-turn coil and set up the rotating mechanism. 3. Connect measuring instruments like a voltmeter or oscilloscope to detect emf. 4. Rotate the coil manually or with a motor to induce emf by changing magnetic flux. Exemplars and Utility: Building a basic alternator prototype to demonstrate electromagnetic induction principles.			
Experiment No.5	Line and phase quantity analysis for balanced three phase star and delta connected load.	2Hrs	CO3
Objective: To analyze and calculate line and phase voltages and currents in balanced three-phase star and delta connected loads. Associated Tasks: 1. Understand the difference between star (Y) and delta (Δ) connections in three-phase systems. 2. Identify line and phase quantities (voltages and currents) in both connection types. 3. Apply formulas to calculate line currents and voltages from phase values for balanced loads. 4. Use phasor diagrams to visualize relationships between line and phase quantities. 5. Solve numerical problems involving balanced three-phase star and delta loads. Exemplars and Utility: 1. Application in power system design and analysis where balanced three-phase loads are common.			
Experiment No.6	Direct loading test to determine transformer efficiency and regulation.	2Hrs	CO4
Objective: To perform a direct loading test on a transformer to determine its efficiency and voltage regulation under load conditions. Associated Tasks: 1. Set up the transformer and necessary measuring instruments (voltmeters, ammeters, wattmeters).			



2. Connect the transformer to a load and gradually increase the load current.
3. Measure input and output voltages, currents, and power at various load levels.
4. Calculate the efficiency of the transformer at each load condition using input and output power.
5. Determine voltage regulation by comparing no-load and full-load voltages.
6. Plot efficiency versus load current and analyze the transformer's performance characteristics.

Exemplars and Utility:

1. Hands-on experience in conducting transformer performance tests in a laboratory setting.

Experiment No.7	Assembly of distribution box with LT switchgear devices.	2Hrs	CO5
------------------------	---	-------------	------------

Objective: To assemble a distribution box incorporating low-tension (LT) switchgear devices ensuring proper electrical distribution and safety.

Associated Tasks:

1. Identify and understand the functions of various LT switchgear devices (MCBs, ELCBs, fuses, isolators).
2. Plan the layout for placing switchgear components within the distribution box.
3. Connect wiring and devices following standard electrical wiring practices and safety codes.
4. Test the assembled distribution box for correct operation and safety compliance.
5. Troubleshoot any connection or functionality issues in the assembly.
6. Document the assembly process and components used for future reference.

Exemplars and Utility:

Prepares students for installation and maintenance roles in electrical engineering

Experiment No.8	Measurement of Earth Resistance for domestic installation.	2Hrs	CO5
------------------------	---	-------------	------------

Objective:

To measure the earth resistance of a domestic electrical installation to ensure effective grounding and safety.

Associated Tasks:

1. Understand the importance of earthing in electrical safety systems.
2. Identify and set up the earth resistance tester (e.g., Megger or Earth Tester).
3. Place auxiliary electrodes (earth spikes) at proper distances from the earth electrode.
4. Connect the tester leads correctly to the earth electrode and auxiliary electrodes.
5. Perform the earth resistance measurement following standard procedures.
6. Record and analyze the readings to determine if the earth resistance meets safety standards.
7. Suggest improvements if resistance is above acceptable limits.

Exemplars and Utility:

Essential knowledge for electricians and electrical engineers working in residential and commercial installations.

Experiment No.9	Comprehensive analysis of LT/HT Electricity billing.	2Hrs	CO3
------------------------	---	-------------	------------

Objective:

To understand and analyze Low Tension (LT) and High Tension (HT) electricity billing, including tariff structures, demand charges, and consumption pattern

Associated Tasks:

1. Study different types of electricity tariffs applicable for LT and HT consumers.
2. Collect sample electricity bills for both LT and HT categories.
3. Identify components of the bill such as fixed charges, energy charges, demand charges, taxes, and penalties.
4. Calculate energy consumption costs based on meter readings and tariff rates.



5. analyze peak demand and its impact on HT billing.
6. Compare LT and HT billing to understand cost differences and advantages.
7. Prepare a detailed report explaining billing components and suggesting ways to optimize electricity costs.

Exemplars and Utility:

Ability to interpret and verify electricity bills for residential and industrial consumers

Experiment No.10	Assembly and disassembly of electric machine	2Hrs	CO4
-------------------------	---	-------------	------------

Objective:

To develop practical skills in the proper assembly and disassembly of an electric machine, ensuring understanding of its components and operational principles.

Associated Tasks:

1. Identify and understand the main parts of the electric machine (stator, rotor, bearings, brushes, etc.).
2. Follow safety protocols before starting disassembly.
3. Carefully disassemble the electric machine, noting the arrangement and condition of parts.
4. Inspect components for wear, damage, or defects.
5. Clean and prepare parts for reassembly.
6. Reassemble the machine correctly, ensuring proper alignment and fit of components.
7. Test the assembled machine for smooth operation and troubleshoot any issues.

Exemplars and Utility:

Hands-on experience with electric machine components and construction

Strength of CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	1	-	1	-	-	1
CO2	3	2	1	2	1	1	-	-	-	-	1
CO3	3	3	2	2	2	1	-	-	-	1	1
CO4	3	2	2	2	2	3	-	-	-	2	2
CO5	2	1	3	2	2	3	3	2	2	2	2
Avg.	2.8	2.2	2	2	1.8	1.8	3	1.5	2	1.7	1.4

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

Assessment Pattern

BT Level	CCE						ESE
	CCE 1	CCE2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	√	√	-	-	-	√	√
K2	√	√	-	-	-	√	√
K3	√	√	-	-	-	-	√
K4	-	-	-	-	-	-	-
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-



This course serves as a prerequisite for / maps with the following future courses: Electrical machine, Electrical measurement and instrumentation, Electric circuits and machines, Electrical Technology

Job Mapping:

Job opportunities that one can get after learning this course: Electrical Supervisor, Maintenance Supervisor, *etc.*



Program:		F. Y. B. Tech		Semester:		I / II	
Course:		Fundamentals of Electronics Engineering		Course Code:		R26-ET-ESC-107	
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit (TH+PR)	CCE	ESE	TW	PR
02	02	-	02 + 01	40	60	25	-
Course Description: The course Fundamentals of Electronics Engineering introduces first-year students to the foundational concepts and principles that form the basis of modern electronics. It begins with an overview of semiconductor devices and basic circuits, covering diodes, transistors, and their applications. Students will explore the structure, operation, and characteristics of BJTs, MOSFETs and FinFETs along with their role in analog and digital circuit design. The course also introduces the basics of digital electronics, including logic gates, combinational and sequential circuits, operational amplifiers and their practical applications. In addition, learners will gain exposure to various sensors used in embedded and IoT systems and will be introduced to the fundamentals of communication systems, focusing on signal transmission and modulation techniques.							
Course Relevance: The knowledge and skills acquired serve as a basis for further learning in circuit design, signal processing, and system development.							
Prerequisite: Basic Physics and Mathematics, Semiconductor Physics							
Bridge Content: -							
Course Objectives: 1. To UNDERSTAND the working principles of PN junction diode and Special purpose diodes. 2. To STUDY the operating principle and applications of BJTs, MOSFETs and FinFETs. 3. To LEARN the concepts of various logic gates, digital circuits, Microprocessor and Microcontroller. 4. To UNDERSTAND the concepts of operational amplifiers and their applications. 5. To KNOW the methods of measurement of physical parameters using sensors and transmission with the help of communication systems.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom's Level
CO1	ANALYZE the characteristics and applications of basic electronic components and circuits						4
CO2	COMPARE BJT, MOSFET, FinFET and GAAFET.						2
CO3	DESIGN and implement simple logic circuits						3
CO4	ANALYZE basic Op-Amp circuits						4
CO5	UNDERSTAND working principle and applications of various sensors and communication systems.						2



Course Contents			
Unit 1	Semiconductor Devices and Circuits	6 Hrs.	CO1
Introduction to active and passive components and their comparison. P-N Junction Diode: P-N Junction diode construction and its working in forward and reverse bias conditions, V-I characteristics of P-N junction Diode, Half wave rectifier, Full wave and Bridge rectifier, Need for voltage regulation, IC 78xx series Fixed Positive Voltage Regulators. Special purpose diodes: Light Emitting Diode (LED) and photo diode along with V- I characteristics and their applications. Exemplars / Practical Applications and usage: SMPS, Mobile and Laptop Chargers, Power Supplies for domestic appliances and industrial equipment, LED TV, IR-Remote Controller, Rolling Displays.			
Unit 2	Transistors and Technology	6 Hrs.	CO2
Bipolar Junction Transistor (BJT): Construction, type, Operation, V-I Characteristics in common emitter mode, BJT as switch and Common Emitter (CE) amplifier. E-MOSFET: Construction, Types, Operation, V-I characteristics, MOSFET as a switch and amplifier, FinFET: Introduction to FinFET. Exemplars / Practical Applications and usage: Audio Amplifier / PA System, Semiconductor Chips/ ICs in Mobile Phones/ Computers/Laptops, Semiconductor memory (Pen Drive).			
Unit 3	Digital Circuits	6 Hrs.	CO3
Number System: Introduction of Binary, Decimal, Hexadecimal number system, Conversion of Binary to Decimal, Decimal to Binary. Logic Gates - AND, OR, NOT, XOR, XNOR. Universal Gates – NAND, NOR. De-Morgan's theorem. Digital circuits - Half & Full adders. SR & D Flip Flops. Basic CMOS logic gates- NAND, NOR, Inverter (NOT gate). Introduction to Microprocessor and Microcontroller (Only block diagram and explanation). Important Specifications/Features of any one State-of-the-art Microprocessor and Microcontroller. Graphics Processing Unit (GPU) and its importance in AI computing (only introduction) Exemplars / Practical Applications and usage: Electronic voting machine, Electronic Control Unit (ECU) in Cars/e-vehicles, Robot Controllers, Embedded controllers in domestic appliances and industrial equipment/machines.			
Unit 4	Operational Amplifiers	6 Hrs.	CO4
Operational amplifier: Pin Diagram IC 741, Functional block diagram of operational amplifier, Ideal and practical values of performance parameters, Virtual Short and Virtual Ground, Op-Amp applications: Inverting, Non-inverting amplifier, Summing Amplifier, Subtractor. Types of OP-AMPS, their applications and example ICs (General purpose, Low power, Ultra Low power, Low noise, High speed, precision, rail-to-rail) Exemplars / Practical Applications and usage: ECG Amplifier, ICU Monitor in Hospital, Audio preamplifier.			
Unit 5	Sensors and Communication Systems	6 Hrs.	CO5
Sensors: Active /Passive Sensors, Motion Sensors (LVDT), Mechanical Sensors (Strain Gauge, Tactile Sensor), Environmental and Process Monitoring Sensors (Temperature-RTD), IoT enabled Data Acquisition. Communication Systems: Block Diagram, Communication Media: Wired and Wireless, Electromagnetic Spectrum, Modulation and its Types (AM & FM), Block diagram of GSM system. Important features of 5G mobile networks.			



Exemplars / Practical Applications and usage: Digital Thermometer, Weighing Machine, Green House Automation in Agricultural, Home Automation. 4G & 5G Technology, Satellite Communication, Radar/Military Communication			
Course Projects:			
1. Build and Test any Electronics Circuit using bread board and discrete components.			
Textbooks:			
1. Thomas L. Floyd, Electronics Devices , Pearson, 9th Edition 2. R. P. Jain Modern Digital Electronics, Tata McGraw Hill, 4th Edition 3. H. S. Kalsi Electronic Instrumentation, Tata McGraw Hill, 3rd Edition, 4. D. Patrnabis Sensors and Transducers, PHI, 2nd Edition, 5. Kennedy & Davis, Electronic Communication Systems , Tata McGraw Hill, 4th Edition			
Reference Books:			
1. Thomas. L. Floyd, Digital Fundamentals, Pearson, 11th Edition 2. J. Schiller, Mobile Communication, Pearson, 2nd Edition 3. S. Soloman Sensors Handbook, 2nd Edition. 4. Baker. CMOS Circuit Design, Layout & Simulation, Wiley IEEE Press 5. Corrado Di Natale, Introduction to Electronic Devices, Springer, 2023			
MOOCs Links and additional reading material:			
1. https://da-iitb.vlabs.ac.in/ 2. https://nptel.ac.in/courses/117103063 3. https://archive.nptel.ac.in/courses/106/105/106105166/			
List of Practical: (Any Eight)			
Experiment No.1	Identification and use of Electronic Components- Resistors (Fixed & Variable), Calculation of resistor value using color code. Capacitors (Fixed & Variable) Inductors, Calculation of inductor value using color code. Devices such as Diode, BJT, MOSFET, various IC packages. Switches & Relays	02 Hrs.	CO1
Objective: To recognize basic electronic components, understand their usage and find their values. Associated Tasks: 1. Identify different types of resistors(carbon film, metal film, wire-wound, SMD, etc.), Recognize fixed and variable resistors, Use the resistor color code chart to determine the resistance value, tolerance, Verify resistor values using a digital multimeter. 2. Identify different types of capacitors (ceramic, electrolytic, tantalum, polyester, variable capacitors), Read capacitance values marked on capacitors, Understand polarity markings, Measure capacitance using a DMM/LCR meter. 3. Identify different types of inductors (air-core, iron-core, ferrite-core, toroidal), Use the inductor color code (if applicable) to determine inductance value and tolerance. 4. Identify different semiconductor devices-Diodes (LED, Zener, Schottky, rectifier), BJT (NPN & PNP transistors), MOSFET (N-channel & P-channel), IC packages (DIP, SOP, QFP, BGA, etc.), Recognize pin configurations of common ICs Identify different types of switches (SPST, SPDT, DPST, DPDT, push-button, toggle, rotary), Test switches for continuity using a DMM, Verify relay coil activation and contact switching.			
5. Exemplars and Utility: LED TV, IR-Remote Controller, Rolling Displays, SMPS, Mobile & Laptop Chargers.			



Experiment No.2	Measurements using various test and measuring instruments: Setup CRO/DSO and function generator for measurement of AC, DC voltages and frequency. Measure Voltage, Resistance using digital multimeter. Test diode and BJT using digital multimeter.	02 Hrs.	CO1
Objective: To develop fundamental competencies in testing, debugging, and troubleshooting common electronic components and basic circuits using standard instruments. Associated Tasks: 1. Identify the controls of CRO/DSO (time base, voltage/division, trigger, probe settings), Learn to adjust frequency, amplitude, and waveform (sine, square, triangle) on Function generator, measure DC voltage, AC voltage, Time period, Frequency. 2. Measure DC voltage, AC voltage, Resistance on DMM. 3. Test Diode and BJT Using a DMM, check forward bias, reverse bias, identify anode, cathode of diode, Identify the terminals (Emitter, Base, Collector) using datasheet/DMM, Check forward bias of Base-Emitter (BE) and Base-Collector (BC) junctions of transistors. Exemplars and Utility: DSO as ICU Monitor in Hospital, Repair, maintenance, fault finding, troubleshooting of electronic appliances/equipment/gadgets.			
Experiment No.3	V-I characteristics of P-N Junction Diode. (Study the datasheet of typical PN junction diode)	02 Hrs.	CO1
Objective: To experimentally determine the V-I characteristics of a PN junction diode and analyze its parameters by comparing measured results with manufacturer datasheet specifications. Associated Tasks: 1. Study the Datasheet of a Typical PN Junction Diode, Identify key parameters. 2. Build the circuit, Experimentally determine the V-I characteristics and plot on graph paper. Exemplars and Utility: Power Supplies for domestic appliances and industrial equipment, SMPS, battery chargers			
Experiment No.4	Rectifier circuits: Implementation of a DC Regulated Power Supply using Bridge Rectifier, Diodes, and 78XX Voltage Regulator IC	02 Hrs.	CO1
Objective: To build a DC regulated power supply. Associated Tasks: 1. Identify all required components. 2. Draw the circuit diagram. 3. Check the pulsating DC output across the bridge rectifier, the smoothing effect (reduction in ripple) of filter capacitor using CRO/DSO. 3. Measure regulated output voltage. Exemplars and Utility: Power Supplies for domestic appliances and industrial equipment, SMPS, battery chargers			
Experiment No.5	Build and test Common Emitter (CE) BJT Amplifier circuit. Calculate the Gain of CE Amplifier	02 Hrs.	CO2



Objective: To build and test Common Emitter (CE) Amplifier Circuit.

Associated Tasks:

1. List and verify all components.
2. Draw the CE amplifier circuit, Calculate the values of base voltage (VB), emitter voltage (VE), and collector voltage (VC) to ensure proper transistor operation (Active Region)
3. Apply a small AC signal to the transistor base, Observe output at the collector. Verify signal amplification and phase shift (180°) and Measure input, output voltages and calculate voltage gain.

Exemplars and Utility:

Audio amplifiers, PA systems, RF transmitters, receivers.

Experiment No.6	Linear applications of Op-amp: Build inverting and non-inverting amplifier using op-amp (Study the data sheet of typical Op-Amp IC741)	02 Hrs.	CO4
------------------------	---	----------------	------------

Objective: To build inverting and non-inverting amplifier using op-amp

Associated Tasks:

Draw neat circuit diagrams.

Ensure proper power supply connection.

Apply a small amplitude sine wave (e.g., 100 mV at 1 kHz) from the signal generator to the amplifier circuit

Observe signal amplification on CRO/DSO, Measure input, output voltages and calculate voltage gain.

Exemplars and Utility:

ECG Amplifier, ICU Monitor in Hospital, Audio preamplifier.

Experiment No.7	Implementation of digital circuits- Basic and Universal Gates (Study the datasheet of respective ICs) Half Adder and Full Adder	02 Hrs.	CO3
------------------------	--	----------------	------------

Objective: To implement simple digital circuits and test their functionality.

Associated Tasks:

1. Gather ICs (7408, 7432, 7404, 7400, 7402, 7486) and digital Trainer kit for implementation of digital circuit and design adder circuit on kit.
2. Verify the truth table.

Exemplars and Utility:

Microprocessors, ALUs, Calculators

Experiment No.8	Measurement using transducers/sensors Any one process/environmental monitoring sensor. Inductive, capacitive, optical proximity sensors (NPN and PNP type proximity sensors).	02 Hrs.	CO5
------------------------	--	----------------	------------

Objective: To sense and measure physical parameters using suitable sensor.

Associated Tasks:

Understand working principle of sensors.

Ensure proper connections on the experimental kit.

Measure parameter value.

Perform object detection using proximity sensors. Compare and understand selection criteria of proximity sensors.

Exemplars and Utility:

Industrial process monitoring, weather monitoring, object detection



Experiment No.9	Implementation of Infrared Remote-Based Switching Circuit (Application of IR pair, transistor as a switch and relay for security alarm/ obstacle detection/ proximity sensing/ actuator control).	02 Hrs.	CO5
Objective: To build and test IR remote based circuit. Associated Tasks: 1. Build the circuit. 2. Test the circuit for any one real life application. Exemplars and Utility: Remote control of appliances/vehicles, burglar alarm, obstacle detection.			
Experiment No.10	Virtual Tour of a Semiconductor Fab (Demonstration should cover key steps involved in semiconductor manufacturing such as Wafer processing, Photolithography and Etching, Deposition, Doping, Metallization, Assembly and Packaging, Testing)	02 Hrs.	CO1
Objective: To understand modern semiconductor manufacturing process. Associated Tasks: 1. Brainstorming on semiconductor manufacturing process, India's semiconductor mission. Exemplars and Utility: Semiconductor Foundry			

Strength of CO-PO Mapping											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	-	-	-	-	2	1	-
CO2	3	2	2	1	-	-	-	-	2	1	-
CO3	3	2	2	1	-	-	-	-	2	1	-
CO4	3	2	2	1	-	-	-	-	2	1	-
CO5	3	2	2	1	-	-	-	-	2	1	-
Avg.	3	2	2	1	-	-	-	-	2	1	-

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

Assessment Pattern							
BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	✓	✓	-	-	✓	✓	✓
K2	✓	✓	-	-	✓	✓	✓
K3	✓	✓	-	-	✓	✓	✓
K4	✓	✓	-	-	✓	✓	✓



K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses:

1. Analog and Digital Electronics
2. Analog and Digital Communication
3. Fundamentals of IoT
4. Embedded System and Edge Computing
5. Power Electronics

Job Mapping:

Job opportunities that one can get after learning this course:

1. Electronics Hardware Maintenance Technician



Program:		F. Y. B. Tech		Semester:		I	
Course:		Programming & Problem Solving using Python		Course Code:		R26-CO-ESC-108	
Teaching Scheme (Hrs./week)			Credits (TH+PR)	Examination Scheme			
Lecture	Practical	Tutorial		CCE	ESE	TW	PR
02	02	-	02+01=03	40	60	25	-
Course Description and: This course introduces problem-solving with Python, covering algorithms, data types, control statements, functions, and file handling, giving students practical skills to solve real-world problems. Course Relevance: This course is essential in today’s tech-driven world, where Python is key in software development, data science, automation, and AI. It builds strong programming and problem-solving skills, helping students handle data, write functions, and manage files for real-world use.							
Prerequisite: Basic computer literacy							
Bridge Content: -							
Course Objectives: 1. To UNDERSTAND problem-solving skills, problem solving aspects and _Python programming fundamentals. 2. To INTRODUCE various data structures like lists, tuples, sets, and dictionaries, along with control statements. 3. To LEARN concepts of functions, modular programming, and the use of Python libraries. 4. To ENABLE students to manipulate and process string data efficiently using Python’s built-in methods. 5. To LEARN operations of file handling and manage files using python.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome					Bloom’s Level	
CO1	APPLY problem-solving fundamentals to develop Python programs using algorithms and flowcharts.					3	
CO2	USE concepts of data structures and control statements for effective decision-making in programs.					3	
CO3	PERFORM modular Python programs using functions and libraries for better code reusability.					3	
CO4	APPLY string operations and built-in string functions for text processing.					3	
CO5	IMPLEMENT operations of file handling and manage files using Python.					3	
Course Contents							
Unit 1	Principles of Problem Solving and Programming using Python			6 Hrs.		CO1	
Problem solving concept, six steps in problem solving, importance of programming paradigm in software development to solve the problem, different type of paradigm: monolithic, procedural, structured, object oriented, functional, and logical. Algorithm, flowcharts, pseudo code. Basics of Python Programming: Features of Python, history and need of Python, Literal constants, Variables and Identifiers, Data Types, Comments, Reserved words, Indentation, Operators and Expressions.							
Exemplars / Practical Applications and usage: Study of Problem Solving Concepts in Real-life problems like calculating shopping costs							
Assignments: 1. Choose a real-life problem (e.g., calculating electricity bill, student grade calculation, ATM transaction)							



and Define the problem, Write the algorithm, Represent it using a flowchart, Convert the algorithm into pseudo code.

2. Demonstrate different data types in Python with examples.

Unit 2	Literal Collections and Control Flow	6 Hrs.	CO2
Literal Collections- Tuples, Lists, Sets and Dictionary and its operations. Decision Control Statements: Branching Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures/Iterative statements: while loop, for loop. Nested loops, The break, continue, pass, else statement used with loops.			
Exemplars / Practical Applications and usage: Study the use of tuples to Store fixed data like coordinates or RGB color values.			
Assignments: 1. Create and print a tuple, list, set, and dictionary containing student details (name, roll no, marks, course). 2. Write a Python program that finds all the even numbers from specific range.			
Unit 3	Functions and Modules	6 Hrs.	CO3
Function: Need for functions, types of functions, defining and calling functions, variable scope and lifetime, the return statement, types of arguments, Lambda or Anonymous function, documentation string, recursive functions. Introduction to modules, and packages in Python, standard library modules.			
Exemplars / Practical Applications and usage: Study that, how functions help in organizing code into reusable blocks.			
Assignments: 1. Create a Python program to demonstrate local and global variables. 2. Import and use various built-in modules using python program.			
Unit 4	String Handling	6 Hrs.	CO4
Strings, Operations on strings- indexing, slicing, concatenation, appending, multiplication, immutable strings, strings formatting operators, built in string methods and functions, ord() and chr() functions, in and not in operators, comparing strings, iterating strings, string module.			
Exemplars / Practical Applications and usage: Use of string operations in passwords or usernames.			
Assignments: 1. Write a Python program for various string operations. 2. Write a Python program which shows string comparison operations			
Unit 5	Working with Files in Python	6 Hrs.	CO5
File Handling: Introduction, types of files, Modes of file, Opening and Closing files, Reading and Writing files, file positions using seek() and tell(), renaming and deleting files, Exception Handling in file operations, Directory methods.			
Exemplars / Practical Applications and usage: To develop a simple system that can store, retrieve, and manage book records using file handling techniques.			
Assignments: 1. Write a Python program to read the content of a text file and print it. 2. Write a Python program for various function using the os module.			
Textbooks:			
1. Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press, 6 th edition. 2. R. Nageswara Rao, Core Python Programming, Dreamtech Press, 2 nd edition.			



Reference Books:			
1. R. G. Dromey, How to Solve it by Computer, Pearson Education India, 1st edition.			
2. Maureen Spankle, Problem Solving and Programming Concepts, Pearson, 9th edition.			
3. Romano Fabrizio, Learning Python, Packt Publishing Limited, 5 th edition.			
4. Martin C. Brown, Python: The Complete Reference, McGraw Hill Education, 4 th edition.			
MOOCs Links and additional reading material:			
1. Python for Everybody, https://pythonbooks.org/python-for-everybody-exploring-data-in-python-3			
2. Python Basics: A Practical Introduction to Python 3, https://static.realpython.com/python-basics-sample-chapters.pdf			
3. NPTEL, Python for Data Science, https://onlinecourses.nptel.ac.in/noc25_cs60/preview			
4. NPTEL, The Joy of Computing using Python, https://onlinecourses.nptel.ac.in/noc25_cs69/preview			
List of Practical:			
Group A: Perform any 8 experiments.			
Experiment No.1	To Design a simple calculator.	2 Hrs.	CO1
Objective: To Design a simple calculator that performs basic tasks such as addition, subtraction, multiplication and division and average of n numbers.			
Associated Task: Design and implement a basic calculator performing addition, subtraction, multiplication, division, and average of n numbers.			
Exemplars: Simple command-line calculator program, menu-driven calculator, or function-based arithmetic module.			
Utility: Useful for understanding basic programming logic, input handling, arithmetic operations, and building foundational problem-solving skills.			
Experiment No.2	Calculate the salary of an employee	2 Hrs.	CO1
Objective: To calculate the net salary of an employee given his basic pay (take input from the user). Calculate gross salary of employee. Let HRA be 10 %, DA be 40%, and TA be 2% of basic pay. Let employees pay professional tax as 2% of total salary. Calculate net salary payable after deductions.			
Associated Task: Calculate gross salary and net salary of an employee using user-input basic pay, applying HRA (10%), DA (40%), TA (2%), and professional tax (2%).			
Exemplars: Menu-based salary calculator, payroll computation script, or program demonstrating salary breakup and deductions.			
Utility: Helps understand arithmetic operations, percentage calculations, input handling, and real-world payroll computation logic.			
Experiment No.3	Calculate the result of a student.	2 Hrs.	CO2
Objective: To accept a student's five courses marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course. If student scores aggregate greater than 75%, then the class is "distinction". If aggregate is 60>= and <75 then the class is "first class". If aggregate is 50>= and <60, then the class is "second class". If aggregate is 40>= and <50, then the class is "third class".			
Associated Task: Accept five course marks, determine pass/fail status, calculate aggregate percentage, and classify the result			



into distinction/first/second/third class.

Exemplars:

Student result calculator program, grade classification script, or marks-processing module.

Utility:

Builds skills in conditional statements, percentage calculation, logical decision-making, and handling multiple inputs in programming.

Experiment No.4	Check whether input number is Armstrong number or not.	2 Hrs.	CO2
------------------------	---	---------------	------------

Objective:

To check whether input number is Armstrong number or not. An Armstrong number is an integer such that the sum of the cubes of its digits is equal to the number itself.

Associated Task:

Check whether a given number is an Armstrong number by comparing it with the sum of the cubes of its digits.

Exemplars:

Armstrong number checker program, digit-extraction logic demo, or number-property verification script.

Utility:

Strengthens understanding of loops, mathematical operations, condition checking, and digit-wise number processing.

Experiment No.5	Perform program for prime and factorial.	2 Hrs.	CO2
------------------------	---	---------------	------------

Objective:

To accept the number and Compute:

a) Check for prime b) factorial of number.

Associated Task:

Accept a number and compute whether it is prime, and also calculate its factorial.

Exemplars:

Prime number checker, factorial calculator, or menu-based number operations program.

Utility:

Enhances understanding of loops, conditional logic, mathematical computation, and function-based problem solving.

Experiment No. 6	To reverse the string.	2 Hrs.	CO3, CO4
-------------------------	-------------------------------	---------------	-----------------

Objective:

Program to reverse the string using user defined function.

Associated Task:

Reverse a given string using a user-defined function to process characters manually.

Exemplars:

String reversal function, character-by-character manipulation program, or simple text-processing module.

Utility:

Builds understanding of string handling, function creation, loop usage, and basic algorithmic thinking.

Experiment No.7	Generate Fibonacci series.	2 Hrs.	CO2
------------------------	-----------------------------------	---------------	------------

Objective:

To accept the number of terms to be generated from the user and prints the Fibonacci series.

Associated Task:

Accept the number of terms from the user and generate the Fibonacci series accordingly.

Exemplars:

Fibonacci sequence generator, iterative/recursive Fibonacci function, or number pattern printing program.

Utility:

Strengthens logic building, loop/recursion concepts, sequence generation, and mathematical pattern



Experiment No.8	Perform various string operations.	2 Hrs.	CO4
Objective: Write a python program that accepts a string from user and perform following string operations: i. Calculate length of string ii. Equality check of two strings iii. Check palindrome iv. Check substring.			
Associated Task: Accept a string from the user and perform length calculation, string equality check, palindrome verification, and substring search.			
Exemplars: String operations module, menu-driven string utility program, or basic text-processing script demonstrating multiple string functions.			
Utility: Improves understanding of string manipulation, conditional checks, user input handling, and implementing common text-processing operations in Python.			
Experiment No.9	Demonstrate some file handling operations.	2 Hrs.	CO5
Objective: To copy contents of one file to other. While copying a) all full stops are to be replaced with commas b) lower case are to be replaced with upper case c) upper case are to be replaced with lower case.			
Associated Task: Copy the contents of one file to another while replacing full stops with commas and swapping all lowercase letters to uppercase and vice versa.			
Exemplars: File copy utility program, text-transform script, or case-conversion and punctuation-replacement module.			
Utility: Develops skills in file handling, character processing, text transformation, and applying conditional logic during file operations.			
Experiment No.10	Count words, characters and lines in given file.	2 Hrs.	CO5
Objective: To count total characters in file, total words in file, total lines in file and frequency of given word in file.			
Associated Task: Read a file and compute total characters, total words, total lines, and the frequency of a user-specified word.			
Exemplars: File statistics analyzer, word-frequency counter, or text-processing utility program.			
Utility: Enhances understanding of file handling, text parsing, counting techniques, and real-world data processing			
Group B: Perform any one experiment relevant to the respective branch of study.			
Experiment No.1	Simulate a gear selector system. (Preferred for Mechanical branch)	2 Hrs.	CO2
Objective: Simulate a gear selector system. Use if-else to print speed ranges for gear values 1–5 entered by the user.			
Associated Task: Simulate a gear selector where the user enters a gear (1–5) and the program displays the corresponding speed range using if-else conditions.			
Exemplars: Gear-speed simulator, menu-based vehicle control demo, or conditional mapping program for gear values.			
Utility: Builds understanding of decision-making statements, input handling, and mapping user inputs to real-world system outputs.			
Experiment No.2	Calculates concrete mix ratio. (Preferred for Civil branch)	2 Hrs.	CO3

**Objective:**

Write a function that calculates concrete mix ratio for given strength requirements (e.g., M20, M25).

Associated Task:

Write a function that accepts a grade of concrete (e.g., M20, M25) and returns the corresponding standard mix ratio.

Exemplars:

Concrete mix ratio function, grade-to-ratio lookup program, or construction-material calculation module.

Utility:

Helps understand function design, mapping inputs to predefined standards, and applying practical

Experiment No.3	Basic Ohm's Law calculator. (Preferred for Electrical branch)	2 Hrs.	CO1
Objective: Create a basic Ohm's Law calculator ($V = IR$) taking any two of the three values. Associated Task: Create an Ohm's Law calculator that takes any two values among voltage (V), current (I), and resistance (R) and computes the third. Exemplars: Ohm's Law solver, electrical parameter calculator, or menu-based circuit computation program. Utility: Builds understanding of formula-based calculations, conditional logic, and applying basic electrical engineering concepts in programming.			
Experiment No.4	Check if a frequency input is within communication bands. (Preferred for Electronics and Telecommunication branch)	2 Hrs.	CO2
Objective: Check if a frequency input is within communication bands (e.g., FM: 88–108 MHz). Associated Task: Accept a frequency value from the user and determine whether it falls within standard communication bands such as FM (88–108 MHz). Exemplars: Frequency band checker program, radio-spectrum validator, or range-based communication signal classifier. Utility: Strengthens conditional checking, range validation, and applying real-world communication system concepts in programming.			
Experiment No.5	Simulate robot arm movement logic. (Preferred for Automation and Robotics branch)	2 Hrs.	CO2
Objective: Simulate robot arm movement logic using nested if-else for axis selection and angles. Associated Task: Simulate robot arm movement by letting the user choose an axis and angle, and use nested if-else to determine valid motions. Exemplars: Robot arm control simulator, axis-angle decision program, or basic robotic movement logic demonstration. Utility: Develops understanding of nested conditions, decision flow, and applying logical structures to model real robotic movements.			
Experiment No.6	Simulate basic logic gates. (Preferred for Electronics and Computer branch)	2 Hrs.	CO2

**Objective:**

Simulate basic logic gates (AND, OR, NOT) using conditional operators.

Associated Task:

Simulate the functioning of basic logic gates (AND, OR, NOT) using conditional operators based on user-provided inputs.

Exemplars:

Logic gate simulator program, binary input evaluator, or truth-table based output generator.

Utility:

Strengthens understanding of Boolean logic, conditional operations, and fundamental digital electronics concepts through programming.

Experiment No.7 **Sort list with even and odd numbers.**

2 Hrs.

CO2

Objective:

To accept list of N integers and partition list into two sub lists even and odd numbers.

Associated Task:

Accept a list of N integers and partition it into two separate lists containing even numbers and odd numbers.

Exemplars:

List partition program, even-odd separator, or basic data categorization script.

Utility:

Enhances list handling skills, conditional filtering, and understanding of data classification using simple logic.

Strength of CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	-	-	-	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-
CO3	2	2	3	2	2	-	-	-	-	-	-
CO4	2	2	2	2	2	-	-	-	-	-	-
CO5	2	2	2	2	3	-	-	-	-	-	-
Avg.	2.4	2.4	2.6	2	2.2	-	-	-	-	-	-

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

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	✓	✓	✓	-	-	✓	✓
K2	✓	✓	✓	-	-	✓	✓
K3	✓	✓	✓	-	-	✓	✓
K4	-	-	-	-	-	-	-
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-



This course serves as a prerequisite for / maps with the following future courses:

- Data Structures and Algorithms
- Object Oriented Programming (OOP) in Python
- Embedded Systems
- Computational Modelling, Simulation
- Robotics Programming
- Cloud and DevOps with Python Scripts
- AI and ML

Job Mapping:

Job opportunities that one can get after learning this course:

This course builds the foundational skills in programming and logical problem-solving using Python, which opens pathways to multiple entry-level and advanced IT and data-related job roles.

Entry-Level Job Roles:

- Junior Python Developer, Application Developer
- Data Analyst (Entry-level)
- ML Intern, AI Project Assistant
- Automation Intern



Program:		F. Y. B. Tech			Semester:		I / II	
Course:		Engineering Workshop Skills Lab			Course Code:		R26-ME-VSEC-109	
Teaching Scheme (Hrs./week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	2	-	1	-	-	50	-	
Course Description: The Engineering Workshop Skills Lab is designed and common for all streams of first-year B. Tech Engineering students to help them understand the basics of manufacturing processes. It provides a practical environment for students to gain hands-on experience with common engineering materials, tools, processes and machineries in various shops; to develop basic skills in fabrication and assembly; and to understand workplace safety regulations. This course provides industrial environment in the educational institute.								
Course Relevance: Bridging the Theory-Practice Gap: It allows students to apply theoretical knowledge from textbooks to physical scenarios, reinforcing core engineering concepts. Developing Essential Practical Skills: It builds technical proficiency in using industry-standard tools, equipment, and software, making graduates "job-ready". Enhancing Problem-Solving and Design Abilities: Hands-on troubleshooting and project implementation in a workshop environment improve analytical and creative problem-solving skills, which are essential for designing solutions to complex engineering problems. Fostering an Entrepreneurial Mindset: Working on prototypes or small projects within a dedicated space can encourage innovation and an entrepreneurial outlook, allowing students to transform ideas into tangible results. Instilling Professional Skills: It develops soft skills like teamwork, communication, and project management through collaborative projects and report writing. Ensuring Safety Awareness: Students learn the importance of safety protocols and hazard avoidance, a critical responsibility in any engineering role. Meeting Industry Demands: Employers highly value engineers who possess a balance of theoretical knowledge and practical application skills to meet the evolving demands of the global job market.								
Prerequisite: 1. Basic knowledge of geometry and mathematics 2. Engineering Drawing 3. Prior exposure to commonly used hand tools - such as files, try square, spanner, hacksaw, measuring tape etc. 4. Basic Manufacturing knowledge								
Course Objectives: 1. To DEVELOP safety awareness and discipline in handling workshop equipment. 2. To FAMILIARIZE students with the basic manufacturing processes and hand tools. 3. To IMPART practical knowledge of fitting, sheet metal, carpentry, welding, plumbing, and machining. 4. To INTRODUCE the concepts of measurement, quality checks and basic fabrication. 5. To ENHANCE the students ability to interpret drawings and execute hands-on tasks accordingly.								



Course Outcomes: After learning the course, students will be able to		
CO	Course Outcome	Bloom's Level
CO1	DESCRIBE the different sections of a typical workshop and EXPLAIN the principles of effective workshop layout.	1
CO2	DEMONSTRATE adherence to safety protocols and standard operating procedures in a workshop environment.	3
CO3	IDENTIFY and EXPLAIN the functions of various hand tools, conventional and advanced machine tools, and workshop equipment.	2
CO4	INTERPRET basic workshop drawings and perform fundamental operations in fitting, carpentry, sheet metal, welding, and plumbing.	3
CO5	UNDERSTAND basics of Conventional and CNC machine tools and their operations.	2

List of Practical:			
Experiment No.1	Plant layout and Industrial Safety	2 Hrs.	CO1, CO2
Objective: 1. Introduction to workshop facilities and importance of safety in workshop/Industry. 2. Importance of safety in workshop/Industry. Associated Tasks: 1. Draw a layout of workshop/visited industry with arrangement of equipment's considering a specific application. 2. Use of Personal Protective Equipment (PPE) i.e. goggles, gloves, aprons, shoes. 3. Safety signs and emergency protocols. Exemplars and Utility: 1. Industrial visit to explore plant payout and safety.			
Experiment No.2	Develop and fabricate utility job by using operations performed in the following sections	18 Hrs.	CO3, CO4
Objective: To prepare a utility job by performing operations in any three of the following sections, in order to become familiar with various workshop tools and measuring equipment. a. Fitting Shop b. Carpentry Shop c. Sheet Metal Shop d. Welding Shop e. Plumbing Shop (GI & PVC Pipes)			
a. Fitting Shop Associated Tasks: 1. Preparation of simple fitting job having sawing, filing, drilling, tapping operations using different tools/equipment's such as files, hammers, drills & taps, etc. Exemplars and Utility: 1. Nut 2. Paper weight etc.			



b. Carpentry Shop Associated Tasks: 1. Preparation of simple wooden job having marking, sawing, planning, chiseling operations using different tools/equipment's such as saws, Jack plane, chisel, hammer, mallet etc. needed for it. Exemplars and Utility: 1. Drawer box 2. Clipboard			
c. Sheet Metal Shop Associated Tasks: 1. Fabrication of simple sheet metal job having shearing, bending and joining operations using different tools/equipment's such as hammers, mallet, stake block, snip, etc. needed for it. Exemplars and Utility: 1. Tray 2. Dustpan			
d. Welding Shop Associated Tasks: 1. Fabrication of simple utility job that involve Lap joint, Butt joint, and T-joint using arc/TIG/MIG welding. Exemplars and Utility: 1. Coconut opener 2. Farm equipment etc.			
e. Plumbing Shop (GI & PVC Pipes) Associated Tasks: 1. GI Pipe Operations: Cutting, threading, joining using elbows, tees, unions 2. PVC Pipe Operations: Cutting, joining using solvent cement, tap installation Exemplars and Utility: 1. Construct a water supply model with one GI and one PVC line connection /Pipe joint using coupling, elbow, tee, and union.			
Experiment No.3	Conventional Machine Tools and Advance Machine Tools	2 Hrs.	CO5
Objective: Introduction to conventional machine tools, advance machine tools and their operations. Associated Tasks: 1. Demonstration of conventional machine Tools: Lathe, Drilling, grinding and Milling machine. 2. Demonstration of advance Machine Tools: CNC, VMC.			

Textbooks:
1. S. K. Hajra Choudhury, "Workshop Technology Vol. I & II", Media Promoters 2. H. S. Bava, "Workshop Technology", Tata McGraw Hill Publishing Co. Ltd., 1995 3. P.N. Rao, "Manufacturing Technology", Tata McGraw-Hill
Reference Books:
1. W. A. J. Chapman, "Workshop Technology", ELBS Low Price Text, Edward Donald Pub. Ltd., 1961. 2. K. C. John, "Mechanical Workshop Practice", PHI Learning. 3. R.K. Rajput, Manufacturing processes, Laxmi Publications Pvt. Ltd. 4. P.C. Sharma, Production Technology, S. Chand Publishing

**MOOCs Links :**

1. NPTEL Course on Industrial Safety And Fire Safety Management, by Dr. P.K.Ghosh & Mrs. Annapurna Adiley, Chhattisgarh Swami Vivekanand Technical University (CSVTU), Bhilai
https://onlinecourses.swayam2.ac.in/nou23_ge81/preview
2. NPTEL Course on Fundamentals of Manufacturing Processes, by Prof. D K Dwivedi, IIT Roorkee
https://onlinecourses.nptel.ac.in/noc20_me67/preview
3. NPTEL Course on Computer Aided Design and Manufacturing II, by Prof. P.V. Madhusudan Rao, IIT Delhi
<https://nptel.ac.in/courses/112102103>

Additional learning material:

1. NPTEL Course on Fundamentals of Industrial safety by Prof. Thomas, IIT Madras
<https://www.youtube.com/watch?v=3VReVbsmjKI>
2. NPTEL Course on Computer Numeric Control Of Machine Tools And Processes by Prof. A. Roy Choudhary, IIT Kharagpur
https://www.youtube.com/watch?v=ImtSsDLgAaI&list=PLSGws_74K01-KX9YtVZACpOoFYy6oaJIC

Strength of CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	3	3	3	3	3	3	2	-	3	-
CO2	-	1	3	2	3	1	3	2	-	1	-
CO3	1	3	3	3	3	1	1	2	-	3	3
CO4	3	3	2	2	1	-	-	-	2	1	-
CO5	1	3	2	3	3	-	3	1	-	3	3
Avg.	1.6	2.6	2.6	2.6	2.6	1.6	2.5	1.75	2	2.2	3

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

This course serves as a prerequisite for / maps with the following future courses:

- Manufacturing Processes, Advanced Manufacturing Processes, Computer Aided Manufacturing, Advanced Forming and Joining Processes, Machine Design, Metrology

Job Mapping:

Job opportunities that one can get after learning this course:

1. Technical Assistant / Technician Trainee: Basic machine operations, CAM support, Workshop / lab assistant roles.
2. Manufacturing/Production Helper: Roles in small manufacturing firms, Machine shop assistant, and Assembly line work.
3. Apprenticeships / Internships: Many industries offer ITI-level apprenticeships for candidates with basic technical knowledge, PSU apprentice schemes under the National Apprenticeship Promotion Scheme (NAPS).
4. Field Technician: Jobs in installation and maintenance of machinery.
5. Customer Service Support (Technical): Call center support for mechanical tools or software, Sales assistant in hardware/tool shops.



Program:	F. Y. B. Tech (AI & DS)			Semester:		I	
Course:	Digital Technology Lab			Course Code:		R26-AI-VSEC-115	
Teaching Scheme (Hrs./week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	02	-	01	-	-	50	-
Course Description: This practical course offers hands-on experience in computer hardware, software tools, networking, IoT, and AI technologies. Students will explore, assemble, configure, and troubleshoot digital systems through structured experiments. It bridges theoretical learning with real-world technical skills essential for modern engineers and innovators.							
Course Relevance: The course develops practical problem-solving and system-integration skills needed in engineering and IT fields. It prepares learners for entry-level technical roles and builds a strong foundation for advanced digital and AI-based applications.							
Prerequisite: Basic Computer Fundamentals							
Bridge Content: Introduction to computers and technologies							
Course Objectives: 1. To EXPLORE, IDENTIFY, ASSEMBLE, and TROUBLESHOOT computer hardware components. 2. To INSTALL and CONFIGURE modern IDEs and set up virtual machines for working with multiple operating systems. 3. To LEARN the basics of IoT using simulation tools and IDE platforms, and apply them in simple real-world projects like traffic light control, temperature sensing, and obstacle detection. 4. DESIGN and SIMULATE a basic virtual network using Cisco Packet Tracer to understand device connectivity and data flow. 5. To GAIN hands-on experience with AI tools for practical tasks and explore a popular educational AI tool for skill development.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom's Level
CO1	EXPLAIN the functions of hardware components, basic computer system assembly and troubleshooting steps.						2
CO2	DEMONSTRATE the installation and configuration of modern IDEs, setup of virtual machines, and use of debugging techniques.						3
CO3	APPLY IoT simulation tools and IDE platforms to implement real-world applications.						3
CO4	DEMONSTRATE the identification of networking components and configuration of LAN settings to simulate and troubleshoot networks in Cisco Packet Tracer.						3
CO5	APPLY different AI tools to solve domain-specific problems and demonstrate their functionalities.						3
Any 8 experiments from A, B, C and D							
Group-A (Basic Hardware and Software)							
Experiment No. 1	Hands-on to explore and identify computer hardware components, assembly and troubleshooting.					2 Hrs.	CO1
Objective: To explore, identify, assemble, and troubleshoot computer hardware components							

**Associated Tasks:**

1. Explore and name key parts like CPU, RAM, motherboard, power supply, GPU, HDD/SSD, etc.
2. Connect and install components inside the cabinet (case) correctly, following safety protocols.
3. Attach external devices such as monitor, keyboard, mouse, printer, and verify functionality.
4. Diagnose issues like loose connections, faulty RAM, or no display, and apply fixes.

Exemplars and Utility:**Exemplars:**

1. Assemble a basic desktop PC using provided hardware components and verify successful boot.
2. Troubleshoot a non-starting PC by checking RAM placement, power connections, and display output.

Utility: Students can apply this knowledge to troubleshoot basic hardware issues at home or work

Experiment No. 2	Learn various types of software and perform following operations a. Installation and configuration of modern IDEs (Spyder, Pycharm, Eclipse, VSCode etc.). b. Learn to use tools like terminals, debuggers, and code formatters available in IDEs using simple program.	2 Hrs.	CO2
-------------------------	---	---------------	------------

Objective: To understand and perform installation and configuration of modern IDEs for software development.

Associated Tasks:

1. Learn types of software: system software and application software
2. Install and configure IDEs like Spyder, PyCharm, and VS Code; set up languages, extensions, and terminals.
3. Write, debug, format, and run simple Python or Java programs using IDE tools like debuggers, formatters, and terminals.

Exemplars and Utility:

Exemplars: A student installs VS Code, adds Python extension, configures the interpreter, and runs a “Hello World” program.

Utility: Demonstrates hands-on ability to set up a working development environment — essential for software development roles.

Experiment No. 3	Set up a virtual machine to install dual operating system on a single machine (Virtual Box).	2 Hrs.	CO2
-------------------------	---	---------------	------------

Objective: To set up and configure virtual machines for installing and using multiple operating systems.

Associated Tasks: Install and configure VirtualBox, create a virtual machine, and install two different operating systems (e.g., Windows and Linux/Ubuntu) on it, either using dual-boot setup or separate virtual machines, and verify their independent functioning.

Exemplars and Utility:

Exemplars: A student successfully installs Ubuntu and Windows on separate virtual machines using Virtual Box and switches between them for different tasks.

Utility: Enables flexibility to develop and test applications across multiple operating systems.



Experiment No. 4	Perform a practical comparison of program execution flow (interpreter and compiler) in C/C++ and Python from source code to final output Identify and fix syntax and logical errors in a program by designing various test cases.	2 Hrs.	CO2
Objective: To compare interpreter- and compiler-based execution and debug code by identifying syntax and logical errors. Associated Tasks : 1. Write equivalent simple programs (e.g., addition of two numbers) in both Python and C/C++. 2. Observe and document the steps from writing source code to getting the output. 3. Introduce and debug both syntax and logical errors using test cases and the tools provided by their respective environments. Exemplars and Utility: Exemplars: A student writes a Python program and executes it directly using the interpreter, observing immediate output and error reporting. Utility: Demonstrates how interpreter and compiler execute program and fixing various types of errors in program.			
Group-B (Basics of IoT)			
Experiment No.5	Understanding the visualization and importance of IoT devices in real-world AI applications using simulation tools such as NetSim /Ansys/ Iotify etc.	2 Hrs.	CO3
Objective: To explore how IoT devices interact in real-time AI systems and visualize their behavior using simulation tools Associated Tasks: 1. Explore the functionality and roles of various IoT devices in real-time, AI-integrated applications. 2. Develop and simulate a smart environment (e.g., home or traffic system) using IoT devices through tools like Iotify or NetSim. 3. Visualize and analyze the connectivity and interaction between IoT components in building real-time intelligent systems. Exemplars and Utility: Exemplars: A student simulates a smart home where temperature sensors trigger AI-based climate control decisions. Utility: Demonstrates how IoT devices are used for smart real-world applications.			
Experiment No.6	Installation of IDE platforms (Raspberry Pi, Arduino, ESP32 etc.) and Hands on exploration of IOT technology for Real world applications. a. Traffic Light control system b. Temperature and Humidity Sensing c. Obstacle detection	2 Hrs	CO3
Objective: To install IDE platforms and hands-on experience with IoT technology by developing simple real-world application. Associated Tasks: 1. Install and configure the Arduino IDE or Raspberry Pi OS to program microcontrollers. 2. Develop and test a traffic light control system using LEDs and a microcontroller. 3. Connect a DHT11 sensor or ultrasonic sensor to measure temperature/humidity or detect obstacles.			

**Exemplars and Utility:****Exemplars:**

1. Basic LED-based traffic signal simulation using Arduino.
2. Using the Arduino IDE and an ultrasonic sensor, build a simple obstacle detection system that detects nearby objects and triggers an LED or buzzer alert

Utility: Learning IoT device setup and programming helps students build smart solutions for real-world problems

Group-C (Networking)

Experiment No.7	Understand use and working of various networking components (Eg. routers switches, Wifi, cables etc.) and Team-based activity for learning crimping of RJ45 cables for PC	2 Hrs	CO4
------------------------	--	--------------	------------

Objective: To understand the use and working of various networking components and perform hands-on activity to crimp RJ45 Ethernet cables for establishing wired network connections.

Associated Tasks:

1. Assemble teams to identify and study key networking components
2. Strip, arrange, and crimp twisted pair cables using RJ45 connectors and a crimping tool
3. Test network connectivity of cables using a LAN tester.

Exemplars and Utility:

Exemplar: A group activity where students successfully crimp CAT6 Ethernet cables using the T568B standard and connect PCs to a switch to create a local area network (LAN).

Utility: Develops practical skills required in network setup and maintenance, provides foundational knowledge for network design, troubleshooting, and infrastructure planning in both home and enterprise environments

Experiment No.8	Establish direct communication between two computers using a crossover cable, perform file sharing and device sharing (like printer)	2 Hrs.	CO4
------------------------	---	---------------	------------

Objective: To establish direct communication between two computers using a crossover Ethernet cable and perform file and device sharing.

Associated Tasks:

1. Configure static IP addresses on both computers, connect them using a crossover cable
2. Enable file and printer sharing settings
3. Transfer files or access a shared printer between the systems.

Exemplars and Utility:**Exemplar:**

1. Connect two desktop computers via a crossover cable with manually assigned IPs (e.g., 192.168.1.1 and 192.168.1.2),
2. Perform direct file sharing and access a shared network printer.

Utility: Useful for offline data transfer, small peer-to-peer networks, or printer sharing in isolated environments; teaches foundational skills in network configuration, IP addressing, and resource sharing without relying on complex infrastructure.



Experiment No.9	Explain a basic local area network (LAN) using a switch, test communication and perform following operations: a. Configure IP addresses (static and dynamic) b. Check network connectivity using ping commands c. Explore basic networking commands like ipconfig, ping, and trace. d. Check Internet Speed and Latency e. Trace the path taken by a data packet to reach a destination websites with longer routes (e.g., ping facebook.com, tracert amazon.in)	2 Hrs.	CO4
Objective: Understand a basic LAN using a switch and perform key network operations like IP configuration, connectivity testing, internet speed check, and data packet tracing. Associated Tasks: 1. Observe and understand LAN setup. 2. Assign both static and dynamic IP addresses, verify connectivity using ping. 3. Explore commands like ipconfig, tracert, and nslookup, measure internet speed and 4. Trace the data route to external websites. Exemplars and Utility: Exemplars: 1. Observe LAN setup of college. 2. Execute commands like ping google.com and ipconfig 3. Use online tools like Speedtest.net to measure current internet download and upload speeds 4. Trace packet routes to amazon.in using tracert amazon.in. Utility: Builds practical skills in network setup, troubleshooting, and analysis			
Experiment No.10	Use Cisco Packet Tracer to design and simulate Virtual Lab setup	2 Hrs.	CO4
Objective: To design and simulate a virtual computer network lab using Cisco Packet Tracer, enabling the visualization and testing of network configurations, protocols, and device communication in a virtual environment. Associated Tasks: 1. Use Cisco Packet Tracer to create a virtual network by adding routers, switches, PCs, and servers 2. Configure IP addresses, set up routing protocols, simulate data transfer, and verify connectivity using Exemplars and Utility: Exemplar: 1. Simulate a small office network by configuring a router with eight PCs in different networks and enable communication between them using routing protocols. 2. Set up a basic client-server network with a web server and multiple client PCs, test HTTP connectivity, and analyze packet flow in simulation mode. Utility: Provides a risk-free, cost-effective platform for practicing network design and troubleshooting; supports learning of real-world networking concepts.			



Group- D (AI Tools)			
Experiment No.11	Hands-on practice of AI-based tools like Chat-GPT, Gemini, Deep seeker. a. Answer questions and solve doubts b. Draft emails and reports c. Generate ideas for projects and presentations d. Translate languages or improve grammar e. Practice for interviews	2 Hrs.	CO5
Objective: To gain practical experience in using AI-powered tools for enhancing productivity in academic, professional, and personal tasks.			
Associated Tasks: 1. Use ChatGPT or Gemini to answer academic questions and clarify subject-related doubts. 2. Draft professional emails or structured reports using AI assistance. 3. Generate creative and technical project ideas or presentation outlines. 4. Translate a paragraph from one language to another or improve grammar using AI tools. 5. Simulate interview practice by interacting with AI for common QSA formats. Exemplars and Utility: Exemplars: 1. Use ChatGPT to explain Ohm's Law and clarify related doubts with step-by-step examples. 2. Generate a formal email requesting permission for industrial visit using Gemini." 3. Brainstorm 5 innovative project ideas on renewable energy using DeepSeeker. 4. Translate a technical passage on computer networks from English to Marathi and refine grammar using Gemini. 5. Simulate an interview scenario where ChatGPT acts as an interviewer asking engineering-related questions. Utility: Promotes the use of tools for day-to-day academic tasks, content writing, language learning, and career readiness			
Experiment No.12	Learn and practice Popular Educational AI Tools. (any one) a. Gamma AI to create presentations, documents, and websites b. Google Colab cloud-based tool to write and run Python code, analysis and use of GPU c. Teachable Machine (No-Code AI Experiment): Trains AI to classify simple emotions (happy, sad, angry) by facial expressions.	2 Hrs.	CO5
Objective: To explore and apply a popular educational AI tool to enhance learning, creativity, and problem-solving through hands-on tasks in coding, content creation, or AI training.			
Associated Tasks: 1. Create an AI-generated presentation on an academic or professional topic using Gamma AI, customize its design, structure the content, and share or present it digitally. 2. Write and run a Python program in Google Colab to perform basic data analysis (e.g., using NumPy or Pandas), visualize results using Matplotlib or Seaborn, and enable GPU runtime for performance-based tasks. 3. Use Teachable Machine to collect image data through a webcam for different emotions (happy, sad, angry), train a classification model, test it in real-time, and analyze the model's accuracy and behaviour.			

**Exemplars and Utility:****Exemplar:**

4. Create a presentation on “Cybersecurity Awareness for Students”, using Gamma AI
5. Use Google Colab to write a Python script that plots a graph of temperature data and run it using cloud GPU.
6. Train an AI model to classify facial expressions (happy, sad, angry) using webcam input without writing any code.

Utility: AI tools enhance presentation and content creation skills, saves time through automation, and supports digital communication and storytelling — essential in academic, professional, and entrepreneurial settings.

Text Books:

1. Sinha, P. K., S Sinha, P., “Computer Fundamentals”, BPB Publications, 6th Edition.
2. Buyya, R., S Dastjerdi, A. V., “Internet of Things: Principles and Paradigms”, Morgan Kaufmann (Elsevier), 2016, ISBN: 978-0128053959
3. Kurose, J. F., S Ross, K. W., “Computer Networking: A Top-Down Approach”, Pearson Education, 8th Edition, ISBN: 978-0136681557
4. McMillan, T., “Cisco Networking Essentials” Wiley, 2nd Edition.
5. Mitchell, M. “Artificial Intelligence: A Guide for Thinking Humans”, Farrar, Straus and Giroux, 1st Edition ISBN: 978-0374257835.

Reference Books:

1. Zacker, C., “PC Hardware: The Complete Reference”, McGraw-Hill/Osborne. ISBN: 978-0072129405
2. Singh, R., Gehlot, A., S Bhargava, S. C., “Internet of Things with Arduino and Raspberry Pi”, CRC Press, 2020. ISBN: 978-0367418275
3. Ciccarelli, P., S Faulkner, C., “Introduction to Networking Basics” Wiley, 2nd Edition, 2008. ISBN: 978-0470112743

MOOCs Links and additional reading material:

1. Internet of Things-https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2. Arduino-<https://projecthub.arduino.cc/>
3. Computer Networks: https://onlinecourses.nptel.ac.in/noc22_cs19/preview
4. Google Colab-<https://colab.research.google.com/notebooks/intro.ipynb>
5. ChatGPT-<https://help.openai.com/en/collections/3742473-chatgpt>
6. Teachable Machine-<https://teachablemachine.withgoogle.com>

Strength of CO-PO-PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	-	-	-	-	-	3	2	2	2
CO2	2	1	2	-	3	-	1	-	-	-	3	3	3	2
CO3	2	1	2	-	3	-	2	-	-	-	3	3	3	2
CO4	2	-	2	-	3	-	2	-	-	-	3	2	2	2
CO5	2	-	2	-	-	-	2	-	-	-	3	2	2	3
Avg.	2	1	2	-	3	-	2	-	-	-	3	2	2	2

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



This course serves as a prerequisite for/maps with the following future courses:

1. AI and Generative AI
2. Computer Networks
3. Internet of Things

Job Mapping:

Job opportunities that one can get after learning this course: Junior Software Developer, IT Support Engineer, IoT Project Developer, Network Support Technician, Technical Content Creator



Program:	F. Y. B. Tech (Civil Engineering)			Semester:	I		
Course:	Digital Technology Lab			Course Code:	R26-CE-VSEC-115		
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	2	-	1	-	-	50	-

Course Description:

This course provides a foundational understanding of Civil Engineering drawing, design, and analysis using modern software and field instruments. It begins with an introduction to AutoCAD, focusing on its interface, fundamental commands, and the creation of detailed 2D building plans, elevations and sections, which are essential for architectural and structural design communication.

Students will also gain proficiency in 3D modeling using Google SketchUp for visualizing building components. The curriculum extends to surveying techniques with hands-on experience using a Total Station to determine elevation differences.

Furthermore, it incorporates geographic information systems (GIS) by teaching QGIS for digitizing and analyzing topographic data, a critical skill for urban planning and environmental management.

The course also covers Non-Destructive Testing (NDT) methods like the Digital Rebound Hammer and UPV to assess concrete strength, a key aspect of structural integrity evaluation.

Finally, it integrates computational skills by applying Python programming to solve structural mechanics problems.

Course Relevance:

This course is highly relevant as it equips students with a comprehensive and modern skill set essential for the contemporary Civil Engineering industry.

Prerequisite:

Specifically, for experiments 1-5, a working knowledge of the AutoCAD interface, drawing commands, and layer management is essential.

For experiment 6, a basic familiarity with 3D modeling concepts and the Google SketchUp software is required.

Experiments 7 and 8 necessitate an understanding of surveying and geographic information systems (GIS), respectively, along with the ability to operate a Total Station and QGIS software.

Finally, experiment 9 requires a grasp of basic civil engineering and material science concepts, particularly regarding concrete properties and non-destructive testing methods, while the last experiment demands fundamental programming skills in Python, including knowledge of data types, variables, and basic mathematical operations, to solve structural analysis problems.

Bridge Content:

- These experiments progressively bridge foundational digital literacy with specialized Civil Engineering software and computational tools.
- This leads into core CAD skills with AutoCAD for precise 2D drafting of building components and plans, followed by Google SketchUp for rapid 3D visualization.
- The curriculum then extends to practical fieldwork and geospatial analysis using Total Stations and QGIS for surveying and mapping, culminating in the application of Python programming for foundational structural analysis, thus equipping civil engineers with a comprehensive toolkit for modern practice.

**Course Objectives:**

1. To **DEVELOP** fundamental skills in creating, modifying, and interpreting 2D building drawings using AutoCAD for architectural planning, detailing, and documentation in civil engineering applications.
2. To **ENABLE** students to understand and apply basic 2D and 3D modeling concepts using Google SketchUp for visualizing and designing building components effectively.
3. To **DEVELOP** fundamental skills in modern surveying and geospatial techniques, using Total Station and QGIS for accurate elevation measurement, data digitization, and spatial analysis.
4. To **DEVELOP** fundamental skills in evaluating concrete strength through non-destructive testing methods and analyzing structural behavior using Python-based computational techniques.

Course Outcomes: After learning the course, students will be able to:

CO	Course Outcomes	Bloom's Level	
CO1	UNDERSTAND AND UTILIZE CAD Software for 2D Building Design and Documentation.	4	
CO2	APPLY 3D Modeling Techniques for Building Visualization using Google SketchUp.	3	
CO3	PERFORM Surveying and Geospatial Data Handling.	4	
CO4	APPLY non-destructive testing (NDT) methods to assess concrete strength and UTILIZE Python programming skills to determine reactions.	4	
Experiment No.1	Introduction to AutoCAD Interface, Basic Settings, Drawing Commands and Layers.	2 Hrs.	CO1

Objective:

To gain proficiency in the fundamental features of AutoCAD, including navigating the interface, configuring basic settings, utilizing core drawing and modification commands and organizing drawings using a layer-based system.

Associated Tasks:

- Identify and navigate the different components of the AutoCAD interface (ribbon, command line, status bar).
- Set up a drawing environment with appropriate units, limits, and grid settings.
- Master basic drawing commands like LINE, CIRCLE, ARC, and RECTANGLE.
- Practice using modification commands such as TRIM, EXTEND, MOVE, and COPY.
- Create and manage layers for different drawing elements (e.g., walls, dimensions, text, furniture).
- Assign lineweights, colors, and linetypes to different layers to create a visually organized and clear drawing.

Exemplars:

- A simple floor plan of a single room showing walls, a door, and a window, with each component on a separate, appropriately named layer.
- A mechanical drawing of a machine part with different lines for the part outline, centerlines, and hidden features, all managed by layers.
- A title block created with a specific layer for text and another for lines, demonstrating layer organization for document creation.



Utility: This experiment is the foundational module for all computer-aided design (CAD) tasks in engineering, architecture, and construction			
Experiment No.2	Interactive 2D models of typical building components (foundations, columns, beams, slabs, walls, roofs) using Auto CAD software.	2 Hrs.	CO1
Objective To develop proficiency in creating accurate and detailed 2D architectural and structural drawings of essential building components using AutoCAD. Associated Tasks: • Drawing Foundational Elements • Modeling Vertical Structures • Designing Horizontal Elements • Representing Roof Structures • Applying Layering and Dimensioning Exemplars: • A detailed 2D drawing showing the plan and section of a reinforced concrete column with stirrups and main reinforcement bars. • A plan view of a floor slab with a grid of beams, indicating their sizes and spacing. • A section drawing of a building wall from the foundation to the roof, showing the wall's material, thickness, and connection details. Utility: This skill is fundamental for civil engineers, architects, and drafters. It enables them to: • Communicate Designs • Ensure Accuracy • Facilitate Analysis • Serve as Legal Documents			
Experiment No. 3	Generating Line Plan and Detailed plan in AutoCAD.	2 Hrs.	CO1
Objective: To create a complete and dimensionally accurate building plan, including both the conceptual line plan and the detailed working drawing, using AutoCAD software. Associated Tasks: • Line Plan • Detailed Plan Exemplars: • Residential House Plan • Commercial Building Layout • Hospital Floor Plan Utility: • Communication • Construction Guidance • Material and Cost Estimation • Permitting			

Experiment	Generating Elevations and Sections Using AutoCAD.	2 Hrs	CO1
-------------------	--	--------------	------------



No.4			
Objective: The objective of this experiment is to develop the skills to generate accurate and detailed elevations and sections of a building from its floor plan using AutoCAD. Associated Tasks: 1. Understand Orthographic Projection 2. Setup Drawing Environment 3. Generate Elevations 4. Generate Sections 5. Add Hatching and Textures 6. Annotation and Dimensioning Exemplars Utility: • Learning Standard Practices: • Problem-Solving Guide • Demonstration of Detail • Encourages Consistency • Fosters Visual Literacy			
Experiment No.5	Prepare Area Statement and Schedule of Openings, Saving, Exporting, and Drawing Area Setup in Auto CAD.	2 Hrs.	CO1
Objective: The primary objective of this experiment is to develop proficiency in preparing accurate and professional-quality documentation from an AutoCAD drawing, specifically focusing on generating an Area Statement and a Schedule of Openings. Associated Tasks: 1. Setup and Preparation: 2. Drawing Area Setup 3. Area Statement Generation 4. Schedule of Openings Creation 5. Saving and Exporting Exemplars Utility: • A fully detailed and annotated AutoCAD drawing • An accurate and neatly formatted Area Statement • A comprehensive Schedule of Openings • A final exported PDF document			
Experiment No.6	Introduction to Google SketchUp for 2D/3D Building Component Modeling.	2 Hrs.	CO2
Objective: The objective of this experiment is to introduce students to the fundamental principles and interface of Google SketchUp. Associated Tasks: 1. Interface Familiarization 2. Basic 2D Geometry Creation 3. Extrusion and 3D Modeling 4. Component Creation and Management			



5. Adding Details and Textures 6. Organizing the Model 7. Saving and Exporting Exemplars Utility: • A simple, completed 3D model of a single • A detailed 3D model of a standard window or door component • A "before and after" • A final rendered image (e.g., JPEG)			
Experiment No.7	Determination of difference in elevation between two consecutive points using Total Station.	2 Hrs.	CO3
Objective: The objective of this experiment is to accurately determine the difference in elevation between two consecutive points on the ground using a Total Station. Associated Tasks: 1. Site Preparation and Setup 2. Instrument Calibration and Configuration 3. Measurement at Point A 4. Measurement at Point B 5. Data Processing and Calculation Exemplars Utility: • A completed field survey sheet • A sample calculation sheet • A digital output from the Total Station • A final report or diagram			
Experiment No.8	Digitize the given part of Toposheet using QGIS software (eg. attribute, name, area, length etc.)	2 Hrs.	CO3
Objective The objective of this experiment is to develop the skills required to digitize geospatial data from a raster image (a toposheet) using QGIS, a free and open-source Geographic Information System (GIS) software. Associated Tasks: 1. Project Setup and Geo referencing 2. Creating Vector Layers 3. Digitization and Data Entry 4. Attribute Management 5. Data Saving and Exporting Exemplars Utility: • A Geo referenced Toposheet • Vector Layers with Digitized Features • A Populated Attribute Table • A Final Map Layout			
Experiment No.9	Non-Destructive Testing (NDT) strength of concrete using Digital Rebound Hammer and Ultra-Sonic Pulse Velocity Meter (UPV).	2 Hrs.	CO4

**Objective:**

The objective of this experiment is to introduce students to the principles and applications of Non-Destructive Testing (NDT) for assessing the in-situ strength and quality of concrete structures.

Associated Tasks:

1. Preparation and Site Selection
2. Non-Destructive Testing (NDT) strength of concrete using Digital Rebound Hammer
3. Ultra-Sonic Pulse Velocity (UPV) Testing:
4. Data Analysis and Report Generation:

Exemplars Utility:

- A "Marked Grid" on a Concrete Surface
- Raw Data Sheets
- A Sample Calculation and Correlation Chart
- A Final Report

Experiment No.10	Find the reactions of simply supported beam for various loading conditions using Python programming skills.	2 Hrs.	CO4
-------------------------	--	---------------	------------

Objective:

To develop a Python program that accurately calculates the reactions (vertical support forces) for a simply supported beam under various common loading conditions.

Associated Tasks:

1. Define Beam Properties
2. Define Loading Conditions
3. Implement Equilibrium Equations
4. Develop Calculation Logic
5. User Interface (Basic)
6. Error Handling and Validation

Exemplars and Utility:**Exemplar 1: Single Point Load**

- **Scenario:** A simply supported beam of length L with a point load P at a distance a from the left support.
- **Input:** $L=10$ m, $P=50$ kN, $a=3$ m
- **Expected Output (Calculated by Program):**
 - $RA = P \times (L-a)/L = 50 \times (10-3)/10 = 35$ kN
 - $RB = P \times a/L = 50 \times 3/10 = 15$ kN
- **Utility:** Demonstrates the fundamental application of equilibrium equations for the most basic loading condition. Useful for validating the core logic of moment and force summation.

Textbooks:

- AutoCAD 202 Tutorial First Level 2D Fundamentals (or current year), by Randy Shih, SDC Publications, Latest Annual Edition.
- Residential Design Using AutoCAD 202* (or current year), by Daniel John Stine, SDC Publications
- SketchUp for Dummies, by Aidan Chopra, Rebecca Huehmer, For Dummies (Wiley).
- Surveying (Vol. I S II), by B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain Laxmi Publications / Firewall Media Latest Edition.
- Surveying and Levelling by Dr. K.R. Arora, Standard Book House Latest Edition.
- QGIS Documentation and Manual, QGIS Project QGIS Website (Official) Latest Version.
- Python Programming and Numerical Methods: A Guide for Engineers and Scientists Qingkai Kong, Timmy Siau, Alexandra de Siqueira Academic Press Latest Edition.

Reference Books:

- Mastering AutoCAD 202* (or current year) George Omura, Brian C. Benton Sybex (Wiley) Latest Annual Edition
- AutoCAD 202 for the Interior Designer* (focuses on plan/layout) Daniel John Stine, SDC publications Latest Annual Edition
- QGIS Documentation and Manual QGIS Project, QGIS Website (Official) Latest Version
- Python Manual: A Learning Guide for Structural Engineering Students Kennedy A. Gomez, et al. Cal Poly, 2021 (or latest)

MOOCs Courses:

- <https://www.coursera.org/projects/autocad-architectural-drafting-basics>
- Autodesk AutoCAD 2D Drafting for Civil Engineers
- <https://www.openlearning.com/usmmooc/courses/autocad-built-environment-beginner-s-guide/>
 - (Specifically Module 6: Printing and Review, which often includes final plan creation)
- <https://www.autodesk.com/in/campaigns/autocad-tutorials>
 - (Look for Architectural/Civil Drafting sections on Elevations/Sections)
- <https://learn.sketchup.com/collections> (Start with **SketchUp Fundamentals**)
- NPTEL Non-destructive Testing of Concrete MOOC Python for Structural Analysis Beam Reactions

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	-	3	-	-	2	2	1	2	3	2	3
CO2	3	2	3	-	3	-	-	2	2	1	2	3	2	3
CO3	2	2	1	3	3	1	-	2	1	-	2	2	2	1
CO4	3	3	1	3	3	1	1	2	2	1	3	3	3	1
Avg.	2.75	2.25	2	3	3	1	1	2	1.75	1	2.25	2.75	2.25	2

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

This course serves as a prerequisite for / maps with the following future courses:



Civil Engineering Lab course forms the foundation for several advanced and applied Engineering courses. Here is a list of future courses.

1. Architectural Planning and Design of Building
2. Design of Steel Structures
3. Design of Reinforced Concrete Structure
4. Computer Programming in Civil Engineering
5. Concrete Technology

Job Mapping:

Job opportunities that one can get after learning experiments of Digital Technology:

1. Planning Engineer
2. Architectural Designer
3. GIS Analyst
4. Civil Software Developer



Program:		F. Y. B. Tech (ECE)			Semester:		I	
Course:		Digital Technology Lab			Course Code:		R26-EC-VSEC-115	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	01	-	-	50	-	
Course Description: This course introduces students to essential tools and technologies used in software and hardware development. It covers the setup and use of development environments (like VS Code and WSL2), basic Linux commands, version control using Git and GitHub, fundamental networking practices, and hands-on work with Arduino-based circuits and open-source tools for simulation and PCB design.								
Course Relevance: The skills learned serve as a foundation for advanced courses, projects, and industry-oriented applications in the domains of IoT, embedded system, automation, and system design.								
Prerequisite: 1. Fundamentals of Computing. 2. Basic knowledge of Electronic components								
Bridge Content: --								
Course Objectives: 1. FAMILIARIZE students with the use of Visual Studio Code, version control, and AI integration tools for software development. 2. INTRODUCE virtualization techniques through hands-on installation and configuration of Virtual Machines and WSL2 environments. 3. DEVELOP proficiency in executing basic and essential Linux commands for system and file management. 4. DEMONSTRATE fundamental networking concepts, including addressing, diagnostics, and physical LAN setup. 5. ENABLE practical application of embedded systems concepts using Arduino, sensors, and open-source tools for circuit simulation and PCB design.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome						Bloom's Level	
CO1	INSTALL and CONFIGURE development environments like VS Code, WSL2, and Virtual Machines to support cross-platform coding.						3	
CO2	EXECUTE essential Linux commands for navigating, managing packages, and performing system operations.						3	
CO3	INTEGRATE Git and GitHub with VS Code for version control and collaborative software development.						3	
CO4	CONSTRUCT and TEST basic electronic and sensor-based circuits using Arduino and open-source EDA/simulation tools.						3	
CO5	DEMONSTRATE understanding of IP addressing and networking basics by operating diagnostic commands and assembling LAN cables.						3	
List of Practical: (Any 08)								
Experiment No.1	Introduction to Visual Studio Code: Installation, extension management, Testing simple Python code, and AI integration with GitHub Copilot.					02 Hrs.	CO1	
Objective: • Learn to install VS Code and use AI (GitHub Copilot) to write basic Python code.								



Associated Tasks: 1. Install VS Code and extensions. 2. Write and test a simple Python program 3. Demonstrate AI integration with GitHub Copilot. Exemplars and Utility: 1. Used in Software Development industry for writing and debugging code efficiently. 2. AI tools like Copilot help increase productivity in real-world software companies.			
Experiment No.2	Virtual Machines: Installation, Configuration, and Usage for OS Virtualization. (host Ubuntu Linux on a Windows operating system using Virtual Box/VMware/QEMU/Hyper- V)	02 Hrs.	CO1
Objective: • Set up a virtual OS like Ubuntu Linux using tools such as VirtualBox or VMware. Associated Tasks: 1. Install and configure Ubuntu on VirtualBox. 2. Run Linux in a virtual environment. Exemplars and Utility: 1. Used in IT companies and DevOps to test software in safe, isolated environments. 2. Cloud and Cybersecurity professionals regularly use virtual machines for system simulations.			
Experiment No.3	Hands-on Practice with Essential Linux Commands for File Management, Navigation, Package management (apt) and System Operations.	02 Hrs.	CO2
Objective: • Use Linux terminal commands for file handling and installing software. Associated Tasks: 1. Navigate folders, create/delete files. 2. Install/update software/packages using apt commands. Exemplars and Utility: 1. System administrators and backend engineers use Linux daily. 2. Essential for jobs in cloud, cyber security, and server management.			
Experiment No.4	Installation and configuration of Windows Subsystem for Linux (WSL2) and Execution of Basic Linux Commands.	02 Hrs.	CO1, CO2
Objective: • Install Linux inside Windows and practice Linux commands using WSL2. Associated Tasks: 1. Set up WSL2 and install Ubuntu. 2. Run Linux commands from Windows terminal. Exemplars and Utility: 1. Software developers use WSL2 for running Linux tools on Windows laptops. 2. Saves time and improves workflow in cross-platform development.			
Experiment No.5	Introduction to Version Control using Git and GitHub on Ubuntu Linux. Usage of VS code with Git and GitHub.	02 Hrs.	CO3
Objective: • Learn version control with Git and GitHub integration in VS Code. Associated Tasks: 1. Create and commit a project to GitHub.			



2. Use VS Code to manage changes. Exemplars and Utility: 1. Every software company uses Git and GitHub for team collaboration. 2. Essential for tracking code, open-source contribution, and CI/CD pipelines.			
Experiment No.6	Fundamentals of Networking: Understanding IP and MAC Addresses with Basic Network Commands (ping, ipconfig, trace route). Demonstration of Crimping process using RJ-45 connector for LAN Cables. LAN cable testing.	02 Hrs.	CO5
Objective: • Understand networking basics and create a working LAN cable. Associated Tasks: 1. Run commands like ping, ipconfig. 2. Crimp and test a LAN cable. Exemplars and Utility: 1. Used by network engineers and IT support teams for troubleshooting and setup. 2. Industries like telecom and internet service providers rely on these skills.			
Experiment No.7	Implementation of Infrared Remote-Based Switching Circuit with Ardiuno. (Application of IR pair, Ardiuno and relay for security alarm/ obstacle detection/ proximity sensing/ actuator control)	02 Hrs.	CO4
Objective: • Create a switching system using IR remote, Arduino, and relay. Associated Tasks: 1. Connect and code IR sensor and relay module. 2. Switch a device like LED or motor using remote. Exemplars and Utility: 1. Home automation systems use IR for lights, fans, and appliances. 2. Useful in consumer electronics and IoT product development.			
Experiment No.8	Temperature Monitoring Using LM35 Sensor and Arduino Serial Interface	02 Hrs.	CO4
Objective: • Read temperature data from LM35 sensor and display it using Arduino. Associated Tasks: 1. Connect LM35 sensor to Arduino. 2. Write code to show temperature on serial monitor. Exemplars and Utility: 1. Used in industrial machines, HVAC systems, and medical devices. 2. Part of smart environment monitoring and IoT solutions.			
Experiment No.9	Simulation of Basic Electronic Circuit Using Open-Source Tools	02 Hrs.	CO4
Objective: 1. Simulate electronic circuits virtually using open source tools. Associated Tasks: 1. Design and test a basic circuit in simulation software. 2. Check output without real components. Exemplars and Utility: 1. Electronics engineers use simulation to test circuits before building. 2. Saves cost and time in R&D, startups, and hardware companies.			



Experiment No.10	PCB Design for simple electronic circuit Using Open-Source EDA Tool.	02 Hrs.	CO4
Objective: Design a printed circuit board (PCB) for an electronic circuit.			
Associated Tasks: - Create a circuit schematic and layout in software. - Export design files for manufacturing.			
Exemplars and Utility: - PCB design is core to electronics manufacturing in industries. - Used in mobile phones, gadgets, automotive, and defense equipment.			

Textbooks:
- William E. Shotts, Jr., The Linux Command Line: A Complete Introduction, No Starch Press, 2nd Edition, 2019. ISBN-13: 978-1593279523 - Scott Chacon & Ben Straub, Pro Git, Apress, 2nd Edition, 2014. ISBN-13: 978-1484200773 - Michael Margolis, Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects, O'Reilly / Maker Media, 3rd Edition, 2022. - Brian Ward, How Linux Works: What Every Superuser Should Know, No Starch Press, 3rd Edition, 2021.
Reference Books:
- Michael Kerrisk, The Linux Programming Interface: A Linux and UNIX System Programming Handbook, 1st Edition, 2010. ISBN-13: 978-1593272203 - Richard E. Silverman, Git Pocket Guide, O'Reilly, 1st Edition, 2013. ISBN-13: 978-1449325862 - Andrew S. Tanenbaum and David J. Wetherall, Computer Networks (Global Edition), Pearson, 6th Edition, 2021. - Gerald L. Peterson S Bruce S. Davie, Computer Networks: A Systems Approach, Morgan Kaufmann / Elsevier, 5th Edition, 2019.
MOOCs Links and additional reading material:
- Introduction to Internet of Things: https://nptel.ac.in/courses/106105166 - Linux Operating System: https://onlinecourses.swayam2.ac.in/aic20_sp24/

Strength of CO-PO-PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	1	1	1	2	2	2	3	2	3
CO2	2	3	2	2	2	1	1	1	2	2	1	3	2	3
CO3	2	2	2	2	3	1	1	1	3	3	2	3	2	3
CO4	3	2	3	2	3	2	1	1	2	2	2	3	3	3
CO5	2	2	2	2	2	1	1	1	2	2	2	3	2	2
Avg.	2.4	2.2	2.2	2.0	2.6	1.2	1.0	1.0	2.2	2.2	1.8	3.0	2.2	2.8

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

This course serves as a prerequisite for / maps with the following future courses:

- Computer Networks
- Embedded Systems
- Internet of Things (IoT)

**Job Mapping:**

Job opportunities that one can get after learning this course:

- IT support specialist
- PCB Design and Prototyping Engineer



Program:		F. Y. B. Tech (ETC)			Semester:		I	
Course:		Digital Technology Lab			Course Code:		R26-ET-VSEC-115	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	01	-	-	50	-	
Course Description: The Digital Technology Lab is designed to introduce students to foundational tools, platforms, and techniques used in electronics and digital systems development. It blends hands-on experiments in circuit design, PCB fabrication, microcontroller programming (Arduino), simulation tools, embedded systems, and modern productivity software.								
Course Relevance: Students develop critical practical skills that serve as a bridge to advanced courses in electronics, IoT, embedded systems, and digital communication.								
Prerequisite: 1. Basic knowledge of electronic components and logic gates. 2. Familiarity with computer operations and file handling.								
Bridge Content: 1. Resistor colour codes, principle of working of electronics components. 2. Basic use of multimeter and breadboard.								
Course Objectives: 1. To DEVELOP skills in designing, simulating, and fabricating basic electronic circuits and PCBs. 2. To GAIN proficiency in interfacing sensors, actuators, and embedded programming using Arduino and related tools. 3. To ENHANCE productivity, and innovation through mini projects addressing real-life applications.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome					Bloom's Level		
CO1	DEMONSTRATE practical knowledge of basic electronic components and circuits.					2		
CO2	APPLY simulation and prototyping skills to build and test circuits.					3		
CO3	DEVELOP embedded solutions using Arduino and sensor interfacing.					4		
CO4	CREATE and present mini-projects solving real-life problems.					4		
Instructor Guidelines: 1. Demonstrate every experiment before hands-on session. 2. Ensure students maintain a lab record with circuit diagrams, code, and observations. 3. Encourage creativity in mini-projects and documentation style. 4. Provide both individual and group tasks for collaborative learning. 5. Regularly update students with examples of real-world applications (IoT, smart cities, etc.).								
Assignments Must Include: 1.Circuit diagrams (hand-drawn or using simulation tools) 2.Code snippets and screenshots of output (if applicable) 3.Observations and reflection on what were learned 4.Application notes – How the experiment can be scaled for real use 5.Documentation using Google Docs or MS Word/Excel where applicable								

**Instructors are expected to:**

1. Use multimedia resources (videos, online simulators) to aid understanding.
2. Monitor each student's engagement and practical skill progression.
3. Provide feedback on lab reports and project documentation.
4. Promote safety in handling soldering tools and electronic instruments.
5. Guide students on project selection and encourage innovation.

Evaluation should consider:

1. Timely completion of experiments
2. Viva and conceptual understanding
3. Lab Journal and documentation
4. Mini Project (Design & Execution)
5. Presentation and Communication

Experiment No.1	Identification and handling of basic electronic components and tools (resistors, diodes, soldering iron, different types of wires, cables and Connectors (coaxial, jumper, USB, ribbon, etc.) Desoldering Pump, Breadboard, Cutting Pliers, Wire Strippers, Multimeter (Digital), IC Base Sockets, Component Tester etc)	2Hrs.	CO1
Objective: To identify and handle basic electronic components and tools used in electronic systems. Associated Tasks: 1. Identify components: resistors, diodes, IC sockets, connectors (coaxial, jumper, ribbon, etc.) 2. Practice tool usage: multimeter, soldering/desoldering pump, breadboard, pliers, wire stripper Exemplars and Utility: 1. Foundation skill for any hardware prototyping or repair. 2. Prepares students for future lab work.			
Experiment No.2	Perform soldering and desoldering of an LED-based circuit on general-purpose PCB and troubleshoot errors.	2Hrs.	CO2
Objective: To perform soldering and desoldering operations on an LED-based circuit. Associated Tasks: 1. Create LED circuit on general-purpose PCB. 2. Solder, desolder, and troubleshoot connection errors. Exemplars and Utility: 1. Hands-on practice of through-hole soldering. 2. Understanding circuit continuity and repair skills.			
Experiment No.3	Circuit design using breadboard: LED chaser or simple switch-based buzzer	2Hrs.	CO2
Objective: To design and test basic circuits on breadboards using switches and LEDs. Associated Tasks: 1. Assemble an LED chaser or buzzer-based circuit. 2. Verify behavior and connections manually. Exemplars and Utility: 1. Teaches circuit logic and hands-on prototyping. 2. Useful for basic electronics validation.			
Experiment No.4	Simulate basic analog/digital circuits, verify circuit behavior (before physical implementation), using circuit simulation Multisim Software.	2Hrs.	CO3
Objective: To simulate analog/digital circuits using NI Multisim.			



Associated Tasks: 1. Use NI Multisim to simulate basic logic/analog circuits. 2. Validate outputs before hardware implementation. Exemplars and Utility: 1. Reduces design errors before building hardware. 2. Builds familiarity with simulation workflows.			
Experiment No.5	Use manual methods or software (e.g., EasyEDA) to create simple PCB layouts. And implementation of PCB fabrication steps: layout transfer, etching, drilling, and tinning (demo + partial hands-on)	2Hrs.	CO3
Objective: To create and partially implement a PCB layout using manual/software-based methods. Associated Tasks: 1. Use EasyEDA or manual drawing to design layout. 2. Demonstrate layout transfer, etching, drilling, tinning (hands-on or demo). Exemplars and Utility: 1. Introduces fabrication lifecycle of real PCBs. 2. Teaches industry-relevant prototyping techniques.			
Experiment No.6	Introduction to Arduino Hardware and IDE Setup	2Hrs.	CO3
Objective: Identify types of Arduino board (Arduino UNO and Arduino NANO Boards) Associated Tasks: 1. Identify different types of Arduino boards (UNO, NANO, MEGA) and their pin configurations. 2. Install and set up the Arduino IDE on a computer. 3. Configure the appropriate board and COM port. 4. Test IDE functionality using basic code compilation (without uploading). Exemplars and Utility: 1. Provides foundational knowledge of microcontroller hardware and development tools. 2. Helps students understand the role of IDE, compiler, and board drivers. 3. Builds readiness for writing and uploading actual programs.			
Experiment No.7	Writing and Uploading the First Arduino Program – Blinking LED	2Hrs.	CO3
Objective: To verify successful Arduino setup by writing, uploading, and executing a simple LED blink program. Associated Tasks: 1. Open the Arduino IDE and load the built-in “Blink” example. 2. Upload the program to the Arduino board. 3. Observe the LED blinking pattern and modify delay parameters. 4. Explain the code structure (setup() and loop() functions). Exemplars and Utility: 1. Demonstrates the complete workflow from coding to hardware execution. 2. Reinforces understanding of embedded programming concepts. 3. Prepares students for sensor/actuator interfacing experiments.			
Experiment No.8	Interface sensors (LDR, DHT11) with Arduino and visualize output on Serial Monitor/LEDs.(controlling output devices like buzzer, relay, or motor)	2Hrs.	CO4
Objective: To interface sensors with Arduino and monitor their output. Associated Tasks: 1. Connect LDR or DHT11 to Arduino and visualize data. 2. Control output devices like a buzzer, motor, or LED.			



Exemplars and Utility: 1. Fundamental skill for IoT system design. 2. Applies theoretical sensor knowledge practically.			
Experiment No.9	Design and present a small working model (e.g., automatic light, security alarm, smart dustbin, automatic night lamp, door alarm, or temperature alert).	2Hrs.	CO4
Objective: To design a working embedded system model based on a real-life problem. Associated Tasks: 1. Plan and build a mini project (e.g., automatic light, security alarm). 2. Present the solution and demonstrate functionality. Exemplars and Utility: 1. Encourages innovation and problem-solving. 2. Strengthens presentation and integration skills.			
Experiment No.10	Installation and basic interface of MATLAB/ Scilab: Perform basic matrix operations and simple signal visualization	2Hrs.	CO3
Objective: To perform matrix and signal operations using MATLAB or Scilab. Associated Tasks: 1. Install the software and practice basic matrix manipulation. 2. Visualize signals using plots. Exemplars and Utility: 1. Strengthens analytical and numerical understanding. 2. Supports further coursework in signals and systems.			
Experiment No.11	Installation of Eclipse IDE: Install Eclipse and write simple programs in C or C++ OR Java	2Hrs.	CO3
Objective: To program microcontrollers using Eclipse IDE. Associated Tasks: 1. Install Eclipse IDE with relevant plugins. 2. Write simple embedded programs and test on simulator or microcontroller. Exemplars and Utility: 1. Prepares students for professional-grade development environments. 2. Supports modular embedded design workflows.			
Experiment No.12	Interfacing an LCD Display with Arduino to Display Sensor Data	2Hrs.	CO4
Objective: To interface a 16x2 LCD display with Arduino and program it to display real-time sensor readings. Associated Tasks: 1. Connect a 16x2 LCD to Arduino using appropriate wiring (4-bit or I2C interface). 2. Interface a basic sensor (e.g., LDR or DHT11) with Arduino. 3. Write and upload an Arduino program to read sensor data and display it on the LCD. Exemplars and Utility: 1. Builds skills in embedded hardware interfacing and data visualization. 2. Forms the foundation for standalone embedded systems without computer monitoring. 3. Useful for industrial panels, IoT devices, and automation displays.			

**Textbooks:**

1. Paul Horowitz and Winfield Hill, The Art of Electronics, Cambridge University Press, 3rd Edition, 2015.
2. M. Morris Mano and Michael D. Ciletti, Digital Design, Pearson Education, 5th Edition, 2013.
3. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085/8086, Penram International Publishing, 6th Edition, 2013.4.
4. John Boxall, Arduino Workshop: A Hands-On Introduction with 65 Projects, No Starch Press, 2nd Edition, 2021.
5. Joshua M. Pearce, Open-Source Lab: How to Build Your Own Hardware and Reduce Research Costs, Elsevier, 1st Edition, 2014.

Reference Books:

1. Albert Paul Malvino and Donald P. Leach, Digital Principles and Applications, McGraw-Hill, 8th Edition, 2017.2.
2. Simon Monk, Programming Arduino: Getting Started with Sketches, McGraw-Hill Education, 2nd Edition, 2016.
3. James K. Peckol, Embedded Systems: A Contemporary Design Tool, Wiley India, 2nd Edition, 2019.
4. Ian Sinclair and John Dunton, Practical Electronics Handbook, Newnes (Elsevier), 7th Edition, 2013.

MOOCs Courses:

1. https://www.classcentral.com/course/freecodecamp-arduino-course-for-beginners-open-source-electronics-platform-104943?utm_source=chatgpt.com
2. https://www.coursera.org/learn/arduino-platform?utm_source=chatgpt.com
3. https://www.coursera.org/learn/introduction-embedded-systems?utm_source=chatgpt.com

Strength of CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	1	1	2	1	1	1	2	1
CO2	3	3	2	1	3	2	1	1	2	1	1	1	3	2
CO3	3	2	3	2	3	2	1	2	2	2	1	1	3	3
CO4	3	3	3	2	2	2	1	2	3	S3	2	2	3	3
Avg.	3	2.5	2.25	1.5	2.5	1.75	1	1.5	2.25	1.75	1.25	2.75	2.75	2.25

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

Project Based Learning, Mini project, Major Project, Analog /Digital Communication, Embedded System Design.

Job Mapping: Technical careers in electronics, embedded systems, and automation.

Job opportunities that one can get after learning this course: Electronics Technician, Maintenance Tech, Soldering Technician.



Program:	F. Y. B. Tech			Semester:	I / II		
Course:	Engineering Drawing Lab			Course Code:	R26-ME-VSEC-110		
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	02	-	01	-	-	50	-

Course Description:

Engineering Graphics is a foundational technical course essential for students across all branches of engineering, including mechanical, civil, electrical, electronics, and computer science. It serves as the basis for engineering communication, visualization, and design documentation. The course introduces first-year students to the core principles of engineering drawing through both manual and computer-aided drafting (CAD). Students will learn to use drawing instruments, understand sheet layouts and standard line types, apply correct dimensioning methods, and construct basic geometric shapes. The curriculum includes detailed study and practice in orthographic and isometric projections to build spatial visualization skills and accurately interpret engineering objects and assemblies. Alongside traditional drawing techniques, the course emphasizes the use of modern CAD software, enabling students to create and modify 2D and 3D engineering drawings in line with current industry standards.

Course Relevance:

Engineering Graphics is crucial for effective visual communication in the engineering domain. It trains students to clearly and accurately express complex ideas using standardized graphical language, a vital skill for technical collaboration and documentation. A key learning outcome is the ability to interpret and analyze engineering drawings, mechanical systems, and assemblies. Through projection techniques and visualization exercises, students enhance their analytical thinking, creativity, and spatial reasoning. This course lays the groundwork for advanced learning in areas such as CAD modeling, product design, computer graphics, manufacturing, AR/VR applications, and simulations. Moreover, early exposure to industry-standard CAD tools equips students with practical, job-relevant skills, making them better prepared and more confident as they progress through their engineering education and careers.

Prerequisite:

1. Basic knowledge of geometry and mathematics
2. Spatial visualization ability
3. Basic computer skills
4. Logical thinking and attention to details
5. High school-level drawing or technical drawing (preferred but not mandatory).

Bridge Content:

1. Introduction to drawing instruments: pencils (grades), set squares, T-square, compass, divider, scales, erasers, protractors; Drawing sheet sizes and title block; setting up a drawing sheet (border, margins, title block, scale).
2. Guidelines for engineering lettering and numerals (standard styles and heights)
3. Dimensioning basics: size and location dimensions, placement rules, units.

Course Objectives:

1. To **INTRODUCE** the fundamentals of engineering drawing using manual drafting techniques and familiarize students with drawing instruments, sheet layouts, and standard practices.
2. To **DEVELOP** students' understanding of orthographic projections, including first angle projection, and enable them to interpret and draw multiple views of mechanical components.
3. To **TRAIN** students in isometric projection techniques and help them visualize and represent



3D objects accurately using 2D orthographic views.			
4. To PROVIDE hands-on experience in CAD software, enabling students to use digital tools for drafting and dimensioning.			
5. To ENHANCE students’ visualization and technical communication skills, preparing them for interpreting and creating engineering drawings in academic and professional settings.			
Course Outcomes: After learning the course, students will be able to			
CO	Course Outcome	Bloom’s Level	
CO1	APPLY drawing instruments and standard drawing conventions including types of lines, dimensioning methods, and lettering in technical drawings	3	
CO2	CONSTRUCT orthographic projections using first angle method from given pictorial views and understand the application of different types of projections.	3	
CO3	CREATE accurate isometric projections of machine components from orthographic views, demonstrating an understanding of isometric principles.	6	
CO4	USE CAD software to produce and modify 2D engineering drawings, including orthographic and isometric projections with appropriate dimensioning.	3	
CO5	INTERPRET and VISUALIZE basic engineering components and assemblies from given views, applying graphical methods for effective technical communication.	4	
Course Contents			
List of Practical:			
Experiment No.1	Introduction to Engineering Drawing	04 Hrs.	CO1
Objective: To introduce students to the fundamental concepts and practices of engineering drawing, including the proper use of drawing instruments, drawing sheet layout, types of lines, lettering, dimensioning techniques, scales, and standard geometrical constructions. Associated Tasks: 1. Demonstrate different types of lines (e.g., visible, hidden, center, cutting-plane) and their appropriate applications. 2. Apply correct dimensioning methods and terminology (e.g., size dimension, location dimension, aligned and unidirectional systems). 3. Draw a simple standard machine component integrating types of lines and dimensioning principles. Exemplars and Utility: 1. Draw and label at least five standard line types with a note on their usage. 2. Practice dimensioning a simple rectangular block using both aligned and unidirectional methods. 3. Draw a standard machine component, such as a square nut or washer, showing correct lines, dimensioning, and scale.			



Experiment No.2	Orthographic Projections	6 Hrs.	CO2
Objective: To develop the ability to visualize and represent 3D objects through 2D orthographic projections using the first angle method. This includes understanding the theory of projection, types of projection systems, and the generation of multiple views from a pictorial representation. Associated Tasks: 1. Understand the theory of projection and quadrant system used in technical drawing. 2. Differentiate between types of projections: Orthographic, and isometric projection. 3. Interpret and apply the first angle projection method based on BIS standards. 4. Identify and construct front, top, and side views of a given pictorial or isometric object. 5. Understand and apply sectional views to represent internal features (full sectional view only). 6. Draw TWO orthographic projection problems with correct line types, layout, and dimensioning using the first angle method. Exemplars and Utility: 1. Draw orthographic views (front, top, side) of a given simple mechanical component using the first angle method. 2. Create orthographic projections of a simple machine component like a flange or bracket. 3. Produce a sectional orthographic projection of a simple mechanical component like a bush or hollow cylinder to show hidden internal details.			
Experiment No.3	Isometric Projections	6 Hrs.	CO3
Objective: To develop students' ability to visualize and construct isometric projections of engineering objects using orthographic views, including the understanding of isometric axes, scaling, and conventions for isometric and non-isometric lines. Associated Tasks: 1. Understand the principles of isometric projection, including the use of isometric axes and isometric scale. 2. Identify and correctly draw isometric and non-isometric lines. 3. Construct standard geometric shapes (e.g., circles, squares) on isometric planes using appropriate methods (like ellipse construction for circles). 4. Convert orthographic views into an isometric projection of an object or component, ensuring proper visualization and proportion. 5. Complete TWO isometric projection problems based on orthographic views of simple machine components. Exemplars and Utility: 1. Draw an isometric projection of a cube, cylinder, and cone using proper isometric angles (30° to horizontal). 2. Convert orthographic views (front, top, side) of a simple mechanical component into an isometric projection. 3. Construct isometric view of a square / hex nut or a washer, showing internal features with poor dimensions.			



Experiment No.4	Computer-Aided Drafting (CAD) - I	4 Hrs.	CO4
Objective: To introduce students to the fundamentals of Computer-Aided Drafting (CAD) using industry-standard software (such as AutoCAD), and to enable them to create accurate orthographic projections through digital tools, enhancing their drawing speed, precision, and industry readiness. Associated Tasks: 1. Understand the basic interface and workspace of CAD software (AutoCAD or equivalent). 2. Learn the fundamental operations of CAD: creating, saving, and opening of drawing files. 3. Use basic drawing commands such as LINE, CIRCLE, POLYGON, ARC etc. 4. Apply dimensioning commands to annotate objects according to standard practices. 5. Utilize editing and modifying commands: MOVE, COPY, OFFSET, MIRROR, TRIM, EXTEND, etc. 6. Draw Orthographic projections (front, top, and side views) of a given object using the AutoCAD. Exemplars and Utility: 1. Launch AutoCAD and set up a new drawing with proper units and limits. 2. Draw a 2D orthographic projection (front, top & side) of a simple object using AutoCAD tools. 3. Apply dimensioning and text annotation using standard dimension styles and settings. 4. Use layers to separate views or drawing elements like object lines, hidden lines, and center lines. 5. Plot or print the final drawing as a hard copy or PDF with a title block using standard sheet size (A3/A4).			
Experiment No.5	Computer-Aided Drafting (CAD) - II	6 Hrs.	CO5
Objective: To develop the ability to construct accurate isometric projections of engineering components using AutoCAD software by effectively utilizing drawing, editing, and dimensioning commands. Associated Tasks: 1. Set up the isometric environment in AutoCAD (snap/grid settings, isometric plane selection). 2. Complete the isometric projection of a machine component using given orthographic views. 3. Use plot and print commands to generate a scaled drawing output (A4 or A3) with title block. Exemplars and Utility: 1. Create an isometric view of a stepped block or machine bracket based on orthographic projections. 2. Construct isometric circles (e.g., holes or cylindrical features) using isocircle option. Textbooks: 1. Bhatt, N. D. and Panchal, V. M., (2016), Engineering Drawing, Charotar Publication, India 2. Venugopal, K, (2015), Engineering and Graphics, New Age International, New Delhi 3. Rathnam, K., (2018), A First Course in Engineering Drawing, Springer Nature Singapore Pte. Ltd., Singapore 4. P.S. Gill ,Text Book of Engineering Graphics S.K. Kataria & Sons Publications. 5. K.L. Narayana and P. Kannaiah, Engineering Drawing and Graphics, New Age International Publisher			



6. Jolhe D. A (2015), Engineering Drawing with introduction to AutoCAD, Tata McGraw Hill.
7. Munir Hamad, AutoCAD 2014: Beginning and Intermediate, Mercury Learning and Information.
8. Elise Moss ,AutoCAD 2014 Fundamentals ,SDC Publications
9. Coimbtore PSG College of Technology,” Design Data Handbook - Data Book of Engineers”, Kalaikathir Achchagam -Coimbatore Publication

Reference Books:

1. Madsen, D. P. and Madsen, D. A., (2016), Engineering Drawing and design, Delmar Publishers Inc., USA
2. Bhatt, N. D., (2018), Machine Drawing, Charotar Publishing House, Anand, India
3. Dhawan, R. K., (2000), A Textbook of Engineering Drawing, S. Chand, New Delhi
4. Basant Agrawal and C. M. Agrawal ,Engineering Graphics , McGraw Hill Education
5. Maheshwari Pradeep Jain, A.P. Gautam, and Anita , Engineering Graphics and Design, Khanna Publishing House
6. Mastering AutoCAD 2014 by G.Omura Autodesk Official press

MOOCs Links and additional reading material:

1. Orthographic Projections: <https://nptel.ac.in/courses/124107157>
2. Engineering Graphics and Modeling: https://onlinecourses.nptel.ac.in/noc21_me128/preview
3. Isometric Projections: <https://youtu.be/Vo9LC9d7FQA?si=7IH-C1wLG60Xj6dD>
4. Introduction to CAD: <https://nptel.ac.in/courses/112102101>
5. AutoCAD Basics: <https://www.youtube.com/watch?v=a4jW2J8wnzI>

Strength of CO-PO Mapping:

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

Note - 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

Engineering Graphics is a fundamental subject that deals with creating visual repetition and technical drawing to communicate design ideas and specifications.

Prerequisites typically includes Mathematics (geometry), Engineering drawing, Computer Aided Design (AutoCAD, Solid works, Fusion software's), Machine Drawing, Mechanical System Design, Building Design, Surveying, Machine Design, 3D software's, etc.

Job Mapping:

Job opportunities that one can get after learning this course:

Some potential job mapping for engineering graphics is –Design Engineer, CAD Designer, Draftsman, Product designer, Architectural visualizer, Industrial Design Engineer. Aerospace, automotive manufacturing gaming and animations industries.



Program:		F. Y. B. Tech			Semester:		I / II	
Course:		Civil Engineering Lab			Course Code:		R26-CE-VSEC-111	
Teaching Scheme(Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	2	-	1	-	-	50	-	
Course Description: This practical course aims to provide first-year Civil Engineering students with hands-on experience in fundamental concepts of Engineering Mechanics and Civil Engineering Systems. The Engineering Mechanics component focuses on understanding the behavior of physical systems under the action of forces, friction, and motion. Students will verify laws of forces, analyze support reactions, and explore frictional behavior and projectile motion through laboratory experiments. The Systems in Civil Engineering component introduces students to environmental monitoring, modern surveying technologies, and material awareness. Students will perform tests on ambient air and soil quality, use Total Station and GPS instruments for data collection and mapping, and conduct a market survey of construction materials.								
Course Relevance: The course solidifies abstract concepts from Engineering Mechanics by allowing students to verify fundamental principles in a laboratory setting. It introduces students to the broader context of Civil Engineering systems and modern professional practices early on.								
Prerequisite: Basic Calculus, Trigonometry, Geometrical expressions, Laws of motion, Concept of mass, acceleration, fundamental knowledge of Engineering Mathematics and Physics and environmental studies.								
Bridge Content: Enable students to visualize and validate fundamental laws of statics and dynamics.								
Course Objectives: 1. To experimentally VERIFY fundamental principles of Engineering Mechanics such as equilibrium of forces, support reactions in beams, frictional behavior, projectile motion, and impact properties through practical demonstrations and measurements. 2. To PROVIDE hands-on experience in assessing environmental and geospatial parameters by conducting experiments related to air quality, soil properties, land measurement using Total Station and GPS, and evaluating construction materials through market survey.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome						Bloom's Level	
CO1	DETERMINE the resultant of force system and verification of law of polygon of forces.						2	
CO2	CALCULATE the vertical reaction forces at the supports of a simply supported and overhang beam under point loading and FIND out the coefficient of static friction by using belt friction apparatus.						3	
CO3	FIND the coefficient of restitution using concept of impact and impulse momentum principle and DETERMINE the parameters of projectile motion.						3	
CO4	CALCULATE the results of air pollution data to assess environmental quality in accordance with national standards. Determine the pH of soil samples and assess its suitability for construction and agricultural applications.						3	



CO5	DEMONSTRATE the ability to use Total Station and GPS instruments to measure distances, coordinates, and areas accurately, and apply the data for mapping and Civil Engineering applications.	1	
List of Practical: A. Engineering Mechanics list of experiments (any four)			
Experiment No.1	Verification of the Polygon law of forces.	2 Hrs.	CO1
Objective: To verify the Polygon Law of Forces using a physical model (force table) through experimental observation. Associated Tasks: 1. Review theoretical background of force systems and vector addition. 2. Study the Polygon Law of Forces and understand equilibrium of concurrent forces. Exemplars and Utility: 1. Understanding force balance is critical in analyzing trusses, frames, and beams in civil, mechanical, and aerospace engineering. 2. Improves Problem-Solving and Observation Skills 3. Reinforces key concepts from physics and mathematics (vector resolution, equilibrium, and trigonometry).			
Experiment No.2	To find support reaction of simply supported beam and overhang beam.	2 Hrs.	CO2
Objective: To experimentally determine the support reactions in simply supported beam and overhang beam. Associated Tasks: 1. Understand hinged and roller supports. 2. Distinguish between simply supported and overhang beams. Exemplars and Utility: 1. Students will successfully apply $\sum F_x=0$, $\sum F_y = 0$ and $\sum M=0$ to calculate support reactions analytically. 2. Students recognize and explain practical deviations due to friction, beam weight, or apparatus imperfections.			
Experiment No.3	To determine coefficient of friction for block and belt using belt friction apparatus.	2 Hrs.	CO2
Objective: To experimentally determine the coefficient of friction (μ) between a belt and a pulley surface using the belt friction apparatus, and to verify the belt friction equation under different loading conditions. Associated Tasks: 1. Review the derivation of the belt friction equation. 2. Learn the function of the belt, pulley, hangers, and how to adjust and measure tension forces. Exemplars and Utility: 1. Belt friction is fundamental in the design of belt drives, conveyor systems, brakes, and clutches. 2. Reinforces Interdisciplinary Learning: Integrates concepts from Physics (friction), Mathematics (logarithms, exponents), and Engineering Mechanics (statics and dynamics).			
Experiment No.4	To determine the parameters of projectile motion.	2 Hrs.	CO3
Objective: To experimentally determine key parameters of projectile motion, such as: Initial velocity(u), Time of flight(T), Maximum height (Hmax), Horizontal range (R) Associated Tasks: 1. Understand horizontal and vertical components of motion. 2. Recall key formulas for time of flight, range, and maximum height.			



Exemplars and Utility: 1. Students successfully measure the projectile's range, time of flight, and maximum height with minimal error.			
Experiment No.5	To determine coefficient of restitution for plastic and rubber ball.	2 Hrs.	CO3
Objective: To experimentally determine the coefficient of restitution (e) for plastic and rubber balls by measuring their rebound height after free fall, and compare their elastic behavior. Associated Tasks: 1. Revise types of collisions—elastic, inelastic, and perfectly inelastic. 2. Learn the definition and physical significance of the coefficient of restitution. Exemplars and Utility: 1. Strongly connects theoretical physics with practical applications in Engineering mechanics. 2. Applicable in design and analysis of: Ballistics and defense systems, Sports science (e.g., optimal angle for long jumps or throws), Civil and mechanical engineering (e.g., water jet systems, concrete pouring trajectories).			
List of Practical: B. Systems in Civil Engineering (any four)			
Experiment No.6	Determination of particulate matter in the ambient air.	2 Hrs.	CO4
Objective: To measure and analyze the concentration of particulate matter present in ambient air using appropriate sampling and filtration techniques. Associated Tasks: 1. Understand types of air pollutants (PM ₁₀ , PM _{2.5}) and their health impacts. 2. Learn the principles and operation of high-volume and low-volume air samplers. Exemplars and Utility: 1. Bridges textbook knowledge with real-time environmental data collection and analysis. 2. Educates students on how particulate matter affects respiratory health, cardiovascular diseases, and overall urban livability.			
Experiment No.7	Determination of pH and N P K concentration of Soil Samples.	2 Hrs.	CO4
Objective: To determine the pH and the macronutrient content—Nitrogen (N), Phosphorus (P), and Potassium (K)—in soil samples, in order to assess soil fertility and suitability for agricultural use. Associated Tasks: 1. Understand the importance of pH and nutrients (N, P, K) in plant growth and soil health. 2. Collect the soil sample from nearby area or from own farm to find out the N, P, K, value. Exemplars and Utility: 1. This practical is essential in agriculture, Civil Engineering, and Geotechnical Engineering where soil quality assessment is critical. 2. Skills gained are directly applicable in: Agriculture and soil testing labs.			
Experiment No.8	Measurement of area using Total Station.	2 Hrs.	CO5
Objective: To determine the area of a given plot or field using Total Station, an advanced electronic surveying instrument that combines electronic theodolite, electronic distance measurement (EDM), and microprocessor with data storage.			

**Associated Tasks:**

1. Study the working principles of a Total Station (integration of EDM, electronic theodolite, microprocessor, and data storage).
2. Learn the names and functions of Total Station components (eyepiece, keypad, tribrach, reflector, etc.).

Exemplars and Utility:

1. This practical introduces students to industry-grade tools used in Civil engineering, construction, and land development.
2. Useful in: Road and highway Engineering, Building construction, Land parceling and urban planning, Irrigation and topographical surveys.

Experiment No.9	Measurement Coordinates and Area using GPS.	2 Hrs.	CO5
Objective: To measure geographic coordinates (latitude, longitude) and compute the area enclosed by multiple points using a Global Positioning System (GPS). Associated Tasks: 1. Understand how GPS works: satellites, receivers, and coordinate systems (latitude/longitude). 2. Identify or outline the area to be measured (field, playground, plot, etc.). Exemplars and Utility: 1. Introduces practical use of surveying technology to complement theoretical knowledge. 2. Used in preparing land records, property boundaries, and topographic maps.			
Experiment No.10	Market Survey of construction materials.	2 Hrs.	CO5
Objective: To conduct a market survey of commonly used construction materials, gather real-time data on their types, availability, specifications, and prices, and understand their suitability for various Civil engineering applications. Associated Tasks: 1. Understand the goal: collecting information on types, specifications, availability, and prices of Civil construction materials. 2. Choose 8–10 key materials to survey (e.g., cement, steel, bricks, sand, tiles, plumbing fixtures, paints, wood, and aggregates). Exemplars and Utility: 1. Builds foundation for: Quantity Surveying, Estimating and Costing, Construction Management 2. Enhances understanding of material specifications used in BOQ (Bill of Quantities).			

Strength of CO-PO Mapping											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	2	2	-	1	2	1	-	2
CO2	3	3	2	2	2	-	1	2	1	-	2
CO3	3	3	2	3	2	1	1	2	1	-	2
CO4	3	3	2	3	2	3	2	2	2	-	2
CO5	3	3	3	3	3	2	3	2	2	-	2
Avg.	3	3	2	2.6	2.2	2	1.6	2	1.4	-	2

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



This course serves as a prerequisite for / maps with the following future courses:

Civil Engineering Lab course forms the foundation for several advanced and applied Engineering courses.

Here is a list of future courses.

1. Mechanics of Structures: Applies concepts of force, stress, moment, and equilibrium to material behavior.
2. Structural Analysis: Understanding of structural systems (beams, columns, frames).
3. Surveying
4. Air Pollution and Control

Job Mapping:

Job opportunities that one can get after learning experiments of Civil Engineering Systems:

It develop skills relevant to environmental monitoring, geotechnical testing, land surveying, and construction management, preparing students for careers as environmental engineers, surveyors, geotechnical engineers, and construction material analysts in civil engineering projects.

Job opportunities that one can get after learning experiments of Engineering Mechanics:

The experiments in Engineering Mechanics develop skills applicable to roles such as design engineer, structural analyst, site engineer.



Program:	F. Y. B. Tech			Semester:	I / II		
Course:	Professional Communication Skill			Course Code:	R26-SH-AEC-112.1		
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	-	02	02	-	-	50	-

Course Description

This course is designed to develop the linguistic competence, interpersonal communication, and professional presentation skills required for academic and workplace success. It focuses on strengthening the four core language skills—Listening, Speaking, Reading, and Writing (LSRW)—through structured learning activities, interactive sessions, and real-life communication scenarios. The course introduces students to active listening, effective speaking, professional writing, and workplace etiquette. Through practical exercises such as group discussions, presentations, report writing, and interview simulations, learners gain confidence and proficiency in expressing their ideas clearly and effectively in professional and social contexts.

Course Relevance

Effective communication is a fundamental skill for engineers in every professional domain. This course bridges the gap between technical expertise and interpersonal competence by enhancing students' ability to communicate ideas, collaborate in teams, and engage with diverse audiences.

It equips learners with:

- Strong verbal and written communication skills for technical and managerial settings.
- The ability to participate effectively in interviews, meetings, and group discussions.
- Professional etiquette, cross-cultural sensitivity, and adaptability in corporate communication.
- Competence in preparing technical documents such as reports, proposals, and correspondence.

Thus, Professional Communication Skills serves as a foundation for employability, leadership, and lifelong learning in the engineering profession.

Prerequisite:

- Basic understanding of English grammar and vocabulary at secondary school level.
- Willingness to engage in interactive speaking and writing activities.
- Openness to feedback and active participation in individual and group exercises.

Bridge Content:

To ensure smooth transition from school-level English learning to professional-level communication, the following bridge modules are introduced at the beginning of the course:

1. Basic Grammar Refresher: Parts of speech, tenses, sentence structure, and punctuation.
2. Vocabulary Enrichment: Synonyms, antonyms, idioms, and usage of technical terms.
3. Functional Communication: Common expressions used in greetings, introductions, and day-to-day academic interactions.
4. Listening and Comprehension Practice: Exposure to short audio clips, speeches, and interviews to enhance listening accuracy.
5. Introduction to Public Speaking: Confidence-building exercises such as “Just a Minute” (JAM) sessions and self-introductions.
6. Digital Communication Skills: Basics of email writing, virtual meeting etiquette, and presentation design tools (MS PowerPoint, Google Slides).

Course Objective:

- **DEVELOP** effective listening, speaking, reading, and writing skills.
- **IMPROVE** pronunciation, fluency, and professional speaking etiquette.
- **STRENGTHEN** reading comprehension and analytical ability.



● BUILD written communication skills required in professional and academic contexts. ● ENABLE students to communicate confidently in workplace situations.			
Course Outcomes: After learning the course, students will be able to			
CO	Course Outcomes	Bloom's Level	
CO1	APPLY effective listening techniques for academic and workplace settings.	3	
CO2	DEMONSTRATE clarity, accuracy, and fluency in speaking	4	
CO3	INTERPRET and ANALYZE written texts using appropriate reading strategies.	4	
CO4	COMPOSE grammatically correct, concise, and structured written communication.	5	
CO5	EXHIBIT professional etiquette, politeness, and confidence in workplace communication.	4	
Course Contents			
Unit 1	Fundamentals of Listening and Communication	5 Hrs.	CO1
● Basics of Listening: Introduction, Process, Importance, and Types ● Effective Listening: Principles, Barriers, and Guidelines ● Active Listening: Sub-skills (Predicting, Clarifying, Inferencing, Evaluating, Note-taking) ● Listening in Business Contexts (Telephony and Meetings) ● Importance of Communication in Professional Life			
Assignments: 1. Listen to an audio/video clip and answer comprehension questions. 2. Take structured notes from a short lecture. 3. Write a reflection on the importance of active listening.			
Unit 2	Speaking Skills and Oral Communication	5 Hrs.	CO2
● Speaking Parameters: Accuracy, Fluency, and Pronunciation ● Pronunciation Guide: Sound Scripting, Stress, and Intonation ● Fluency Activities: JAM, Role Plays, Picture/Audio-Visual Based Speaking ● Group Discussion: Principles, Preparation, and Practice ● Presentation Skills: Basics, Micro Presentations ● Situational Conversations: Introductions, Descriptions, and Inquiries			
Assignments: 1. Participate in a JAM session or role play. 2. Deliver a short (3–5 min) micro presentation. 3. Take part in a group discussion on a current topic.			
Unit 3	Reading and Comprehension Skills	5 Hrs.	CO3
● Effective Reading: Process, Types, and Reading Rate Adjustment ● Tips for Improving Reading and Vocabulary ● Reading Comprehension and Analytical Exercises ● Interpreting Technical and Literary Texts ● Critical and Contextual Reading			



Assignments: 1. Solve a reading comprehension exercise. 2. Write a short book/film/article review. 3. Summarize a given text in your own words.			
Unit 4	Writing Skills for Professional and Academic Contexts	5 Hrs.	CO4
• Importance and Structure of Written Communication • Writing Book / Article / Film Reviews • Letter Writing: Types, Formats, and Official Correspondence (Memos, Notices, Circulars) • Report Writing: Principles and Types (Project & Internship Reports) • Precise Writing, Editing, Proofreading, Abstract and Conclusion Writing			
Assignments: 1. Write a formal letter or email. 2. Draft a short event or visit report. 3. Prepare a notice, memo, or circular.			
Unit 5	Workplace Communication and Etiquette	4 Hrs.	CO5
• Greeting, Welcoming, Giving Instructions, Handling Complaints • Providing Information: Directions, Facilities, and Local Guidance • Polite and Persuasive Communication Techniques • Accepting Praise and Criticism, Apologizing Professionally • Developing Fluency, Etiquette, and Confidence			
Assignments: 1. Draft a polite workplace conversation or email. 2. Participate in a mock interview or feedback activity. 3. Write a reflection on workplace communication etiquette.			
Textbooks:			
1. M. Ashraf Rizvi, <i>Effective Technical Communication</i>, Tata McGraw-Hill Education, 2010. 2. Meenakshi Raman and Sangeeta Sharma, <i>Technical Communication: Principles and Practice</i>, Oxford University Press, 2018. 3. Krishna Mohan and Meera Banerji, <i>Developing Communication Skills</i>, Macmillan Publishers India, 2009.			
Reference Books:			
1. Lehmann, Donna, <i>Business Communication</i>, Cengage Learning, 2018. 2. Lesikar, R.V. and Flatley, M.E., <i>Basic Business Communication</i>, Tata McGraw-Hill, 2011. 3. Raymond V. Lesikar, Marie E. Flatley, Kathryn Rentz, <i>Business Communication: Making Connections in a Digital World</i>, McGraw Hill Education, 2014. 4. Courtland L. Bovee and John V. Thill, <i>Business Communication Today</i>, Pearson Education, 2019. 5. Andrea J. Rutherford, <i>Basic Communication Skills for Technology</i>, Pearson Education, 2011.			
MOOCs links			
1. NPTEL – Professional Communication Course (IITs) – Covers listening, speaking, reading, and writing skills with workplace communication modules: https://nptel.ac.in/courses/109/106/109106176/ 2. SWAYAM – Communication Skills – Government-approved MOOC on business and professional communication: https://swayam.gov.in/ 3. Coursera – Business Communication by University of British Columbia – Develops clarity, confidence, and persuasion in communication: https://www.coursera.org/learn/business-communication			

4. **edX – English for Workplace Communication (UPValenciaX)** – Practical course for professional speaking and writing: <https://www.edx.org/>
5. **LinkedIn Learning – Communication Foundations** – Focuses on active listening, presentation, and interpersonal skills: <https://www.linkedin.com/learning/>
6. **BBC Learning English – Business English** – Free resources for improving workplace English and communication etiquette: <https://www.bbc.co.uk/learningenglish/businessenglish>
7. **Toastmasters International** – Global platform for developing public speaking and leadership communication: <https://www.toastmasters.org/>

Strength of CO-PO Mapping											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	-	-	-	2	3	-
CO2	2	1	-	-	-	-	-	-	3	3	2
CO3	3	2	-	-	-	-	-	-	2	3	-
CO4	1	-	-	-	-	1	1	2	3	3	-
CO5	1	-	-	-	1	2	3	2	3	3	2
Average	1.8	1.3	-	-	1	1.5	2	2	2.6	3	2

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

This course lays the foundation for advanced communication-based and professional development courses such as Business Communication, Managerial Communication, Soft Skills and Personality Development, Corporate Readiness, and Technical Report Writing. It also maps with Project Communication, Internship Presentations, and Entrepreneurship Development courses that require effective verbal and written communication in professional environments.

Job Mapping:

Job opportunities that one can get after learning this course:

- Corporate Communication Executive / Public Relations Officer
- Technical Writer / Content Developer
- HR Executive / Recruiter
- Customer Relationship Manager / Client Support Executive
- Training and Development Coordinator
- Administrative or Front Office Executive
- Marketing and Sales Associate requiring strong communication skills
- Anchor, Presenter, or Event Coordinator

Program:	F. Y. B. Tech				Semester:	I / II	
Course:	Indian Knowledge System				Course Code:	R26-SH-AEC-113	
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	-	02	02	-	-	50	-

Course Description

This course introduces learners to the vast and diverse Indian Knowledge System (IKS) — the ancient and indigenous body of knowledge encompassing philosophy, science, engineering, architecture, arts, and culture. It explores India’s civilizational heritage, major dynasties, intellectual traditions, and UNESCO World Heritage Sites.

Students will study foundational texts like the Vedas, Upanishads, and Shastras, understand ancient Indian education systems, and analyze the scientific and technological achievements of ancient India.

Course Relevance

- The course also connects ancient wisdom with modern learning, promoting sustainability, ethics, and cultural awareness.
- Understanding India's indigenous knowledge systems helps students appreciate the nation's intellectual depth and its contribution to global civilization. The course:
- Builds awareness of India's philosophical and scientific heritage.
- Enhances critical and comparative understanding of ancient and modern systems.
- Encourages sustainability-oriented thinking through traditional practices.
- Promotes cultural literacy and national pride among future engineers and professionals

Prerequisite:

Students are expected to possess:

- Basic understanding of history and culture.
- Interest in learning about ancient Indian achievements and philosophies.
- Curiosity to explore the roots of science, technology, and arts in India.

Bridge Content:

Before starting the course, the following introductory modules will be covered:

1. Introduction to Indian Civilization and Cultural Heritage.
2. Overview of Knowledge Systems in India — Vedic and Post-Vedic.
3. Understanding BC/BCE and AD/CE timelines.
4. Linking Ancient Indian Science to modern STEM principles.
5. Awareness about UNESCO Heritage and Global Cultural Legacy.

Course Objective:

- To **INTRODUCE** students to the foundational concepts and sources of Indian Knowledge Systems.
- To **EXPLORE** the philosophical, educational, and scientific achievements of ancient India.
- To **STUDY** Indian dynasties and their cultural, political, and technological contributions.
- To **EXAMINE** India's artistic, architectural, and musical traditions.
- To **UNDERSTAND** the global influence of ancient Indian knowledge and heritage.

Course Outcomes: After learning the course, students will be able to		
CO	Course Outcome	Bloom's Level



CO1	UNDERSTAND the significance of Vedas, Upanishads, the Six Schools of Philosophy, Gurukul education system, and Varna system.	2
CO2	ANALYZE ancient Indian Shastras, astronomy, astrology, and scientific achievements in historical and cultural contexts.	4
CO3	EXAMINE the contributions of music, dance, arts, and architecture to Indian cultural heritage and traditions.	5
CO4	RECOGNIZE the governance, achievements, and contributions of major Indian dynasties and civilizations including Indus Valley Civilization.	4
CO5	EXPLORE ancient Indian engineering, technology, UNESCO World Heritage sites, and assess their influence on modern practices and global knowledge systems.	6
Course Contents		
Unit 1	Foundations of Indian Knowledge	4 Hrs.
• Vedic Period: Vedas and their significance • Upanishads: Philosophy and knowledge • Six Schools of Indian Philosophy • Gurukul Education System • Varna System		
Assignments: 1. Write a report on the significance of the Vedas or Upanishads. 2. Discuss the Gurukul education system and its relevance today. 3. Compare the ancient Varna system with modern social structures.		
Unit 2	Philosophy, Literature, and Scientific Thought	4 Hrs.
• Introduction to Shastras: Yoga Shastra, Nyaya Shastra, Dharmashastra, Arthashastra • Ancient Indian Astronomy and Astrology • Ancient Indian Arts and Architecture		
Assignments: 1. Prepare a presentation on any one Shastra (Yoga, Nyaya, Dharmashastra, or Arthashastra). 2. Write a report on ancient Indian contributions to astronomy or astrology. 3. Analyze a key scientific achievement from ancient India (e.g., Aryabhata's mathematics)		
Unit 3	Music, Dance, and Cultural Heritage	5 Hrs.
• Ancient Indian Music and Dance • Cultural traditions and festivals • Indian culture through ages: ethics, rituals, and symbolism		
Assignments: 1. Write an essay on a classical Indian music or dance form. 2. Prepare a visual presentation on Indian cultural festivals and traditions. 3. Study an ancient architectural style and summarize its features.		
Unit 4	Civilization and Dynastic Heritage	5 Hrs.
CO4		



- Indus Valley Civilization: Mohenjo-Daro and Harappa
- Major Indian Dynasties: Haryanka, Nanda, Maurya, Shunga, Gupta, Kushan, Maratha, Chola, Pandya, Chera, Satavahana, Pallava, Chalukya, Varman, Mlechchha, Kamrupa-Palas, Ahom

Assignments:

1. Create a timeline of major Indian dynasties and their achievements.
2. Prepare a short report on Indus Valley Civilization (Mohenjo-Daro or Harappa).
3. Analyze the governance and cultural contributions of any one dynasty.

Unit 5	Architectural, Engineering, UNESCO Sites & Global Influence	4 Hrs.	CO5
---------------	--	---------------	------------

- Ancient Indian Engineering and Technology
- Temples and structural design
- Metallurgy, town planning, irrigation, and water management systems
- Overview of UNESCO World Heritage Sites: Ajanta, Ellora, Hampi, Mahabalipuram, Khajuraho, Bhimbetka, Konark, Champaner, Mahabodhi, Sanchi, Pattadakal, Nanda Devi, etc.
- Ancient Indian Knowledge and its global influence

Assignments:

1. Write a report on any one UNESCO World Heritage Site in India.
2. Prepare a case study on ancient Indian engineering or metallurgy techniques.
3. Discuss the global influence of Indian knowledge systems in a short essay.

Textbooks:

1. Indian Knowledge System – AICTE, 2022
2. Knowledge Traditions and Practices of India – Kapil Kapoor & Michel Danino
3. Essence of Indian Knowledge Tradition – NPTEL/SWAYAM Course Material

Reference Books:

1. A.L. Basham – The Wonder That Was India
2. Subhash Kak – The Astronomical Code of the Rigveda
3. Indian Knowledge System: Concepts and Applications – CBSE Publication

MOOCs links

1. Introduction to Indian Knowledge System (SWAYAM) – https://onlinecourses.swayam2.ac.in/nou25_ge95/preview (Swayam)
2. IKS Division, AICTE – <https://iksindia.org/> (Indian Knowledge Systems)
3. IKS: Concepts & Applications in Engineering (SWAYAM) – https://onlinecourses.swayam2.ac.in/imb23_mg53/preview (Swayam)
4. Indian Knowledge System: Concepts & Applications in Science (SWAYAM) – https://onlinecourses.swayam2.ac.in/imb24_mg21/preview (Swayam)
5. SWAYAM Platform – <https://swayam.gov.in/> (swayam.gov.in)



Strength of CO-PO Mapping											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	1	—	—	—	1	2	-
CO2	2	1	-	-	—	1	—	1	2	3	-
CO3	2	2	-	-	1	—	2	2	2	3	-
CO4	1	—	-	1	2	2	—	1	2	2	-
CO5	2	1	-	1	2	2	1	1	2	3	-
Avg.	2.16	1.6	-	1	1.4	1.66	1.5	1.25	1.66	2.5	-

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

Courses on Indian Philosophy, Heritage Studies, Ethics and Values in Engineering, Art and Architecture of India, Environmental Sustainability inspired by Ancient Practices, and Interdisciplinary Studies on Science and Technology in Ancient India.

Job Mapping:

Job opportunities that one can get after learning this course:

Knowledge of Indian Knowledge Systems enhances opportunities in fields such as education, heritage management, cultural tourism, archaeology, art and architecture conservation, research and documentation, museum curation, civil services, and interdisciplinary roles promoting India's cultural and scientific heritage.



Program:	F. Y. B. Tech			Semester:	I		
Course:	Cocurricular Course - I Art And Crafts			Course Code:	R26-SH-CC-114.1		
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	02	-	01	-	-	25	-

Course Description

This course provides an introduction to the fundamental concepts, techniques, and creative processes involved in arts and crafts. It explores various art forms such as drawing, painting, paper craft, textile art, clay modelling, and eco-friendly crafts. Students will gain hands-on experience through practical projects that enhance creativity, fine motor skills, and aesthetic appreciation.

Course Relevance

Arts and Crafts play a vital role in developing creativity, imagination, and self-expression. This course is relevant for learners seeking to : Understand the cultural and historical significance of art and craft traditions. Develop practical artistic skills applicable in education, design, and community projects. Promote sustainable practices through recycled and eco-friendly materials. Foster teamwork and communication through collaborative art projects.

Course Outcomes: After learning the course, the student will

1. Understand the meaning, history, and importance of arts and crafts in human culture.
2. Learn and apply basic drawing and painting techniques, including sketching, shading, and color theory.
3. Create paper crafts and origami models using folding and cutting techniques.
4. Experiment with textile and fabric art methods such as tie-dye, block printing, embroidery, and fabric painting.
5. Explore clay modeling and pottery basics for three-dimensional artistic expression.

CO	Course Outcome	Bloom's Level
CO1	Explain the meaning, history, importance, and evolution of arts and crafts and demonstrate basic drawing and painting techniques.	3
CO2	Create decorative items using paper craft and origami techniques and apply basic textile and fabric art methods such as tie-dye, block printing, embroidery, and fabric painting.	3
CO3	Develop clay models using hand-building and sculpting techniques and demonstrate basic pottery and surface finishing skills.	3
CO4	Produce eco-friendly craft items using recycled materials and practice sustainable art-making methods.	3
CO5	Design, execute, and present creative individual or group art projects and organize exhibitions effectively.	3

Course Contents			
Unit 1	Introduction to Arts and Crafts	4 Hrs.	CO1
Meaning, history, importance, and evolution of arts and crafts across cultures, Basic Drawing and Painting Techniques Sketching, shading, color theory, brushwork, and composition.			
Unit 2	Paper Craft, Origami, Textile and Fabric art	4 Hrs.	CO2

Amrutvahini

R. G. G. G.



Paper Craft and Origami Techniques of folding, cutting, and creating decorative items; greeting cards and paper sculptures. Textile and Fabric Art - Tie-dye methods, block printing, basic embroidery stitches, and fabric painting.			
Unit 3	Clay and Modeling	4 Hrs.	CO3
Hand-building techniques, sculpting, introduction to pottery and surface finishing.			
Unit 4	Recycled and Eco-Friendly Craft	4 Hrs.	CO4
Creating art using waste materials, sustainable art practices, and environmental awareness.			
Unit 5	Creative Projects and Exhibitions	4 Hrs.	CO5
Designing, executing, and presenting individual or group art projects; organizing exhibitions.			

Strength of CO-PO Mapping											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	–	–	–	–	–	–	–	1	–
CO2	1	1	2	–	–	–	1	–	–	–	–
CO3	1	–	2	1	–	–	–	–	–	–	–
CO4	1	–	2	–	–	–	2	–	–	–	–
CO5	–	–	2	–	–	–	–	–	2	2	1
Average	1.25	1	2	1	-	-	1.5	-	2	1.5	1

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Amrutvahini

R. G. Ganimkar



Program:	F. Y. B. Tech				Semester:		I	
Course:	Cocurricular Course- I Dance & Drama				Course Code:		R26-SH-CC-114.2	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	01	-	-	25	-	

Course Description

This course introduces students to the art and discipline of dance as a form of physical expression, cultural heritage, and creative movement. It explores the meaning, importance, and various forms of dance, ranging from folk and classical traditions to contemporary and creative styles. Students will develop fundamental dance skills, including posture, balance, rhythm, coordination, and spatial awareness. Through theory and practical sessions, learners will gain insights into choreography, group formations, and performance techniques. The course also emphasizes the role of dance in fitness, emotional expression, stress relief, and personal confidence.

Course Relevance

Dance is not only a performing art but also a powerful medium for cultural preservation, self-expression, and physical fitness. In today's context, where holistic well-being and creative communication are increasingly valued, dance serves as a bridge between tradition and modernity, nurturing both body and mind. This course is relevant for students pursuing careers in performing arts, physical education, choreography, and wellness, or anyone seeking to enhance their creativity and confidence through movement.

Course Objectives:

1. Understand the meaning, history, and significance of dance as a cultural and artistic expression.
2. Demonstrate basic dance movements involving posture, rhythm, balance, and coordination.
3. Explore and perform selected folk and classical dance forms.
4. Engage with contemporary and creative dance styles, emphasizing freedom of expression.
5. Apply choreographic principles in creating and organizing dance sequences.

Course Outcomes: After learning the course, the student will

CO	Course Outcome	Bloom's Level
CO1	Exhibit foundational skills in diverse dance styles and techniques.	3
CO2	Identify and appreciate the cultural diversity of dance forms.	3
CO3	Design and perform original choreographic pieces with effective group coordination.	3
CO4	Demonstrate improved physical fitness, rhythm, and body awareness.	3
CO5	Use dance as a medium for self-expression and stress management.	3

Course Contents			
Unit 1	Introduction to Dance	4 Hrs.	CO1
• Meaning and definition of dance • Importance in culture, expression, and fitness • Overview of folk, classical & contemporary form			
Unit 2	Basic Dance Movements	4 Hrs.	CO2
• Posture & body alignment • Balance & coordination • Rhythm, timing, basic steps, gestures			



Unit 3	Folk and Classical Dance Forms	4 Hrs.	CO3
- Major Indian folk dance styles - Classical dance forms & basic elements			
Unit 4	Contemporary & Creative Dance	4 Hrs.	CO4
- Modern dance styles & evolution - Freestyle, expressive dance - Improvisation & creativity - Basics of choreography (sequencing, patterns, transitions, group formations, storytelling)			
Unit 5	Dance, Fitness & Well-being	4 Hrs.	CO5
- Physical benefits (strength, flexibility, stamina) - Mental & emotional benefits (stress relief, confidence, teamwork) - Dance as fitness & lifestyle activity			

Strength of CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	–	2	–	–	1	–	–	1	–	–
CO2	1	1	–	–	–	–	–	–	–	1	–
CO3	–	–	3	–	–	–	–	–	2	2	1
CO4	–	–	2	–	–	2	–	–	1	–	–
CO5	–	–	–	–	–	2	–	–	1	1	–
Average	1.0	1.0	2.33	–	–	1.67	–	–	1.25	1.33	1.0

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Amrutvahini

R. G. G. G.



Program:		F.Y. B. Tech		Semester:		I	
Course:		Physical Fitness and Sports		CourseCode:		R26-SH-CC-114.3	
Teaching Scheme (Hrs./week)			Credits (PR)	ExaminationScheme			
Lecture	Practical	Tutorial		CCE	ESE	TW	PR
-	2	-	1	-	-	50	-
Course Description and Relevance:							
Course Description and Relevance The Physical Fitness and Sports course focuses on developing students’ physical fitness, health awareness, and basic sports skills. It provides knowledge and practical experience related to exercise, fitness components, nutrition, sports activities, and healthy lifestyle practices. The course also promotes discipline, teamwork, leadership, confidence, and sportsmanship through active participation in physical and recreational activities.The course is relevant for promoting physical and mental well-being among students. Regular physical activity helps improve strength, endurance, flexibility, coordination, and overall fitness. Knowledge of sports and fitness also encourages students to adopt healthy habits, manage stress, work effectively in teams, and maintain an active lifestyle. The course contributes to the overall personality development and well-being of students.							
Prerequisite:							
• No specific prior knowledge or qualification is required. • Students should have a basic interest in physical fitness, sports, and recreational activities.							
• BridgeContent: Awareness of sports safety, injury prevention, and first aid. • Development of teamwork, discipline, cooperation, and sportsmanship.							
CourseObjectives:							
1. Understand the importance of physical fitness, exercise, and sports in daily life. 2. Develop basic physical fitness components such as strength, endurance, flexibility, speed, and agility. 3. Perform basic warm-up, stretching, exercise, and cool-down activities correctly. 4. Understand the basic rules, skills, and techniques of selected sports and games.							
CourseOutcomes: After successful completion of the Physical Fitness and Sports course, students will be able to::							
CO	CourseOutcome					Bloom’sLevel	
CO1	Explain the importance of physical fitness, exercise, and sports in maintaining a healthy lifestyle.					2	
CO2	Demonstrate basic exercises and activities for improving strength, endurance, flexibility, speed, and agility.					3	
CO3	Apply fundamental skills, techniques, and rules of selected sports and games					2	
CO4	Implement appropriate practices related to nutrition, hydration, personal hygiene, safety, and injury prevention.					3	
List of Practical:							
Experiment No.1		List of Practicals – Physical Fitness and Sports			4 Hrs.	CO1	

**Learning Objectives:**

1. **Warm-up and Cool-down Exercises** – Basic warm-up, stretching, and relaxation exercises.
2. **Measurement of Height, Weight and BMI** – Recording basic physical fitness parameters.
3. **Physical Fitness Assessment** – Basic fitness tests for strength, endurance, speed, agility, and flexibility.
4. **Strength Exercises** – Push-ups, sit-ups, squats, lunges, and plank exercises.
5. **Flexibility Exercises** – Basic stretching and flexibility drills.
6. **Endurance Training** – Jogging, running, skipping, and aerobic activities.
7. **Speed and Agility Training** – Shuttle run, short sprints, and agility drills.
8. **Yoga and Breathing Exercises** – Basic asanas, pranayama, and relaxation techniques.
9. **Athletics Practical** – Basic skills of running, jumping, and throwing events.
10. **Team Games** – Basic skills and rules of games such as volleyball, basketball, football, or kabaddi.
11. **Individual Games** – Basic skills and rules of games such as badminton, table tennis, or chess.
12. **First Aid and Sports Safety** – Basic first-aid practices and prevention of common sports injuries.
13. **Sports Nutrition and Hydration** – Understanding proper nutrition and hydration before, during, and after physical activity.
14. **Fitness Training Plan** – Preparation and demonstration of a simple personal fitness programme.
15. **Final Fitness Assessment** – Reassessment of selected fitness components to observe improvement.

Experiment No.2	Physical Fitness and Sports	4 Hrs.	CO2
Objectives			
• To understand the components of physical fitness. • To assess personal fitness levels. • To identify areas that need improvement. • To prepare a simple and practical fitness programme.			
Assignment Tasks			
1. Measure and record height, weight, and BMI. 2. Perform the following fitness tests: ○ Push-ups – strength ○ Sit-ups – muscular endurance ○ Sit and Reach – flexibility ○ 50 m sprint – speed ○ Shuttle Run – agility ○ 800 m/1 km run – endurance 3. Record the results in a table. 4. Analyze your performance and identify areas for improvement. 5. Prepare a 4-week personal fitness plan including exercise, duration, frequency, and rest. 6. Write a short conclusion describing the importance of regular physical activity.			
Outcome			
Students will be able to assess their physical fitness, interpret basic fitness results, and develop an			



appropriate personal fitness plan.

Experiment No.3	Creativity and Innovation – Physical Fitness and Spo	4 Hrs.	CO2
------------------------	--	---------------	------------

Learning Objectives

- Design new **fitness games and exercise activities** using simple resources.
- Develop innovative **warm-up and stretching routines**.
- Create a personalized fitness programme based on individual needs.
- Modify traditional sports and games to make them more **inclusive and engaging**.
- Use low-cost or recycled materials to develop **sports equipment and activity aids**.

Experiment No.4	Identifying Problems	4Hrs.	CO4
------------------------	-----------------------------	--------------	------------

Learning Objectives

- Identifying lack of regular physical activity and exercise.
- Recognizing poor fitness levels such as low strength, endurance, flexibility, or agility.
- Identifying incorrect exercise techniques and poor warm-up or cool-down practices.
- Recognizing problems related to improper nutrition and inadequate hydration.
- Identifying common causes of sports injuries and unsafe playing practices.
- Identifying barriers to sports participation such as lack of time, facilities, equipment, or motivation.

Strength of CO-PO-PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	–	–	-	2	3	-	1	-	-	2	1	2
CO2	2	1	1	–	-	2	2	1	3	1	-	2	2	2
CO3	-	1	1	-	-	2	2	3	3	2	1	2	2	3
CO4	2	-	-	-	-	3	3	1	2	1	-	2	1	3
Avg.	2	1.0	1.0	0.00	0.00	2.00	3.00	1.00	2.00	1.00	0.00	2.00	2.00	2.00

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

Job Mapping:

Physical Fitness Trainer, Sports Coach, Gym/Fitness Instructor, Sports & Recreation Officer, Wellness/Fitness Coordinator.

Amrutvahini

R. G. G. G.



Program:		F. Y. B. Tech			Semester:		I	
Course:		Cocurricular Course-1 Yoga			Course Code:		R26-SH-CC-114.4	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	01	-	-	25	-	
Course Description This course provides a comprehensive understanding of the meaning, origin, and philosophy of Yoga. It explores the historical development of Yoga, its objectives, and its relevance in contemporary life. Students will learn about the four major paths of Yoga—Karma, Bhakti, Jnana, and Raja Yoga—as well as Patanjali’s Ashtanga Yoga (Eightfold Path). The practical component includes the performance of basic asanas (postures), pranayama (breathing techniques), and meditation and relaxation practices for overall well-being. The course emphasizes Yoga as a holistic lifestyle promoting physical health, mental clarity, emotional balance, and spiritual growth. It also highlights the role of Yoga in modern contexts such as education, workplace wellness, and sustainable living.								
Course Relevance Yoga education is essential in today’s fast-paced world where stress, sedentary habits, and lifestyle diseases are on the rise. This course equips learners with lifelong skills to maintain health, enhance concentration, and achieve emotional balance. By integrating Yoga into daily life, individuals cultivate mindfulness, self-discipline, and inner harmony. Moreover, with the global acceptance of Yoga—celebrated through the International Day of Yoga—this course contributes to creating a healthier, more peaceful, and sustainable society.								
Course Objectives: 1. Introduce students to the meaning, origin, and historical evolution of Yoga. 2. Explain the philosophical foundations of Yoga through its major paths and principles. 3. Develop awareness about Yoga as a holistic way of life that integrates body, mind, and spirit. 4. Teach basic Yogic practices including asanas, pranayama, and meditation for physical and mental well-being. 5. Demonstrate the role of Yoga in promoting health, managing stress, and preventing lifestyle-related diseases.								
Course Outcomes: After learning the course, the student will								
CO	Course Outcome						Bloom’s Level	
CO1	Describe the origin, meaning, and philosophy of Yoga.						3	
CO2	Identify and explain the four paths of Yoga and Patanjali’s Ashtanga Yoga..						3	
CO3	Perform basic Yoga asanas with correct posture and alignment.						3	
CO4	Practice breathing techniques (pranayama) and relaxation methods effectively.						3	
CO5	Apply Yoga principles for physical fitness, emotional balance, and mental clarity.						3	

4/10/25

R. G. G. G.



Course Contents			
Unit 1	Warm-up & Loosening Practices	4 Hrs.	CO1
Warm-up, loosening exercises, Surya Namaskar, breathing coordination.			
Unit 2	Basic Standing Asanas	4 Hrs.	CO2
Tadasana, Trikonasana, Vrikshasana, Padahasthasana – posture & balance.			
Unit 3	Sitting Asanas	4 Hrs.	CO3
Sukhasana, Vajrasana, Ardha Matsyendrasana – flexibility & spinal mobility.			
Unit 4	Prone & Supine Asanas	4 Hrs.	CO4
Bhujangasana, Shalabhasana, Dhanurasana, Pavanamuktasana, Setubandhasana.			
Unit 5	Relaxation & Mind–Body Practices	4 Hrs.	CO5
Shavasana, Yoga Nidra – relaxation, mindfulness, body–mind integration.			

Strength of CO-PO Mapping											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	–	–	–	–	–	–	–	1	–
CO2	2	2	–	–	–	–	1	–	–	1	–
CO3	–	–	3	–	–	2	–	–	1	–	–
CO4	–	–	2	–	–	3	–	–	1	–	–
CO5	1	–	1	–	–	3	1	–	1	1	–
Avg.	1.67	1.50	2.00	–	–	2.67	1.00	–	1.00	1.00	–

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Amrutvahini

R. G. G. G.



Program:	F. Y. B. Tech	Semester:	I
Course:	Entrepreneurship Essential - I	Course Code:	R26-ME-PCC-114.5
Teaching Scheme (Hrs./week)		Examination Scheme	
Lecture	Practical	Tutorial	Credits (PR)
-	2	-	1
		CCE	ESE
		-	-
		TW	PR
		50	-

Course Description and Relevance:

Entrepreneurship Essentials–I is an introductory course designed to develop an entrepreneurial mindset among first-year engineering students. The course introduces students to the fundamentals of entrepreneurship, entrepreneurial qualities, creativity, innovation, problem identification, opportunity recognition, customer understanding, idea generation, teamwork, and basic business thinking. Through simple practical activities, discussions, examples, and case studies, students learn to identify real-world problems and develop innovative solutions.

The course is relevant to engineering students because engineers are expected not only to develop technical solutions but also to identify problems, understand user needs, innovate, and create value. Entrepreneurship education helps students connect their technical knowledge with real-world applications and develop skills such as creativity, critical thinking, problem-solving, communication, teamwork, leadership, and opportunity recognition.

Prerequisite:

Students are expected to have a basic interest in solving problems, exploring new ideas, and working in teams. Basic communication and observation skills will be helpful.

Bridge Content: Observation and problem identification.

Course Objectives:

- Introduce** students to the fundamental concepts of entrepreneurship, entrepreneurs, start-ups, and the entrepreneurial ecosystem.
- Develop** an entrepreneurial mindset by encouraging initiative, curiosity, risk awareness, and opportunity recognition.
- Enhance** students' creativity and innovative thinking through simple ideation and problem-solving activities.
- Develop** an understanding of customers, their needs, and the importance of user-centric solutions.

Course Outcomes: After learning the course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Explain the fundamental concepts of entrepreneurship, entrepreneurs, start-ups, and the entrepreneurial ecosystem.	2
CO2	Describe the characteristics of an entrepreneurial mindset , including imitative, curiosity , risk awareness , and opportunity recognition	2
CO3	Explain the role of creativity and innovation in entrepreneurship and problem solving	2
CO4	Explain the customer needs , customer problems and importance of user centric solution in entrepreneurship	2

4/11/25

R. G. G. G.



List of Practical:			
Experiment No.1	Introduction to Entrepreneurship	4 Hrs.	CO1
Learning Objectives: - Define entrepreneur and entrepreneurship in simple terms. - Understand the difference between a job, business and entrepreneurship. - Recognize entrepreneurship in everyday life. - Identify examples of entrepreneurs around them Classroom Activity: Entrepreneur around Me Students identify 3 entrepreneurs they know personally or locally and discuss: - What problem do they solve? - What product/service do they provide? - Who are their customers? Entrepreneur Observation Sheet: Entrepreneur → Problem → Solution → Customer			
Experiment No.2	Entrepreneurial Qualities and Skills	4 Hrs.	CO2
Learning Objectives - Understand common entrepreneurial qualities. - Identify their own strengths and areas for improvement. - Understand that entrepreneurs can develop skills through learning and practice Key Qualities: Creativity, Initiative, Risk-taking, Problem-solving, Communication, Leadership, Teamwork, Persistence, Decision-making Activity: “Am I Entrepreneurial?” Self-Assessment: Students rate themselves from 1–5 on selected qualities. Practical Output: My Entrepreneurial Strength Profile			
Experiment No.3	Creativity and Innovation	4 Hrs.	CO2

**Learning Objectives**

- Understand creativity and innovation.
- Differentiate between an idea and an innovation.
- Develop divergent thinking.

Activity 1: Improve an Existing Product

Students select one product such as: Water bottle, School bag, Bicycle, Helmet, and Umbrella and suggest 5 improvements.

Practical Output: Creative Ideas Sheet

Experiment No.4	Identifying Problems		4 Hrs.	CO4
------------------------	-----------------------------	--	---------------	------------

Learning Objectives

- Understand the importance of identifying real problems.
- Observe problems in their surroundings.
- Separate minor inconveniences from meaningful problems.
- Record problems systematically.

Activity: “Problem Hunt” College, Classroom, Hostel, Canteen, Laboratory, Transport, Home, Community and identify at least 5 problems.

Example: Problem: Students waste time searching for available laboratory equipment.

Practical Output: Problem Identification Sheet

No.	Problem	Where observed?	Who faces it?
1			

Experiment No.5	From Problem to Opportunity		4 Hrs.	CO5
------------------------	------------------------------------	--	---------------	------------

Learning Objectives

- Understand the difference between a problem and an opportunity.
- Identify who is affected by a problem.
- Understand why some problems can become entrepreneurial opportunities.
- Convert a problem statement into an opportunity statement.

Simple Framework: Problem → Person Affected → Possible Need → Opportunity

Practical: Students convert 3 identified problems into opportunity statements.

Experiment No.6	Understanding the Customer		4 Hrs.	CO5
------------------------	-----------------------------------	--	---------------	------------

Amrutvahini

R. G. G. G.



	.			
Learning Objectives • Understand the meaning of customer/user. • Identify different types of users. • Understand basic customer needs. • Learn the importance of listening to users. Activity: “Who is My Customer?” For a selected problem, students identify: • Who faces the problem? • How frequently? • What difficulty do they experience? • What solution might they want? Mini Interview: Students interview 3–5 people using simple questions. Practical: Customer → Problem → Need → Expected Solution				



Semester – II



Program:	F. Y. B. Tech	Semester:	II
Course:	Differential Equations And Numerical Integration	Course Code:	R26-SH-BSC-116
Teaching Scheme			
Lecture	Practical	Tutorial	Credit
4	--	--	04

Examination Scheme			
CCE	ESE	TW	PR
40	60	--	--

Course Description

This course covers essential mathematical concepts including differential equations, multiple integrals, interpolation, and numerical integration. It equips students with analytical and numerical skills to model and solve real-world engineering and physical science problems.

Course Relevance

The syllabus has direct applications in engineering mechanics, thermodynamics, electrical circuits, naval navigation, and computational analysis. It builds a strong foundation for using mathematical tools in motion analysis, structural calculations, and data estimation—critical in marine, aerospace, and technical domains.

Prerequisite:

1. Introduction of syllabus & Prerequisite: 2D and 3D Geometry
2. Concepts of Series
3. Basic Fundamental of Differentiation and Integration

Bridge Content:

Foundational topics such as algebra, calculus, coordinate geometry, and introduction of essential concepts in differential equations

Course Objectives:

To **FAMILIARIZE** the students with Multiple integrals and their applications, Mathematical modeling of physical systems using differential equations. The aim is to equip them with the concept and tools to understand advanced level mathematics and its applications, that would enhance thinking power, useful in their disciplines.

Course Outcomes: On completion of the course, learner will be able to -:

CO	Course Outcome	Bloom's Level
CO1	APPLY the effective mathematical tools for solving first order ordinary differential equations such as Exact and Reducible to exact Linear and reducible to Linear.	3
CO2	SOLVE Differential equation formed in Newton's law of cooling, electrical circuit, rectilinear motion, mass spring systems, heat transfer etc.	3
CO3	EVALUATE double and triple integrals in various coordinate systems.	3
CO4	APPLY of multiple integrals to find area bounded by curves, volume bounded by surfaces, Centre of gravity and Moment of inertia.	3
CO5	OBTAIN Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step methods used in modern scientific computing.	3

Course Contents

Unit 1	Differential Equations	10 Hrs.	CO1
Solution of first order first degree differential equations, Homogeneous DE, Exact differential equations, Equations reducible to exact form, Linear differential equations, Equations reducible to linear form. Branch-wise utilization of the unit.			



Exemplars / Practical Applications, Usage: Differential equations are used to model the growth and decay of populations and radioactive material, analyze dynamic systems like electrical circuits and mechanical vibrations, and describe the rates of change in fluid flow, heat transfer, and chemical reactions.			
Assignments: 1. Differential equations: Water Tank Draining Problems 2. Apply to a control system where input-output relation is a DE reducible to exact form.			
Unit 2	Applications of Differential Equations	10 Hrs.	CO2
Applications of Differential Equations to Orthogonal Trajectories, Newton's Law of Cooling, Application to Electric Circuit, Rectilinear Motion, Heat conduction. Branch-wise utilization of the unit.			
Exemplars / Practical Applications, Usage: Orthogonal trajectories help in designing families of curves in physics and electrostatics. Newton's law of cooling models temperature change in bodies and is widely used in thermal engineering and food processing. Rectilinear motion equations are used to model linear movement under variable forces in mechanical systems. Heat conduction is modeled using the heat equation, essential in thermal analysis of materials, insulation design, and electronic cooling systems. Transient response of circuits and thermal systems			
Assignments: 1. Orthogonal Trajectories: Determine path of fluid flow orthogonal to equipotential lines. 2. Application of DE: Determine time taken for a vehicle to stop under braking force. 3. Application of DE: Application to refrigeration cycle.			
Unit 3	Multiple Integral	10 Hrs.	CO3
Co-ordinate Geometry, Double integrations- Evaluation, change of order of integration, use polar co-ordinates, Triple integrations- Evaluation, use spherical polar and cylindrical co-ordinates. Branch-wise utilization of the unit.			
Exemplars / Practical Applications, Usage: Coordinate geometry, double integrals, and triple integrals are used to calculate the mass, volume, and other physical properties of objects with both uniform and variable densities, with multiple integrations in polar, cylindrical, or spherical coordinates used to simplify these calculations, particularly for objects with circular or spherical symmetry.			
Assignments: 1. Change order for evaluating $\int_0^1 \int_x^1 f(x,y) dy dx$ in thermal analysis. 2. Multiple integral: Problems on Fluid flow rate through a region.			
Unit 4	Applications of Multiple Integrals	10 Hrs.	CO4
Double Integration- Area, Mass, Centre of Gravity and Moment of Inertia Triple Integration- Volume, Dirichlet's theorem Branch-wise utilization of the unit.			
Exemplars / Practical Applications, Usage: These integrals are used to evaluate quantities over regions and solids with varying density or geometry, commonly found in structural and mechanical engineering. Applications include locating the center of gravity for stability analysis, and computing the moment of inertia for analyzing rotational motion in mechanical systems.			
Assignments: 1. Triple Integral: Volume of irregular mechanical part in design. 2. Dirichlet's theorem: Problems on electromagnetic field computations.			
Unit 5	Numerical Methods	10 Hrs.	CO5



Interpolation- Newtons Forward and Backward Interpolation, Lagrange's Interpolation,
Numerical Integration: Trapezoidal Rule, Simpson's $1/3^{\text{rd}}$, $3/8^{\text{th}}$ Rules
Branch-wise utilization of the unit.

Exemplars / Practical Applications, Usage: Interpolation methods are used to estimate intermediate values from discrete data, which is especially useful in signal processing, control systems, and experimental data analysis. Numerical integration techniques like the Trapezoidal rule and Simpson's $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ rules are applied to approximate definite integrals when functions are complex or data-driven. Numerical solutions where analytical integration is complex, Signal processing, structural simulation, aerodynamics

Assignments:

1. Use Newton's interpolation to estimate temperature at an intermediate time in a heat transfer experiment.
2. Numerical Integration to approximate area under stress-strain curve.
3. Numerical integral for thermal energy calculations.
4. Presentation:
 - Interpolation and Integration: Essential Tools for Engineering Computation
 - Mathematics Behind Data Estimation and Area Computation
 - From Experimental Data to Results: Interpolation and Integration in Practice

Course Projects:

1.----

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Ltd. (10th Edition (2019))
2. Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers. (45th Edition (2024–25))

Reference Books:

1. B. V. Ramana, Higher Engineering Mathematics. Tata McGraw Hill Education. (First Edition (2017))
2. M. D. Greenberg, Advanced Engineering Mathematics. Pearson Education. (2nd Edition (1998))
3. Peter V. O'Neil, Advanced Engineering Mathematics. Thomson Learning. (8th Edition (2018))
4. G. B. Thomas, Thomas' Calculus. Addison-Wesley, Pearson. (13th Edition (2018))
5. P. N. Wartikar, & J. N. Wartikar, Applied Mathematics (Vol. I & Vol. II). Vidyarthi Griha Prakashan, Pune. (9th Edition (2019))
6. Ron Larson, & David C. Falvo, Elementary Linear Algebra. Houghton Mifflin Harcourt Publishing Company. (7th Edition (2013))

MOOCs Links and additional reading material:

Unit 1: Differential Equations

- <https://www.youtube.com/watch?v=Im242eBqaxw&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&index=52>
- <https://www.youtube.com/watch?v=De-yi95YILE&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&index=53>
- <https://www.youtube.com/watch?v=6r5jft8xrXM&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&index=54>
- <https://www.youtube.com/watch?v=Wx19LXs77mM&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&index=55>
- <https://www.youtube.com/watch?v=AEHTsXRaQmE&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&index=56>

Unit 2: Applications of Differential Equations

- <https://www.youtube.com/watch?v=5sphfNn4YYM>

Amrutvahini

R. G. G. G.



- <https://www.youtube.com/watch?v=IICR-wljYcA>
- <https://www.youtube.com/watch?v=nsf9KwRT98s>
- https://www.youtube.com/watch?v=rw30_ONcHQo

Unit 3: Multiple Integral

- https://www.youtube.com/watch?v=gQ-u_HlSKNk
- <https://youtu.be/KgItZSst2sU?si=2hAdQzkaGZxAonDC>
- <https://youtu.be/T7XPoJmdUZ8?si=9aRrCuJumL2B5nRE>

Unit 4: Applications of Multiple Integrals

- <https://www.youtube.com/watch?v=usMCKWyZZiU>
- https://www.youtube.com/watch?v=cHk_BKIoIXM&list=PLbRMhDVUMngflrZCNOyPZwHUU1pP66vQW&index=25
- <https://www.youtube.com/watch?v=zYObFXyDLJY&list=PLbRMhDVUMngflrZCNOyPZwHUU1pP66vQW&index=26>
- https://www.youtube.com/watch?v=FtUBwF4ppjw&list=PLtKWB-wrvn4nA2h8TFxzWL2zy8O9th_fy&index=27

Unit 5: Numerical Methods*Interpolation-*

- https://www.youtube.com/watch?v=oY1F9QGLdTY&list=PLyqSpQzTE6M_Fy0lgicmuEyWZ-BhXyG6Y&index=74
- <https://www.youtube.com/watch?v=Lp2MdAvk2MY&list=PL6E313980EF23CA6E&index=25>
- <https://www.youtube.com/watch?v=nhfCY43iAP0&list=PL6E313980EF23CA6E&index=26>
- https://www.youtube.com/watch?v=_7BWFgJNNkA&list=PL6E313980EF23CA6E&index=28
- <https://www.youtube.com/watch?v=zvqXMA8OKYA&list=PL6E313980EF23CA6E&index=29>
- https://www.youtube.com/watch?v=HJg2OabtsgM&list=PLyqSpQzTE6M_Fy0lgicmuEyWZ-BhXyG6Y&index=50

Numerical Integration:

- https://www.youtube.com/watch?v=YTHt4Sp8Hag&list=PLyqSpQzTE6M_Fy0lgicmuEyWZ-BhXyG6Y&index=61
- https://www.youtube.com/watch?v=DyOS2BuHL3A&list=PLyqSpQzTE6M_Fy0lgicmuEyWZ-BhXyG6Y&index=59
- https://www.youtube.com/watch?v=Cfcc1WceJOw&list=PLyqSpQzTE6M_Fy0lgicmuEyWZ-BhXyG6Y&index=56

Strength of CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	2	2	1	-	2
CO2	3	3	-	-	-	-	2	2	1	-	2
CO3	2	2	-	-	-	-	2	2	1	-	2
CO4	3	3	-	-	-	-	2	2	1	-	2
CO5	3	3	-	-	-	-	2	2	1	-	2
Avg.	2.6	2.6	-	-	-	-	2	2	1	-	2

Note - 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Amrutvahini

R. G. G. G.



Assessment Pattern							
BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	✓	✓	✓	-	✓	✓	✓
K2	✓	✓	✓	-	✓	-	✓
K3	✓	✓	✓	-	✓	-	✓
K4	-	-	-	-	-	-	-
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses:

1. Modeling and simulation
2. Real-world data analysis
3. Mechanical/electrical system design
4. Advanced software tools like MATLAB, ANSYS, CFD, and ML algorithms
5. **GATE Exam/ CAT Exam /Aptitude Tests**

Job Mapping:

Job opportunities that one can get after learning this course:

1. Applied Mathematician
2. Computational Scientist
3. Numerical Analyst
4. Data Analyst
5. Tool Design Engineer

Amrutvahini

R. G. G. G.



Program:	F. Y. B. Tech.			Semester:	II			
Course:	Programming in C			Course Code:	R26-AI-PCC-119			
Teaching Scheme				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	OR	
02	-	-	02	40	60	-	-	
Course Description: This course introduces the fundamental concepts of structured programming using the C programming language. It focuses on developing algorithmic thinking, problem-solving skills and programming logic through the design and implementation of C programs. The course covers C fundamentals, operators, control structures, arrays, strings, user-defined functions and structures. Emphasis is placed on writing, testing, debugging, and documenting simple programs using modular programming practices to solve basic engineering and real-world computational problems. The course provides a strong foundation for advanced programming and core computer science courses.								
Course Relevance: Programming in C provides the foundation for computational thinking, structured programming and problem-solving skills essential for engineering students. The course enables learners to develop logical and modular programs, serving as a prerequisite for advanced courses such as Data Structures, Object-Oriented Programming, Operating Systems and Database Management Systems.								
Prerequisite: Basic knowledge of Computer Fundamentals , Basic Mathematics								
Course Objectives: 1. Understand the fundamental concepts of C Programming. 2. Acquire knowledge and apply operators and expressions in C Programming. 3. Apply decision-making and iterative control structures in C Programming for problem solving. 4. Design solutions using arrays, character arrays and string handling techniques in C Programming. 5. Design and develop solutions for simple computational problems using user-defined functions and structures in C Programming.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome						Bloom's Level	
CO1	Explain Algorithms, Flowcharts, variables and storage						2	
CO2	Discuss arithmetic, relational, logical, bitwise, conditional operators and expressions.						2	
CO3	Demonstrate iterative control structures to solve computational problems						3	
CO4	Implement solutions using one, two-dimensional arrays and string library functions						4	
CO5	Understand user defined functions and structures.						4	
Course Contents								
Unit 1	Introduction to Fundamental Concepts of C Programming						6 Hrs.	CO1
Basic Concepts: Algorithms, Flowcharts, Pseudocode, Program, Characteristics of Good Programs, Features and Applications of C, Structure of a C Program, Compilation and Execution Process.								

4/10/25

R. G. G. G.

C Fundamentals: Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration and Initialization of Variables, Assigning Values to Variables, Symbolic Constants, Basic Input/Output Functions (printf(), scanf()).			
Exemplar / Case Study / Practical Applications and usage: Understand the complete program development cycle, including program creation, compilation, execution, testing and debugging of simple C programs.			
Unit 2	Operators and Expressions	6 Hrs.	CO2
Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators (Introduction), sizeof() Operator.			
Expressions: Arithmetic Expressions, Evaluation of Expressions, Operator Precedence and Associativity, Type Conversion and Type Casting, Introduction to Mathematical Functions.			
Exemplar / Case Study / Practical Applications and usage: Student Grade and Percentage Calculator			
Unit 3	Decision Making and Flow Control	6 Hrs.	CO3
Decision Making and Branching: Simple if, if-else, Nested if, else-if Ladder, switch Statement, Conditional Operator.			
Decision Making and Looping: while, do-while, for Loops, Nested Loops, break, continue, goto (Introduction and Limitations).			
Programming Applications: Number Processing, Prime Number, Menu-driven Programs, Simple Pattern Generation.			
Exemplar / Case Study / Practical Applications and usage: Library Management Menu System			
Unit 4	Arrays and Strings	6 Hrs.	CO4
Arrays: One-dimensional Arrays, Declaration and Initialization of One-dimensional Arrays, Two-dimensional Arrays, Matrix Representation, Matrix Addition.			
Character Arrays and Strings: Declaration and Initialization of String Variables, Reading and Writing Strings, String Handling Functions: strlen(), strcpy(), strcat(), strcmp(), strcmp().			
Exemplar / Case Study / Practical Applications and usage: Student Record Management using Arrays and Strings			
Unit 5	Functions and Structures	6 Hrs.	CO5
User Defined Functions: Need for User-defined Functions, Elements of User-defined Functions, Definition of Functions, Function Declaration, Function Calls, Return Values and their Types, Categories of Functions: No Arguments and No Return Value, Arguments but No Return Value, Arguments with Return Value, No Arguments but Return Value, Recursive Functions.			
Structures: Structure, Structure Type Declaration, Structure Declaration, Referencing Structure Members, Initialization of Structures.			
Exemplar / Case Study / Practical Applications and usage: Employee Payroll Management System			

**Textbooks:**

1. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw Hill Education, 2019, ISBN: 978 93-5260-618-0.
2. Yashavant Kanetkar, Let Us C, 17th Edition, BPB Publications, 2020, ISBN: 978-93-89898-06-3.

Reference Books:

1. Stephen G. Kochan, Programming in C, 4th Edition, Addison-Wesley Professional, 2014, ISBN: 978-0-321-77641-9.
2. H. M. Deitel and P. J. Deitel, C: How to Program, 8th Edition, Pearson Education, 2015, ISBN: 978-0-13-397689-2.
3. Peter Prinz and Tony Crawford, C in a Nutshell: The Definitive Reference, 2nd Edition, O'Reilly Media, 2015, ISBN: 978-1-491-94728-8.

MOOCs Links and additional reading material:

1. Learn C Programming-Programiz <https://www.programiz.com/c-programming>
2. C Programming Language Tutorials – GeeksforGeeks <https://www.geeksforgeeks.org/c-programming-language/>
3. Programming in C: By Prof. S. N. Sivanandam, IIT Kanpur (NPTEL) https://onlinecourses.nptel.ac.in/noc23_cs53/preview
4. Programming in C: By Prof. S. R. Iyengar, IIT Ropar (NPTEL) https://onlinecourses.nptel.ac.in/noc22_cs40/preview

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments/ Case Studies	Course Project	Field Activity / Case Study	Quiz / Presentation etc.	
L1	-	-	-	-	-	-	-
L2	✓	✓	✓	-	-	✓	✓
L3	✓	✓	✓	-	-	✓	✓
L4	-	-	✓	-	-	-	✓
L5	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	1	3	2	-
CO2	3	3	2	1	2	-	-	-	-	-	1	3	2	1
CO3	2	3	3	2	2	-	-	-	-	-	1	3	3	1
CO4	2	2	3	2	2	-	-	-	-	-	1	3	3	2
CO5	2	2	2	3	2	-	-	-	-	1	1	3	3	2
Avg	2.4	2.4	2.2	1.6	2.0	-	-	-	-	0.2	1.0	3.0	2.6	1.2

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

Amrutvahini

R. Ganesh



This course serves as a prerequisite for maps with the following future courses:

- **Data Structures** – Applying arrays, functions, structures, and problem-solving techniques for implementing linear and non-linear data structures.
- **Object-Oriented Programming (C++)** – Building a strong foundation in programming logic, control structures, and modular programming concepts.
- **Database Management Systems (DBMS)** – Developing programming logic and computational thinking for database-driven applications.
- **Operating Systems** – Understanding system-level programming concepts and process-oriented programming fundamentals.
- **Computer Networks** – Applying programming concepts for network-based applications and socket programming.
- **System Programming** – Utilizing C programming concepts for developing system-level utilities and software.
- **Embedded Systems and IoT** – Applying C programming for microcontroller-based and embedded application development.
- **Software Engineering** – Developing structured programming skills required for software design, implementation, testing, and maintenance.

Job Mapping:

Job/Future opportunities that one can get after learning this course:

- Junior C Programmer
- Entry-Level Software Developer
- Application Programmer
- Embedded Systems Programmer (Foundation)
- Technical Support Engineer
- Programming Trainee



Program:	F. Y. B. Tech (A & R)			Semester:	II		
Course:	Foundations of Automation and Robotics Engineering			Course Code:	R26-AR-PCC-118		
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
02	-	-	02	40	60	-	-
Course Description: This course offers an introduction to the fundamental principles of automation and robotics. It emphasizes essential concepts, technologies, and practical applications, utilizing straightforward explanations and illustrative examples.							
Course Relevance: The course establishes a comprehensive foundation and fosters early awareness of the tools, methodologies, and career prospects within the fields of automation and robotics, thereby equipping students for more in-depth studies in subsequent years.							
Prerequisite: Engineering Mathematics I, Engineering Physics (Mechanics), Introduction to Programming, Basic Electrical and Electronics Engineering, Engineering Graphics.							
Bridge Content: This course bridges foundational theory with practical applications, guiding students from basic robotics principles and control systems to AI integration, mechanical design, and ethical considerations, preparing them for real-world automation and robotics challenges.							
Course Objectives: 1. UNDERSTAND the basic principles of robotics and automation, including the USA principle (Understand, Simplify, Automate), in a simple and practical way. 2. IDENTIFY and DESCRIBE basic technologies used in robotics such as control systems, embedded electronics, and mechanical design. 3. APPLY beginner-friendly software tools and simulators to DESIGN and TEST simple robotic tasks. 4. RECOGNIZE real-life applications of robotics in fields like farming, healthcare, and manufacturing. 5. EXPLAIN simple ethical issues and explore possible career paths in robotics and automation.							
Course Outcomes: After learning the course, students will be able to:							
CO	Course Outcome					Bloom’s Level	
CO1	RECALL and EXPLAIN the meaning of robotics, automation, the USA principle, and basic types of robots.					2	
CO2	DESCRIBE the role of simple control systems, sensors, and microcontrollers in basic robotic applications.					2	
CO3	USE a simulator or beginner-friendly software to CREATE and TEST a basic robotic task (e.g., pick-and-place).					3	
CO4	IDENTIFY and give examples of how robotics and AI are used in agriculture, healthcare, and industry.					3	
CO5	RECOGNIZE basic ethical concerns and LIST possible career opportunities in robotics.					2	



Course Content			
Unit 1	Robotics & Autonomous Systems	6 Hrs.	CO1
Historical development of industrial robots, robot anatomy, laws of robots, Classification of robots, basic performance and selection criteria of robots. Categories of tools for robot design, degrees of freedom, joint types, configurations, workspace, types of robot programming, robot languages and simulators, economic analysis, Use-cases: warehouse automation, surveillance bots, social robots. Exemplars / Practical Applications and usage: In small e-commerce warehouses (e.g., local Amazon fulfillment centers), robotic arms like the ABB IRB 6700 perform pick-and-place tasks to sort packages, improving efficiency and reducing manual labor. Simulations help optimize arm movements for speed and accuracy. Assignments: Design a simple 2D simulation of a robotic arm for a warehouse pick-and-place task using a free simulator like RoboDK or GeoGebra. Simulate the arm moving a 2 kg package from a conveyor to a shelf, ensuring it follows a smooth path within a 1 m workspace.			
Unit 2	Control & Embedded Technology	6 Hrs.	CO2
Open-loop and closed-loop systems, basic structure of control system, Types of controllers and their significance PID control, PLC, microprocessor and microcontroller, Arduino/Microcontroller architecture: digital I/O, analog sensors, PWM control (Pulse Width Modulation), Overview of Mechatronics system integration, Industrial applications: bottling plant, water level controller. Exemplars / Practical Applications and usage: In small-scale agriculture (e.g., local farms), Arduino-based controllers manage water pumps for drip irrigation, ensuring consistent watering schedules to save water and improve crop yield. Assignments: Build an Arduino-based circuit to control a water pump motor that turns on for 5 seconds every minute, simulating a basic water level controller for a small irrigation system.			
Unit 3	AI & Human-Robot Interaction	6 Hrs.	CO3
Basics of AI and ML: supervised/unsupervised learning, Human-Robot Interaction (HRI), Cognitive robotics, Introduction to IoT and cloud computing in automation, Applications of GenAI in automation: ChatGPT, LLMs, Basics of data analytics and visualization using Python, NDVI (Normalized Difference Vegetation Index) in Agri-robots, emerging trends: AR/VR, block-chain, digital twins. Exemplars / Practical Applications and usage: In precision agriculture, Agri-robots use sensors to collect temperature or soil data, visualized with Python tools to help farmers make decisions, such as when to irrigate or plant crops (e.g., NDVI-based monitoring for crop health). Assignments: Use Python to create a simple data visualization of temperature sensor data (simulated or real) from a robotic weather station, plotting the data to identify trends for an agricultural application.			
Unit 4	Mechanical Design & Smart Manufacturing	6 Hrs.	CO4
Historical evolution and definition of automation and robotics, Types of automation, USA principle, Role of CAD in robot and automation system design, Basics of modern manufacturing processes: CNC, 3D Printing, Injection Molding, Introduction to Flexible Manufacturing Systems (FMS) and lean manufacturing, Digital Twin & QA. Smart materials.			

**Exemplars / Practical Applications and usage:**

In small-scale electronics manufacturing (e.g., local circuit board assembly), 3D-printed gripper bases are used on robotic arms to hold components, enabling cost-effective customization for specific tasks.

Assignments:

Design a simple 3D model of a robotic gripper base using Tinkercad, suitable for holding a small object (e.g., a 100 g component) in a manufacturing assembly line.

Unit 5**Robotics Career & Ethics****6 Hrs.****CO5**

Scenario of robotics in India industries. Robotics and AI applications in various domains: healthcare, defense, agriculture, logistics, manufacturing and automobile, Professional ethics in AI and automation, Career paths: job roles, essential skills, professional organizations, Future technologies: space robotics, collaborative robots, bionics, brain-machine interface.

Exemplars / Practical Applications and usage:

In healthcare clinics, cobots like Universal Robots' UR5 assist with tasks like delivering medical supplies, improving efficiency but raising ethical concerns about patient trust and staff job security.

Assignments:

Use online resources (e.g., articles from IEEE or Robotics Business Review) to identify one ethical issue (e.g., patient privacy) and one career opportunity (e.g., cobot programmer), and summarize their impact in a simple report.

Course Projects:**1. Arduino-Based Automatic Plant Watering System**

- **Description:** Design and build a basic automatic irrigation system using an Arduino, soil moisture sensor, and a small water pump.
- **Learning Outcome:** Apply basic embedded system programming and understand control systems in an agricultural context.

2. 2D Simulation of a Robotic Pick-and-Place Arm

- **Description:** Create a simple 2D simulation using RoboAnalyser/GeoGebra to move an object from one position to another, optimizing path and movement.
- **Learning Outcome:** Use simulation software to design and test a basic robotic application.

Textbooks:

1. D. K. Pratihari. (2019), Fundamentals of Robotics, Narosa Publishing House, ISBN: 978-81-8487-577-5
2. M. P. Groover. (2015). Automation, Production Systems, and Computer-Integrated Manufacturing (4th ed.). Pearson. ISBN: 978-9332572492
3. S. B. Niku. (2020). Introduction to Robotics: Analysis, Control, Applications (3rd ed.). Wiley. ISBN: 978-1-119-52760-2
4. Prateek Joshi. (2017), Artificial Intelligence with Python: A Comprehensive Guide to Building Intelligent Apps for Python Beginners and Developers, Packt Publishing, ISBN: 978-1786464392
5. Massimo Banzi, Michael Shiloh. (2022), Getting Started with Arduino 4e: The Open-Source Electronics Prototyping Platform, Make Community, LLC, ISBN: 978-1680456936
6. S. R. Deb & S. Deb. (2017). Robotics technology and flexible automation (2nd ed.). Tata McGraw-Hill Education. ISBN: 978-0070077911

Reference Books:

1. Y. Koren. (1985). Robotics for Engineers. McGraw-Hill. ISBN: 978-0070353992
2. Robert J. Schilling. (2015), Fundamentals of Robotics Analysis and Control, Pearson, ISBN:



9789332555235

MOOCs Links and additional reading material:

1. Arduino tutorials: <https://www.arduino.cc/en/Tutorial/HomePage>
2. GeoGebra guides: <https://www.geogebra.org>
3. TinkerCAD for 3D design: <https://www.tinkercad.com>
4. Robotics Business Review for industry insights: <https://www.roboticsbusinessreview.com>
5. IEEE Robotics and Automation Society: <https://www.ieee-ras.org>
6. V. B. Shinde, P. J. Pawar, V. S. Gadakh, "Research Progress on Industrial Robots: A Review", Recent Patents on Mechanical Engineering. 19 (1), 27-61, 2026.
<https://dx.doi.org/10.2174/0122127976326652241018114550>.

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	1	2	2	1	2
CO2	3	2	2	1	2	-	-	-	-	1	2	2	2	2
CO3	3	2	3	2	3	-	-	-	-	2	2	3	2	2
CO4	2	2	2	1	2	1	1	-	-	1	2	2	2	2
CO5	1	-	-	-	-	2	2	3	-	1	3	1	1	3
Avg.	2	2	2	1	2	2	2	3	-	1	2	2	2	2

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	√	√	√	√	-	-	√
K2	√	√	√	√	-	-	√
K3	-	√	√	-	-	-	-
K4	-	-	-	-	-	-	-
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses:

- Sensors and Actuators for Robotics
- Mechatronics and Control Systems
- Industrial Robotics and Automation
- Artificial Intelligence in Robotics
- Robot Kinematics and Dynamics

Job Mapping:

Job opportunities that one can get after learning this course:

- Robotics Engineer/ Analyst
- Automation System Analyst
- Process Simulation Analyst

A. J. J.

R. J. J.



- Embedded Systems Analyst
- Field Analyst in Agricultural/Industrial Automation



Program:	F. Y. B. Tech (Civil)				Semester:		II	
Course:	Smart and Sustainable Civil Engineering				Course Code:		R26-CE-PCC-118	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
2	-	-	2	40	60	-	-	

Course Description:

A course in Smart and Sustainable Civil Engineering typically encompasses a blend of core Civil Engineering subjects with specialized modules focusing on modern technologies and sustainable practices.

Course Relevance:

The curriculum is designed to equip students with the knowledge and skills to tackle complex infrastructure challenges in the context of rapid urbanization, climate change, and resource scarcity.

Prerequisite:

Basic knowledge of Civil Engineering fundamentals, environmental studies, construction materials, infrastructure systems, and elementary concepts of sustainability

Bridge Content:

Modernization of construction industry to meet the need of mankind through recent techniques and materials.

Course Objectives:

1. To **INTRODUCE** students with the evolution, significance, and sustainability of civil engineering, highlighting emerging technologies, smart infrastructure, and diverse career opportunities through real-world case studies.
2. To **EQUIP** students with knowledge and practical skills in modern surveying instruments, GPS/GNSS, GIS, remote sensing, and drone/LIDAR technologies for accurate mapping, analysis, and sustainable infrastructure plan.
3. To **ENABLE** students to understand and apply innovative, sustainable, and smart construction materials and modern techniques, promoting efficiency, durability, and environmental responsibility in civil engineering projects.
4. To **ENABLE** students to understand the development, classification, and design of highways, expressways, and railways, and to explore intelligent, urban, and prefabricated transport and building systems for sustainable infrastructure.
5. To **INTRODUCE** concepts of green, energy-efficient, and sustainable construction practices, emphasizing environmental protection, resource conservation, and assessment methods for resilient Civil Engineering projects.

Course Outcomes: After learning the course, students will be able to

CO	Course Outcome	Bloom's Level
CO1	DESCRIBE the evolution, scope, and societal importance of civil engineering and its contribution to national development.	2
CO2	EXPLAIN the use of modern surveying equipment, GPS, GIS, and remote sensing technologies in civil engineering applications.	2
CO3	IDENTIFY and DIFFERENTIATE between traditional and innovative construction materials and methods used in modern infrastructure projects.	2
CO4	DEMONSTRATE awareness of smart transportation systems including bridges, expressways, railways, and metro rail, along with their planning and construction principles.	2
CO5	APPLY sustainable Civil Engineering principles such as green building concepts,	3

Amrutvahini

R. G. G. G.



	environmental impact assessment, and climate-resilient infrastructure planning.	
Course Contents		
Unit 1	Evolution and Scope of Civil Engineering	5 Hrs. CO1
Introduction and National/International Significance • Definition and evolution of Civil Engineering from ancient to modern times. • Key contributions of Civil Engineering to infrastructure: buildings, roads, bridges, dams, etc. • Role in economic development and improving quality of life through infrastructure. • Introduction to Sustainable Development and 17 SDGs. Emerging Trends and Career Outlook • Introduction to smart infrastructure, automation in construction industry. • Use of emerging tools: BIM (Building Information Modeling), IoT, robotics • Diverse career opportunities and roles in modern civil engineering projects. • Case studies: Iconic Indian projects like Atal Tunnel, Statue of Unity, UNESCO World Heritage Sites, Burj Khalifa...etc		
Exemplars / Practical Applications and usage: • BIM is more than just 3D modeling; it's a collaborative process that integrates data-rich models with smart workflows. • Design and Planning Optimization, Project Management and Scheduling, Infrastructure and Structural Health Monitoring, Risk Assessment and Mitigation, Sustainability and Environmental Impact.		
Assignments: 1. How can increase the quality of life through infrastructure. 2. Report on Smart Cities guidelines.		
Unit 2	Advanced Surveying and Geospatial Techniques	5 Hrs. CO2
Modern Surveying Instruments and Methods • Working principles of Total Station and its application in fieldwork. • Comparison of traditional instruments (chain, theodolite) with modern tools (Total Station, EDM) • GPS and GNSS: Introduction, Working Principles, uses. Geospatial Technology Applications • Fundamentals of GIS and RS and its application in mapping, urban planning and analysis. • Remote sensing basics: satellite imagery and interpretation. • Introduction to drone surveys and LIDAR for terrain and infrastructure mapping.		
Exemplars / Practical Applications and usage: • Operate advanced surveying equipment for real-world applications. • Conduct topographical, cadastral, and infrastructure surveys. • Create accurate maps, profiles, and 3D models. • Analyze spatial data for planning, design, and decision-making.		
Assignments: 1. Enlist the modern surveying instruments and explain any one with proper function. 2. Elaborate practical application of geospatial technology in the field of Civil Engineering		
Unit 3	Modern Construction Materials and Methods	5 Hrs. CO3
Innovative and Sustainable Materials • Types and applications of advanced concrete: self-compacting, fiber-reinforced, nano concrete. • Eco-friendly and sustainable materials: fly ash bricks, geopolymers concrete, recycled aggregates.		



- Smart and high-performance materials: carbon fiber, smart glass, phase change materials.

Smart sensors in construction, carbon footprint reduction

Modern Construction Techniques

- 3D printing in building components and on-site construction.
- Prefabrication and modular systems for speed and precision.
- Pre-engineered buildings: concept, benefits, and case studies.

Exemplars / Practical Applications and usage:

- Extends the lifespan of infrastructure like bridges, roads, tunnels, and buildings, significantly reducing maintenance costs and increasing durability.
- Speeds up construction, improves quality control, enhances structural integrity, reduces on-site waste, and allows for greater customization, lowers on-site labor requirements.

Assignments:

1. Choose three to five sustainable building materials and for each, discuss their environmental benefits, construction techniques, and current market adoption.
2. Describe in detail application of modern construction techniques.

Unit 4	Smart Transportation Infrastructure	5 Hrs.	CO4
---------------	--	---------------	------------

Highways, Expressways & Railways

- **Role and Importance:** Importance of road transportation, history of road development (e.g., Roman roads, Indian road development plans like Nagpur, Bombay, and Lucknow plans).
- **Road Classification:** Various classifications (National Highways, State Highways, Major District Roads, Other District Roads, Village Roads, Expressways).
- **Expressways:** classification and case study (Delhi–Mumbai Expressway, Samruddhi Expressway).

Intelligent and Urban Transport Systems

- Introduction to Intelligent Transportation Systems (ITS) for smart mobility.
- Concepts of smart roads: plastic roads, solar roads, and piezoelectric roads.
- Urban transport advancements: Metro rail systems – need, design, construction, operation and Case Study: Delhi Metro or Mumbai Metro.

Exemplars / Practical Applications and usage:

Highways for inter-city Connectivity, Commercial and Freight Transport, Commuting, Tourism and Personal Travel, Emergency Services and National Defense.

Expressways for High-Speed, Long-Distance Travel, Reducing Congestion, Economic Corridors, Bypassing Urban Areas, Regional Connectivity.

Railways for Mass Passenger Transport, Heavy Freight Transport, Specialized Transport, Land Use Optimization.

Assignments:

1. List out the agencies involved in the transportation/ highway system in India.
2. Explain Intelligent Transportation Systems (ITS) for smart mobility.

Unit 5	Sustainable Civil Engineering Practices	5 Hrs.	CO5
---------------	--	---------------	------------

Green and Energy-Efficient Construction

- Definition and benefits of green buildings.
- Green building materials and techniques: low energy and low carbon.
- Rating systems: LEED, GRIHA – overview and criteria for certification.

Environmental Protection and Resilience

- Basics of Environmental Impact Assessment (EIA) in civil projects.
- Waste management and water conservation practices on construction sites.

Amrutvahini

R. G. G. G.



- Rain Water Harvesting

Exemplars / Practical Applications and usage:

Renewable Energy Integration
 Smart Building Systems
 Passive Design Strategies, Hybrid Energy Systems
 Gravity-Based Energy Storage
 Grey water Recycling
 Rainwater harvesting

Assignments:

1. Definition of green building? Explain in detail green building rating system.
2. What is mean by EIA and their project criteria for sanctioning?

Course Projects:

-

Textbooks:

1. S.S. Bhavikatti, "Basic Civil Engineering", New Age International Publisher, 3rd edition.
2. S.K. Khanna, C.E.G. Justo, "Highway Engineering", Nem Chand and Bros. Roorkee, 10th edition.
3. R. Subramanian, "Surveying and Levelling", Oxford University

Reference Books:

1. Handbook of Green Building design and construction by Charles Kibert
2. Sustainable Building Materials by J. KhatibPress, 2nd edition.

MOOCs Links and additional reading material:

1. Website of LEED <https://www.usgbc.org/leed>
2. Website of GRIHA <https://www.grihaindia.org/griha-rating>
3. Environment Protection Act 1986 (EIA)

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	1	2	3	-	-	-	2	2	3	3	3
CO2	3	1	2	1	2	3	-	-	-	-	2	3	3	3
CO3	3	1	2	1	2	3	-	-	-	2	2	3	3	3
CO4	3	1	2	1	2	3	-	-	-	2	2	3	3	3
CO5	3	1	2	1	2	3	2	-	-	2	2	3	3	3
Avg.	3.0	1.0	2.0	1.0	2.0	3.0	2.0	-	-	2.0	2.0	3.0	3.0	3.0

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

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	√	√	√	-	√	-	√
K2	√	√	√	-	√	-	√
K3	√	√	√	√	√	√	√
K4	-	-	-	-	√	-	-

Signature

Signature



K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses:

1. Architectural Planning and Design of Building
2. Architecture and Town Planning
3. Transportation Engineering
4. Environmental Engineering
5. Green Building and Smart Cities

Job Mapping:

Job opportunities that one can get after learning this course:

1. Government Sector
2. Construction and Real Estate Sector
3. Consultancy Firms
4. Research and Academia
5. Tech and Innovation Startups



Program:		F. Y. B. Tech.			Semester:		II	
Course:		Programming in C			Course Code:		R26-CO-PCC-120	
Teaching Scheme				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	OR	
02	-	-	02	40	60	-	-	
Course Description: This course introduces the fundamental concepts of structured programming using the C programming language. It focuses on developing algorithmic thinking, problem-solving skills and programming logic through the design and implementation of C programs. The course covers C fundamentals, operators, control structures, arrays, strings, user-defined functions and structures. Emphasis is placed on writing, testing, debugging, and documenting simple programs using modular programming practices to solve basic engineering and real-world computational problems. The course provides a strong foundation for advanced programming and core computer science courses.								
Course Relevance: Programming in C provides the foundation for computational thinking, structured programming and problem-solving skills essential for engineering students. The course enables learners to develop logical and modular programs, serving as a prerequisite for advanced courses such as Data Structures, Object-Oriented Programming, Operating Systems and Database Management Systems.								
Prerequisite: Basic knowledge of Computer Fundamentals , Basic Mathematics								
Course Objectives: 6. Understand the fundamental concepts of C Programming. 7. Acquire knowledge and apply operators and expressions in C Programming. 8. Apply decision-making and iterative control structures in C Programming for problem solving. 9. Design solutions using arrays, character arrays and string handling techniques in C Programming. 10. Design and develop solutions for simple computational problems using user-defined functions and structures in C Programming.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome						Bloom's Level	
CO1	Explain Algorithms, Flowcharts, variables and storage						2	
CO2	Discuss arithmetic, relational, logical, bitwise, conditional operators and expressions.						2	
CO3	Demonstrate iterative control structures to solve computational problems						3	
CO4	Implement solutions using one, two-dimensional arrays and string library functions						4	
CO5	Understand user defined functions and structures.						4	
Course Contents								
Unit 1	Introduction to Fundamental Concepts of C Programming						6 Hrs.	CO1
Basic Concepts: Algorithms, Flowcharts, Pseudocode, Program, Characteristics of Good Programs, Features and Applications of C, Structure of a C Program, Compilation and Execution Process.								

4/10/25

R. G. G. G.

C Fundamentals: Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration and Initialization of Variables, Assigning Values to Variables, Symbolic Constants, Basic Input/Output Functions (printf(), scanf()).			
Exemplar / Case Study / Practical Applications and usage: Understand the complete program development cycle, including program creation, compilation, execution, testing and debugging of simple C programs.			
Unit 2	Operators and Expressions	6 Hrs.	CO2
Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators (Introduction), sizeof() Operator.			
Expressions: Arithmetic Expressions, Evaluation of Expressions, Operator Precedence and Associativity, Type Conversion and Type Casting, Introduction to Mathematical Functions.			
Exemplar / Case Study / Practical Applications and usage: Student Grade and Percentage Calculator			
Unit 3	Decision Making and Flow Control	6 Hrs.	CO3
Decision Making and Branching: Simple if, if-else, Nested if, else-if Ladder, switch Statement, Conditional Operator.			
Decision Making and Looping: while, do-while, for Loops, Nested Loops, break, continue, goto (Introduction and Limitations).			
Programming Applications: Number Processing, Prime Number, Menu-driven Programs, Simple Pattern Generation.			
Exemplar / Case Study / Practical Applications and usage: Library Management Menu System			
Unit 4	Arrays and Strings	6 Hrs.	CO4
Arrays: One-dimensional Arrays, Declaration and Initialization of One-dimensional Arrays, Two-dimensional Arrays, Matrix Representation, Matrix Addition.			
Character Arrays and Strings: Declaration and Initialization of String Variables, Reading and Writing Strings, String Handling Functions: strlen(), strcpy(), strcat(), strcmp(), strcmp().			
Exemplar / Case Study / Practical Applications and usage: Student Record Management using Arrays and Strings			
Unit 5	Functions and Structures	6 Hrs.	CO5
User Defined Functions: Need for User-defined Functions, Elements of User-defined Functions, Definition of Functions, Function Declaration, Function Calls, Return Values and their Types, Categories of Functions: No Arguments and No Return Value, Arguments but No Return Value, Arguments with Return Value, No Arguments but Return Value, Recursive Functions.			
Structures: Structure, Structure Type Declaration, Structure Declaration, Referencing Structure Members, Initialization of Structures.			
Exemplar / Case Study / Practical Applications and usage: Employee Payroll Management System			

**Textbooks:**

1. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw Hill Education, 2019, ISBN: 978 93-5260-618-0.
2. Yashavant Kanetkar, Let Us C, 17th Edition, BPB Publications, 2020, ISBN: 978-93-89898-06-3.

Reference Books:

1. Stephen G. Kochan, Programming in C, 4th Edition, Addison-Wesley Professional, 2014, ISBN: 978-0-321-77641-9.
2. H. M. Deitel and P. J. Deitel, C: How to Program, 8th Edition, Pearson Education, 2015, ISBN: 978-0-13-397689-2.
3. Peter Prinz and Tony Crawford, C in a Nutshell: The Definitive Reference, 2nd Edition, O'Reilly Media, 2015, ISBN: 978-1-491-94728-8.

MOOCs Links and additional reading material:

1. Learn C Programming-Programiz <https://www.programiz.com/c-programming>
2. C Programming Language Tutorials – GeeksforGeeks <https://www.geeksforgeeks.org/c-programming-language/>
3. Programming in C: By Prof. S. N. Sivanandam, IIT Kanpur (NPTEL) https://onlinecourses.nptel.ac.in/noc23_cs53/preview
4. Programming in C: By Prof. S. R. Iyengar, IIT Ropar (NPTEL) https://onlinecourses.nptel.ac.in/noc22_cs40/preview

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments/ Case Studies	Course Project	Field Activity / Case Study	Quiz / Presentation etc.	
L1	-	-	-	-	-	-	-
L2	✓	✓	✓	-	-	✓	✓
L3	✓	✓	✓	-	-	✓	✓
L4	-	-	✓	-	-	-	✓
L5	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	1	3	2	-
CO2	3	3	2	1	2	-	-	-	-	-	1	3	2	1
CO3	2	3	3	2	2	-	-	-	-	-	1	3	3	1
CO4	2	2	3	2	2	-	-	-	-	-	1	3	3	2
CO5	2	2	2	3	2	-	-	-	-	1	1	3	3	2
Avg	2.4	2.4	2.2	1.6	2.0	-	-	-	-	0.2	1.0	3.0	2.6	1.2

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

Amrutvahini

R. Srinivasan



This course serves as a prerequisite for maps with the following future courses:

- **Data Structures** – Applying arrays, functions, structures, and problem-solving techniques for implementing linear and non-linear data structures.
- **Object-Oriented Programming (C++)** – Building a strong foundation in programming logic, control structures, and modular programming concepts.
- **Database Management Systems (DBMS)** – Developing programming logic and computational thinking for database-driven applications.
- **Operating Systems** – Understanding system-level programming concepts and process-oriented programming fundamentals.
- **Computer Networks** – Applying programming concepts for network-based applications and socket programming.
- **System Programming** – Utilizing C programming concepts for developing system-level utilities and software.
- **Embedded Systems and IoT** – Applying C programming for microcontroller-based and embedded application development.
- **Software Engineering** – Developing structured programming skills required for software design, implementation, testing, and maintenance.

Job Mapping:

Job/Future opportunities that one can get after learning this course:

- Junior C Programmer
- Entry-Level Software Developer
- Application Programmer
- Embedded Systems Programmer (Foundation)
- Technical Support Engineer
- Programming Trainee

Signature

Signature



Program:		F. Y. B. Tech.			Semester:		II	
Course:		Programming in C			Course Code:		R26-EC-PCC-120	
Teaching Scheme				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	OR	
02	-	-	02	40	60	-	-	
Course Description: This course introduces the fundamental concepts of structured programming using the C programming language. It focuses on developing algorithmic thinking, problem-solving skills and programming logic through the design and implementation of C programs. The course covers C fundamentals, operators, control structures, arrays, strings, user-defined functions and structures. Emphasis is placed on writing, testing, debugging, and documenting simple programs using modular programming practices to solve basic engineering and real-world computational problems. The course provides a strong foundation for advanced programming and core computer science courses.								
Course Relevance: Programming in C provides the foundation for computational thinking, structured programming and problem-solving skills essential for engineering students. The course enables learners to develop logical and modular programs, serving as a prerequisite for advanced courses such as Data Structures, Object-Oriented Programming, Operating Systems and Database Management Systems.								
Prerequisite: Basic knowledge of Computer Fundamentals , Basic Mathematics								
Course Objectives: 11. Understand the fundamental concepts of C Programming. 12. Acquire knowledge and apply operators and expressions in C Programming. 13. Apply decision-making and iterative control structures in C Programming for problem solving. 14. Design solutions using arrays, character arrays and string handling techniques in C Programming. 15. Design and develop solutions for simple computational problems using user-defined functions and structures in C Programming.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome						Bloom's Level	
CO1	Explain Algorithms, Flowcharts, variables and storage						2	
CO2	Discuss arithmetic, relational, logical, bitwise, conditional operators and expressions.						2	
CO3	Demonstrate iterative control structures to solve computational problems						3	
CO4	Implement solutions using one, two-dimensional arrays and string library functions						4	
CO5	Understand user defined functions and structures.						4	
Course Contents								
Unit 1	Introduction to Fundamental Concepts of C Programming						6 Hrs.	CO1
Basic Concepts: Algorithms, Flowcharts, Pseudocode, Program, Characteristics of Good Programs, Features and Applications of C, Structure of a C Program, Compilation and Execution Process.								

4/10/25

R. G. G. G.

C Fundamentals: Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration and Initialization of Variables, Assigning Values to Variables, Symbolic Constants, Basic Input/Output Functions (printf(), scanf()).			
Exemplar / Case Study / Practical Applications and usage: Understand the complete program development cycle, including program creation, compilation, execution, testing and debugging of simple C programs.			
Unit 2	Operators and Expressions	6 Hrs.	CO2
Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators (Introduction), sizeof() Operator.			
Expressions: Arithmetic Expressions, Evaluation of Expressions, Operator Precedence and Associativity, Type Conversion and Type Casting, Introduction to Mathematical Functions.			
Exemplar / Case Study / Practical Applications and usage: Student Grade and Percentage Calculator			
Unit 3	Decision Making and Flow Control	6 Hrs.	CO3
Decision Making and Branching: Simple if, if-else, Nested if, else-if Ladder, switch Statement, Conditional Operator.			
Decision Making and Looping: while, do-while, for Loops, Nested Loops, break, continue, goto (Introduction and Limitations).			
Programming Applications: Number Processing, Prime Number, Menu-driven Programs, Simple Pattern Generation.			
Exemplar / Case Study / Practical Applications and usage: Library Management Menu System			
Unit 4	Arrays and Strings	6 Hrs.	CO4
Arrays: One-dimensional Arrays, Declaration and Initialization of One-dimensional Arrays, Two-dimensional Arrays, Matrix Representation, Matrix Addition.			
Character Arrays and Strings: Declaration and Initialization of String Variables, Reading and Writing Strings, String Handling Functions: strlen(), strcpy(), strcat(), strcmp(), strcmp().			
Exemplar / Case Study / Practical Applications and usage: Student Record Management using Arrays and Strings			
Unit 5	Functions and Structures	6 Hrs.	CO5
User Defined Functions: Need for User-defined Functions, Elements of User-defined Functions, Definition of Functions, Function Declaration, Function Calls, Return Values and their Types, Categories of Functions: No Arguments and No Return Value, Arguments but No Return Value, Arguments with Return Value, No Arguments but Return Value, Recursive Functions.			
Structures: Structure, Structure Type Declaration, Structure Declaration, Referencing Structure Members, Initialization of Structures.			
Exemplar / Case Study / Practical Applications and usage: Employee Payroll Management System			

**Textbooks:**

1. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw Hill Education, 2019, ISBN: 978 93-5260-618-0.
2. Yashavant Kanetkar, Let Us C, 17th Edition, BPB Publications, 2020, ISBN: 978-93-89898-06-3.

Reference Books:

1. Stephen G. Kochan, Programming in C, 4th Edition, Addison-Wesley Professional, 2014, ISBN: 978-0-321-77641-9.
2. H. M. Deitel and P. J. Deitel, C: How to Program, 8th Edition, Pearson Education, 2015, ISBN: 978-0-13-397689-2.
3. Peter Prinz and Tony Crawford, C in a Nutshell: The Definitive Reference, 2nd Edition, O'Reilly Media, 2015, ISBN: 978-1-491-94728-8.

MOOCs Links and additional reading material:

1. Learn C Programming-Programiz <https://www.programiz.com/c-programming>
2. C Programming Language Tutorials – GeeksforGeeks <https://www.geeksforgeeks.org/c-programming-language/>
3. Programming in C: By Prof. S. N. Sivanandam, IIT Kanpur (NPTEL) https://onlinecourses.nptel.ac.in/noc23_cs53/preview
4. Programming in C: By Prof. S. R. Iyengar, IIT Ropar (NPTEL) https://onlinecourses.nptel.ac.in/noc22_cs40/preview

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments/ Case Studies	Course Project	Field Activity / Case Study	Quiz / Presentation etc.	
L1	-	-	-	-	-	-	-
L2	✓	✓	✓	-	-	✓	✓
L3	✓	✓	✓	-	-	✓	✓
L4	-	-	✓	-	-	-	✓
L5	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	1	3	2	-
CO2	3	3	2	1	2	-	-	-	-	-	1	3	2	1
CO3	2	3	3	2	2	-	-	-	-	-	1	3	3	1
CO4	2	2	3	2	2	-	-	-	-	-	1	3	3	2
CO5	2	2	2	3	2	-	-	-	-	1	1	3	3	2
Avg	2.4	2.4	2.2	1.6	2.0	-	-	-	-	0.2	1.0	3.0	2.6	1.2

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

Amrutvahini

R. Srinivasan



This course serves as a prerequisite for maps with the following future courses:

- **Data Structures** – Applying arrays, functions, structures, and problem-solving techniques for implementing linear and non-linear data structures.
- **Object-Oriented Programming (C++)** – Building a strong foundation in programming logic, control structures, and modular programming concepts.
- **Database Management Systems (DBMS)** – Developing programming logic and computational thinking for database-driven applications.
- **Operating Systems** – Understanding system-level programming concepts and process-oriented programming fundamentals.
- **Computer Networks** – Applying programming concepts for network-based applications and socket programming.
- **System Programming** – Utilizing C programming concepts for developing system-level utilities and software.
- **Embedded Systems and IoT** – Applying C programming for microcontroller-based and embedded application development.
- **Software Engineering** – Developing structured programming skills required for software design, implementation, testing, and maintenance.

Job Mapping:

Job/Future opportunities that one can get after learning this course:

- Junior C Programmer
- Entry-Level Software Developer
- Application Programmer
- Embedded Systems Programmer (Foundation)
- Technical Support Engineer
- Programming Trainee

Signature

Signature



Program:		F. Y. B. Tech.			Semester:		II	
Course:		Programming in C			Course Code:		R26-EE-PCC-120	
Teaching Scheme				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	OR	
02	-	-	02	40	60	-	-	
Course Description: This course introduces the fundamental concepts of structured programming using the C programming language. It focuses on developing algorithmic thinking, problem-solving skills and programming logic through the design and implementation of C programs. The course covers C fundamentals, operators, control structures, arrays, strings, user-defined functions and structures. Emphasis is placed on writing, testing, debugging, and documenting simple programs using modular programming practices to solve basic engineering and real-world computational problems. The course provides a strong foundation for advanced programming and core computer science courses.								
Course Relevance: Programming in C provides the foundation for computational thinking, structured programming and problem-solving skills essential for engineering students. The course enables learners to develop logical and modular programs, serving as a prerequisite for advanced courses such as Data Structures, Object-Oriented Programming, Operating Systems and Database Management Systems.								
Prerequisite: Basic knowledge of Computer Fundamentals , Basic Mathematics								
Course Objectives: 16. Understand the fundamental concepts of C Programming. 17. Acquire knowledge and apply operators and expressions in C Programming. 18. Apply decision-making and iterative control structures in C Programming for problem solving. 19. Design solutions using arrays, character arrays and string handling techniques in C Programming. 20. Design and develop solutions for simple computational problems using user-defined functions and structures in C Programming.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome						Bloom's Level	
CO1	Explain Algorithms, Flowcharts, variables and storage						2	
CO2	Discuss arithmetic, relational, logical, bitwise, conditional operators and expressions.						2	
CO3	Demonstrate iterative control structures to solve computational problems						3	
CO4	Implement solutions using one, two-dimensional arrays and string library functions						4	
CO5	Understand user defined functions and structures.						4	
Course Contents								
Unit 1	Introduction to Fundamental Concepts of C Programming						6 Hrs.	CO1
Basic Concepts: Algorithms, Flowcharts, Pseudocode, Program, Characteristics of Good Programs, Features and Applications of C, Structure of a C Program, Compilation and Execution Process.								
C Fundamentals: Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration and Initialization of Variables, Assigning Values to Variables, Symbolic Constants, Basic Input/Output Functions (printf(), scanf()).								

4/10/25

R. G. G. G.



Exemplar / Case Study / Practical Applications and usage:			
Understand the complete program development cycle, including program creation, compilation, execution, testing and debugging of simple C programs.			
Unit 2	Operators and Expressions	6 Hrs.	CO2
Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators (Introduction), sizeof() Operator. Expressions: Arithmetic Expressions, Evaluation of Expressions, Operator Precedence and Associativity, Type Conversion and Type Casting, Introduction to Mathematical Functions.			
Exemplar / Case Study / Practical Applications and usage:			
Student Grade and Percentage Calculator			
Unit 3	Decision Making and Flow Control	6 Hrs.	CO3
Decision Making and Branching: Simple if, if-else, Nested if, else-if Ladder, switch Statement, Conditional Operator. Decision Making and Looping: while, do-while, for Loops, Nested Loops, break, continue, goto (Introduction and Limitations). Programming Applications: Number Processing, Prime Number, Menu-driven Programs, Simple Pattern Generation.			
Exemplar / Case Study / Practical Applications and usage:			
Library Management Menu System			
Unit 4	Arrays and Strings	6 Hrs.	CO4
Arrays: One-dimensional Arrays, Declaration and Initialization of One-dimensional Arrays, Two-dimensional Arrays, Matrix Representation, Matrix Addition. Character Arrays and Strings: Declaration and Initialization of String Variables, Reading and Writing Strings, String Handling Functions: strlen(), strcpy(), strcat(), strcmp(), strrev().			
Exemplar / Case Study / Practical Applications and usage:			
Student Record Management using Arrays and Strings			
Unit 5	Functions and Structures	6 Hrs.	CO5
User Defined Functions: Need for User-defined Functions, Elements of User-defined Functions, Definition of Functions, Function Declaration, Function Calls, Return Values and their Types, Categories of Functions: No Arguments and No Return Value, Arguments but No Return Value, Arguments with Return Value, No Arguments but Return Value, Recursive Functions. Structures: Structure, Structure Type Declaration, Structure Declaration, Referencing Structure Members, Initialization of Structures.			
Exemplar / Case Study / Practical Applications and usage:			
Employee Payroll Management System			
Textbooks:			
1. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw Hill Education, 2019, ISBN: 978 93-5260-618-0. 2. Yashavant Kanetkar, Let Us C, 17th Edition, BPB Publications, 2020, ISBN: 978-93-89898-06-3.			

**Reference Books:**

1. Stephen G. Kochan, Programming in C, 4th Edition, Addison-Wesley Professional, 2014, ISBN: 978-0-321-77641-9.
2. H. M. Deitel and P. J. Deitel, C: How to Program, 8th Edition, Pearson Education, 2015, ISBN: 978-0-13-397689-2.
3. Peter Prinz and Tony Crawford, C in a Nutshell: The Definitive Reference, 2nd Edition, O'Reilly Media, 2015, ISBN: 978-1-491-94728-8.

MOOCs Links and additional reading material:

1. Learn C Programming-Programiz <https://www.programiz.com/c-programming>
2. C Programming Language Tutorials – GeeksforGeeks <https://www.geeksforgeeks.org/c-programming-language/>
3. Programming in C: By Prof. S. N. Sivanandam, IIT Kanpur (NPTEL) https://onlinecourses.nptel.ac.in/noc23_cs53/preview
4. Programming in C: By Prof. S. R. Iyengar, IIT Ropar (NPTEL) https://onlinecourses.nptel.ac.in/noc22_cs40/preview

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments/ Case Studies	Course Project	Field Activity / Case Study	Quiz / Presentation etc.	
L1	-	-	-	-	-	-	-
L2	✓	✓	✓	-	-	✓	✓
L3	✓	✓	✓	-	-	✓	✓
L4	-	-	✓	-	-	-	✓
L5	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	1	3	2	-
CO2	3	3	2	1	2	-	-	-	-	-	1	3	2	1
CO3	2	3	3	2	2	-	-	-	-	-	1	3	3	1
CO4	2	2	3	2	2	-	-	-	-	-	1	3	3	2
CO5	2	2	2	3	2	-	-	-	-	1	1	3	3	2
Avg	2.4	2.4	2.2	1.6	2.0	-	-	-	-	0.2	1.0	3.0	2.6	1.2

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

This course serves as a prerequisite for maps with the following future courses:

- **Data Structures** – Applying arrays, functions, structures, and problem-solving techniques for implementing linear and non-linear data structures.
- **Object-Oriented Programming (C++)** – Building a strong foundation in programming logic, control structures, and modular programming concepts.

Amrutvahini

R. G. G. G.



- **Database Management Systems (DBMS)** – Developing programming logic and computational thinking for database-driven applications.
- **Operating Systems** – Understanding system-level programming concepts and process-oriented programming fundamentals.
- **Computer Networks** – Applying programming concepts for network-based applications and socket programming.
- **System Programming** – Utilizing C programming concepts for developing system-level utilities and software.
- **Embedded Systems and IoT** – Applying C programming for microcontroller-based and embedded application development.
- **Software Engineering** – Developing structured programming skills required for software design, implementation, testing, and maintenance.

Job Mapping:

Job/Future opportunities that one can get after learning this course:

- Junior C Programmer
- Entry-Level Software Developer
- Application Programmer
- Embedded Systems Programmer (Foundation)
- Technical Support Engineer
- Programming Trainee



Program:		F. Y. B. Tech.			Semester:		II	
Course:		Programming in C			Course Code:		R26-ET-PCC-120	
Teaching Scheme				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	OR	
02	-	-	02	40	60	-	-	
Course Description: This course introduces the fundamental concepts of structured programming using the C programming language. It focuses on developing algorithmic thinking, problem-solving skills and programming logic through the design and implementation of C programs. The course covers C fundamentals, operators, control structures, arrays, strings, user-defined functions and structures. Emphasis is placed on writing, testing, debugging, and documenting simple programs using modular programming practices to solve basic engineering and real-world computational problems. The course provides a strong foundation for advanced programming and core computer science courses.								
Course Relevance: Programming in C provides the foundation for computational thinking, structured programming and problem-solving skills essential for engineering students. The course enables learners to develop logical and modular programs, serving as a prerequisite for advanced courses such as Data Structures, Object-Oriented Programming, Operating Systems and Database Management Systems.								
Prerequisite: Basic knowledge of Computer Fundamentals , Basic Mathematics								
Course Objectives: 21. Understand the fundamental concepts of C Programming. 22. Acquire knowledge and apply operators and expressions in C Programming. 23. Apply decision-making and iterative control structures in C Programming for problem solving. 24. Design solutions using arrays, character arrays and string handling techniques in C Programming. 25. Design and develop solutions for simple computational problems using user-defined functions and structures in C Programming.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome						Bloom's Level	
CO1	Explain Algorithms, Flowcharts, variables and storage						2	
CO2	Discuss arithmetic, relational, logical, bitwise, conditional operators and expressions.						2	
CO3	Demonstrate iterative control structures to solve computational problems						3	
CO4	Implement solutions using one, two-dimensional arrays and string library functions						4	
CO5	Understand user defined functions and structures.						4	
Course Contents								
Unit 1	Introduction to Fundamental Concepts of C Programming						6 Hrs.	CO1
Basic Concepts: Algorithms, Flowcharts, Pseudocode, Program, Characteristics of Good Programs, Features and Applications of C, Structure of a C Program, Compilation and Execution Process.								

4/10/25

R. G. G. G.

C Fundamentals: Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration and Initialization of Variables, Assigning Values to Variables, Symbolic Constants, Basic Input/Output Functions (printf(), scanf()).			
Exemplar / Case Study / Practical Applications and usage:			
Understand the complete program development cycle, including program creation, compilation, execution, testing and debugging of simple C programs.			
Unit 2	Operators and Expressions	6 Hrs.	CO2
Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators (Introduction), sizeof() Operator.			
Expressions: Arithmetic Expressions, Evaluation of Expressions, Operator Precedence and Associativity, Type Conversion and Type Casting, Introduction to Mathematical Functions.			
Exemplar / Case Study / Practical Applications and usage: Student Grade and Percentage Calculator			
Unit 3	Decision Making and Flow Control	6 Hrs.	CO3
Decision Making and Branching: Simple if, if-else, Nested if, else-if Ladder, switch Statement, Conditional Operator.			
Decision Making and Looping: while, do-while, for Loops, Nested Loops, break, continue, goto (Introduction and Limitations).			
Programming Applications: Number Processing, Prime Number, Menu-driven Programs, Simple Pattern Generation.			
Exemplar / Case Study / Practical Applications and usage: Library Management Menu System			
Unit 4	Arrays and Strings	6 Hrs.	CO4
Arrays: One-dimensional Arrays, Declaration and Initialization of One-dimensional Arrays, Two-dimensional Arrays, Matrix Representation, Matrix Addition.			
Character Arrays and Strings: Declaration and Initialization of String Variables, Reading and Writing Strings, String Handling Functions: strlen(), strcpy(), strcat(), strcmp(), strcmp().			
Exemplar / Case Study / Practical Applications and usage: Student Record Management using Arrays and Strings			
Unit 5	Functions and Structures	6 Hrs.	CO5
User Defined Functions: Need for User-defined Functions, Elements of User-defined Functions, Definition of Functions, Function Declaration, Function Calls, Return Values and their Types, Categories of Functions: No Arguments and No Return Value, Arguments but No Return Value, Arguments with Return Value, No Arguments but Return Value, Recursive Functions.			
Structures: Structure, Structure Type Declaration, Structure Declaration, Referencing Structure Members, Initialization of Structures.			
Exemplar / Case Study / Practical Applications and usage: Employee Payroll Management System			

**Textbooks:**

1. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw Hill Education, 2019, ISBN: 978 93-5260-618-0.
2. Yashavant Kanetkar, Let Us C, 17th Edition, BPB Publications, 2020, ISBN: 978-93-89898-06-3.

Reference Books:

1. Stephen G. Kochan, Programming in C, 4th Edition, Addison-Wesley Professional, 2014, ISBN: 978-0-321-77641-9.
2. H. M. Deitel and P. J. Deitel, C: How to Program, 8th Edition, Pearson Education, 2015, ISBN: 978-0-13-397689-2.
3. Peter Prinz and Tony Crawford, C in a Nutshell: The Definitive Reference, 2nd Edition, O'Reilly Media, 2015, ISBN: 978-1-491-94728-8.

MOOCs Links and additional reading material:

1. Learn C Programming-Programiz <https://www.programiz.com/c-programming>
2. C Programming Language Tutorials – GeeksforGeeks <https://www.geeksforgeeks.org/c-programming-language/>
3. Programming in C: By Prof. S. N. Sivanandam, IIT Kanpur (NPTEL) https://onlinecourses.nptel.ac.in/noc23_cs53/preview
4. Programming in C: By Prof. S. R. Iyengar, IIT Ropar (NPTEL) https://onlinecourses.nptel.ac.in/noc22_cs40/preview

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments/ Case Studies	Course Project	Field Activity / Case Study	Quiz / Presentation etc.	
L1	-	-	-	-	-	-	-
L2	✓	✓	✓	-	-	✓	✓
L3	✓	✓	✓	-	-	✓	✓
L4	-	-	✓	-	-	-	✓
L5	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	1	3	2	-
CO2	3	3	2	1	2	-	-	-	-	-	1	3	2	1
CO3	2	3	3	2	2	-	-	-	-	-	1	3	3	1
CO4	2	2	3	2	2	-	-	-	-	-	1	3	3	2
CO5	2	2	2	3	2	-	-	-	-	1	1	3	3	2
Avg	2.4	2.4	2.2	1.6	2.0	-	-	-	-	0.2	1.0	3.0	2.6	1.2

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



This course serves as a prerequisite for maps with the following future courses:

- **Data Structures** – Applying arrays, functions, structures, and problem-solving techniques for implementing linear and non-linear data structures.
- **Object-Oriented Programming (C++)** – Building a strong foundation in programming logic, control structures, and modular programming concepts.
- **Database Management Systems (DBMS)** – Developing programming logic and computational thinking for database-driven applications.
- **Operating Systems** – Understanding system-level programming concepts and process-oriented programming fundamentals.
- **Computer Networks** – Applying programming concepts for network-based applications and socket programming.
- **System Programming** – Utilizing C programming concepts for developing system-level utilities and software.
- **Embedded Systems and IoT** – Applying C programming for microcontroller-based and embedded application development.
- **Software Engineering** – Developing structured programming skills required for software design, implementation, testing, and maintenance.

Job Mapping:

Job/Future opportunities that one can get after learning this course:

- Junior C Programmer
- Entry-Level Software Developer
- Application Programmer
- Embedded Systems Programmer (Foundation)
- Technical Support Engineer
- Programming Trainee

Signature

Signature



Program:		F. Y. B. Tech.			Semester:		II	
Course:		Programming in C			Course Code:		R26-IT-PCC-120	
Teaching Scheme				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	OR	
02	-	-	02	40	60	-	-	
Course Description: This course introduces the fundamental concepts of structured programming using the C programming language. It focuses on developing algorithmic thinking, problem-solving skills and programming logic through the design and implementation of C programs. The course covers C fundamentals, operators, control structures, arrays, strings, user-defined functions and structures. Emphasis is placed on writing, testing, debugging, and documenting simple programs using modular programming practices to solve basic engineering and real-world computational problems. The course provides a strong foundation for advanced programming and core computer science courses.								
Course Relevance: Programming in C provides the foundation for computational thinking, structured programming and problem-solving skills essential for engineering students. The course enables learners to develop logical and modular programs, serving as a prerequisite for advanced courses such as Data Structures, Object-Oriented Programming, Operating Systems and Database Management Systems.								
Prerequisite: Basic knowledge of Computer Fundamentals , Basic Mathematics								
Course Objectives: 26. Understand the fundamental concepts of C Programming. 27. Acquire knowledge and apply operators and expressions in C Programming. 28. Apply decision-making and iterative control structures in C Programming for problem solving. 29. Design solutions using arrays, character arrays and string handling techniques in C Programming. 30. Design and develop solutions for simple computational problems using user-defined functions and structures in C Programming.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome						Bloom's Level	
CO1	Explain Algorithms, Flowcharts, variables and storage						2	
CO2	Discuss arithmetic, relational, logical, bitwise, conditional operators and expressions.						2	
CO3	Demonstrate iterative control structures to solve computational problems						3	
CO4	Implement solutions using one, two-dimensional arrays and string library functions						4	
CO5	Understand user defined functions and structures.						4	
Course Contents								
Unit 1	Introduction to Fundamental Concepts of C Programming						6 Hrs.	CO1
Basic Concepts: Algorithms, Flowcharts, Pseudocode, Program, Characteristics of Good Programs, Features and Applications of C, Structure of a C Program, Compilation and Execution Process.								

4/10/25

R. G. G. G.

C Fundamentals: Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration and Initialization of Variables, Assigning Values to Variables, Symbolic Constants, Basic Input/Output Functions (printf(), scanf()).			
Exemplar / Case Study / Practical Applications and usage: Understand the complete program development cycle, including program creation, compilation, execution, testing and debugging of simple C programs.			
Unit 2	Operators and Expressions	6 Hrs.	CO2
Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators (Introduction), sizeof() Operator.			
Expressions: Arithmetic Expressions, Evaluation of Expressions, Operator Precedence and Associativity, Type Conversion and Type Casting, Introduction to Mathematical Functions.			
Exemplar / Case Study / Practical Applications and usage: Student Grade and Percentage Calculator			
Unit 3	Decision Making and Flow Control	6 Hrs.	CO3
Decision Making and Branching: Simple if, if-else, Nested if, else-if Ladder, switch Statement, Conditional Operator.			
Decision Making and Looping: while, do-while, for Loops, Nested Loops, break, continue, goto (Introduction and Limitations).			
Programming Applications: Number Processing, Prime Number, Menu-driven Programs, Simple Pattern Generation.			
Exemplar / Case Study / Practical Applications and usage: Library Management Menu System			
Unit 4	Arrays and Strings	6 Hrs.	CO4
Arrays: One-dimensional Arrays, Declaration and Initialization of One-dimensional Arrays, Two-dimensional Arrays, Matrix Representation, Matrix Addition.			
Character Arrays and Strings: Declaration and Initialization of String Variables, Reading and Writing Strings, String Handling Functions: strlen(), strcpy(), strcat(), strcmp(), strcmp().			
Exemplar / Case Study / Practical Applications and usage: Student Record Management using Arrays and Strings			
Unit 5	Functions and Structures	6 Hrs.	CO5
User Defined Functions: Need for User-defined Functions, Elements of User-defined Functions, Definition of Functions, Function Declaration, Function Calls, Return Values and their Types, Categories of Functions: No Arguments and No Return Value, Arguments but No Return Value, Arguments with Return Value, No Arguments but Return Value, Recursive Functions.			
Structures: Structure, Structure Type Declaration, Structure Declaration, Referencing Structure Members, Initialization of Structures.			
Exemplar / Case Study / Practical Applications and usage: Employee Payroll Management System			

**Textbooks:**

1. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw Hill Education, 2019, ISBN: 978 93-5260-618-0.
2. Yashavant Kanetkar, Let Us C, 17th Edition, BPB Publications, 2020, ISBN: 978-93-89898-06-3.

Reference Books:

1. Stephen G. Kochan, Programming in C, 4th Edition, Addison-Wesley Professional, 2014, ISBN: 978-0-321-77641-9.
2. H. M. Deitel and P. J. Deitel, C: How to Program, 8th Edition, Pearson Education, 2015, ISBN: 978-0-13-397689-2.
3. Peter Prinz and Tony Crawford, C in a Nutshell: The Definitive Reference, 2nd Edition, O'Reilly Media, 2015, ISBN: 978-1-491-94728-8.

MOOCs Links and additional reading material:

1. Learn C Programming-Programiz <https://www.programiz.com/c-programming>
2. C Programming Language Tutorials – GeeksforGeeks <https://www.geeksforgeeks.org/c-programming-language/>
3. Programming in C: By Prof. S. N. Sivanandam, IIT Kanpur (NPTEL) https://onlinecourses.nptel.ac.in/noc23_cs53/preview
4. Programming in C: By Prof. S. R. Iyengar, IIT Ropar (NPTEL) https://onlinecourses.nptel.ac.in/noc22_cs40/preview

Assessment Pattern

BT Level	CCE						ESE
	CT1	CT2	Assignments/ Case Studies	Course Project	Field Activity / Case Study	Quiz / Presentation etc.	
L1	-	-	-	-	-	-	-
L2	✓	✓	✓	-	-	✓	✓
L3	✓	✓	✓	-	-	✓	✓
L4	-	-	✓	-	-	-	✓
L5	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	1	3	2	-
CO2	3	3	2	1	2	-	-	-	-	-	1	3	2	1
CO3	2	3	3	2	2	-	-	-	-	-	1	3	3	1
CO4	2	2	3	2	2	-	-	-	-	-	1	3	3	2
CO5	2	2	2	3	2	-	-	-	-	1	1	3	3	2
Avg	2.4	2.4	2.2	1.6	2.0	-	-	-	-	0.2	1.0	3.0	2.6	1.2

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

Amrutvahini

R. Srinivasan



This course serves as a prerequisite for maps with the following future courses:

- **Data Structures** – Applying arrays, functions, structures, and problem-solving techniques for implementing linear and non-linear data structures.
- **Object-Oriented Programming (C++)** – Building a strong foundation in programming logic, control structures, and modular programming concepts.
- **Database Management Systems (DBMS)** – Developing programming logic and computational thinking for database-driven applications.
- **Operating Systems** – Understanding system-level programming concepts and process-oriented programming fundamentals.
- **Computer Networks** – Applying programming concepts for network-based applications and socket programming.
- **System Programming** – Utilizing C programming concepts for developing system-level utilities and software.
- **Embedded Systems and IoT** – Applying C programming for microcontroller-based and embedded application development.
- **Software Engineering** – Developing structured programming skills required for software design, implementation, testing, and maintenance.

Job Mapping:

Job/Future opportunities that one can get after learning this course:

- Junior C Programmer
- Entry-Level Software Developer
- Application Programmer
- Embedded Systems Programmer (Foundation)
- Technical Support Engineer
- Programming Trainee



Program:		F. Y. B. Tech		Semester:		II	
Course:		Basic Mechanical Engineering		Course Code:		R26-ME-PCC-121	
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
02	02		3	40	60	50	--
Course Description and Relevance: This course introduces students to the foundational concepts of mechanical engineering systems, providing a broad understanding of key domains such as design engineering, thermal systems and heat transfer, manufacturing processes, automobile systems, and power plant engineering. Through conceptual learning, real life examples, and system-level thinking, students will explore how mechanical components and subsystems function individually and in integration. The course not only lays the groundwork for advanced engineering subjects but also helps students appreciate the interdisciplinary nature of modern engineering solutions. Mechanical engineering plays a pivotal role in the design and operation of physical systems that underpin all branches of engineering. A basic understanding of these systems benefits students from all disciplines by enhancing their ability to analyze and contribute to the development of physical and integrated systems. This foundational knowledge supports participation in interdisciplinary work involving technologies like IoT, automation, and robotics, while also nurturing problem-solving skills and engineering intuition. The course highlights mechanical engineering’s critical role in industries such as aerospace, energy, healthcare, construction, and product development, preparing students to collaborate and innovate across diverse engineering domains.							
Prerequisite: 4. Basic Physics for understanding mechanics, energy systems, and machine elements. 5. Basic Mathematics for analyzing motion, forces in mechanisms, and solving simple design problems. 6. Understanding of 2D/3D views, simple orthographic projections to visualize mechanisms, assemblies, machine elements and mechanical systems.							
Bridge Content: Basic concepts of physics, mathematics, and engineering drawing will be reinforced to help students understand mechanics, energy systems, machine elements, and visualize mechanical systems.							
Course Objectives: 10. To introduce the classification, functions, working principles, and practical applications of basic machine elements and power transmission systems used in mechanical and automotive engineering. 11. To enable students to understand the fundamentals of thermal systems by exploring the core principles of thermodynamics, heat transfer, refrigeration, and air conditioning, with an emphasis on their practical applications in various engineering fields. 12. To develop an understanding of conventional and renewable energy resources, power generation technologies, their environmental impacts, and emerging sustainable energy solutions. 13. To introduce the fundamentals of IC engines, automobile systems, electric and hybrid vehicles, and emerging smart mobility technologies such as autonomous vehicles and ADAS. 14. To equip students with fundamental knowledge of conventional and unconventional manufacturing processes and their applications.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom’s Level
CO1	EXPLAIN the functions of basic machine and power transmission elements such as shafts, keys, bearings, couplings, and drives.						2
CO2	DESCRIBE the fundamental principles of thermal systems, encompassing thermodynamic concepts, heat transfer modes, and the operation of basic refrigeration and air conditioning systems.						2
CO3	IDENTIFY various energy sources, their working principles, environmental impacts, and emerging trends in sustainable power generation.						2
CO4	UNDERSTAND the basic working principles and classifications of IC engines and						2



	automobiles, and DEMONSTRATE awareness of emerging vehicle technologies.	
CO5	DEMONSTRATE an understanding of conventional and unconventional manufacturing processes.	2
Course Content		
Unit 1	Machine Elements	6 Hrs. COs Mapped CO1
Machine and Power Transmission Elements: Classification, functions, and practical applications of fundamental machine elements such as shafts, axles, keys, bearings, and couplings. Types of drives: Belt, Chain and Gear drives. Gear box (Sliding mesh & Synchromesh). Introduction to clutch and brakes. Exemplars / Practical Applications and usage: Shafts, Axles, Keys, Bearings and Couplings: Used in automobiles, industrial machines, pumps, and gearboxes to transmit power, support rotating components, and connect shafts safely. Drives: Commonly used in fans, conveyors, washing machines, and agricultural machinery for smooth and economical power transmission. Clutches: Used in automobiles and machines to engage or disengage power transmission between the driving and driven shafts. Brakes: Used in automobiles, elevators, cranes, and industrial machines to reduce speed or stop motion safely and effectively. Assignments: 4. Prepare a comparative study of Belt, Chain, and Gear Drives based on construction, working principle, advantages, disadvantages, and practical applications with suitable sketches. 5. Study and prepare a short report on Machine Elements (shaft, axle, key, bearing, coupling, clutch, and brake), explaining their functions and applications in an automobile or industrial machine. 6. Study and identification of machine elements (shaft, axle, key, bearing, coupling, clutch and brake) using actual components. Understand function, classification and industrial applications of machine elements.		
Unit 2	Thermal Systems	6 Hrs. COs Mapped CO2
Concept of a system, types of systems, energy interactions: heat and work, First law of thermodynamics & its limitations. Second laws of thermodynamics (simple numerical). Modes of Heat Transfer, Basic Terminology: Heat, temperature, thermal conductivity, heat flux, etc. Fourier's Law, Thermal conductivity: concept and examples of materials; Newton's Law of Cooling, Basic concept of thermal radiation and Stefan-Boltzmann Law. Definition of Refrigeration, Concept of COP, Simple Refrigeration Cycle (vapor compression), Common refrigerants, Insulating materials. Basics of Air Conditioning: Definition and necessity, Comfort conditions, Types of Air Conditioning Systems (central, split, window), Exemplars / Practical Applications and usage: Applications of heat transfer in daily life and engineering (e.g., heat exchangers in process industries, cooling of electronics components, building insulation, thermal management of batteries, radiators in cars for engine cooling, thermal protection systems. Applications of Refrigeration like Domestic refrigerator, Cold storage and Industrial and transport refrigeration Applications: homes, offices, vehicles, data centers. Assignments: 6. Choose any one application (from the listed exemplars) and explain how heat transfer is involved in its operation or design. 7. Measurement of temperature using thermocouple, RTD and infrared thermometer. Develop understanding of temperature measurement and instrumentation. 8. Compare central, split, and window-type air conditioning systems in terms of application, cost, and efficiency. 9. Explain the role of air conditioning in thermal management in data centers or electric vehicles. 10. Select any household device such as a refrigerator or a split/window air conditioner and describe its		

4/10/25

R. G. G. G.



working cycle with the help of a simple diagram and explanation of key components.			
Unit 3	Energy resources and Power plants	6 Hrs.	COs Mapped CO3
Classification: Renewable vs Non-Renewable, Global and national energy scenario, Need for sustainable energy solutions. Introduction, components, working, environmental impact of conventional power plants such as thermal power plant, hydroelectric power plant, nuclear power plant. Introduction, components, working of renewable and green energy technologies such as solar energy, wind energy, biomass and bioenergy & geothermal and tidal energy. Environmental Impact (emission and carbon foot print) and Energy Conservation, climate change Future trends in green energy: Carbon capture and storage. Exemplars / Practical Applications and usage: Power generation for cities and industries (e.g., Eklahare Thermal Power Station, SMBST Sugar Factory Co-generation power plant); hydro dams (e.g., Bhandardara, Koyana, Bhakra Nangal Dam), Large-scale nuclear power plants (Tarapur, Kakrapar, Kaiga, Kudankulam Atomic Power Station), Rooftop solar panels in residential buildings and agriculture purpose; Wind farms, hybrid solar-wind systems in coastal and desert regions; Bio-digesters and Biomass power plants (Rajhans). Assignments: 5. Prepare a comparative analysis of at least one conventional power plant (e.g., thermal, nuclear, hydroelectric) and one renewable/green energy systems (e.g., solar, wind, biomass) considering basic components and working principles of each system, fuel sources and energy conversion process, efficiency and operational characteristics, environmental impacts (e.g., emissions, land use, waste) and future potential and role in sustainable energy transition. 6. Energy audit of classroom/laboratory and identification of energy conservation opportunities. Develop awareness of energy efficiency and carbon footprint reduction. 7. Visit to Roof Top Solar Power Plant / Cogeneration Power Plant.			
Unit 4	Automobile Engineering	6 Hrs.	COs Mapped CO4
Introduction to Internal Combustion (IC) engines, Engine terminology, including the working principles of Spark Ignition (SI) and Compression Ignition (CI) engines (Two stroke & Four stroke), along with their classifications. Overview of automobile classifications and specifications of two-wheelers, four-wheelers, and multi-axle vehicles. Chassis layouts and types of drive systems. Fundamental concepts of electric vehicles (EVs), their environmental significance, construction, and working principles. Introduction to hybrid electric vehicles, autonomous vehicles. Exemplars / Practical Applications and usage: Two-wheelers: Scooters and Motorbikes used for personal and delivery transport; Four-wheelers: Hatchbacks, sedans, SUVs for private, commercial, and utility purposes; Multi-axle Vehicles: Transport of heavy goods (e.g., 10-wheeler trucks used in logistics and mining). Front Engine Front Wheel Drive (FF-FWD), Front Engine Rear Wheel Drive (FR-RWD), Rear Engine Rear Wheel Drive (RR-RWD), All-Wheel Drive (AWD) / Four-Wheel Drive (4WD) Passenger EVs, Electric Two-Wheelers, Electric Buses and Delivery Vans, Charging Infrastructure. Self-driving Cars and ADAS Systems. Assignments: 4. Study and analyze various types of vehicles commonly used in real life. Select one two-wheeler, one four-wheeler, and one multi-axle commercial vehicle (e.g., scooter, SUV, and transport truck). Identify and describe their: classification (passenger, commercial, utility, etc.), key specifications (engine type, fuel type, capacity, etc.), type of chassis layout and drive system (e.g., FF-FWD, AWD, etc.) and real-world usage scenario (e.g., delivery services, long-distance transport, daily commuting) 5. Demonstration of ADAS features and autonomous vehicle technologies through simulation/videos.			

4/10/25

R. G. G. G.



Introduce emerging automotive technologies and intelligent transportation systems. 6. Write a report on "The shift toward sustainable and smart mobility: a case study on EVs and autonomous vehicles".			
Unit 5	Manufacturing Processes	6 Hrs.	COs Mapped CO5
Introduction to manufacturing processes and their importance in engineering and industry, Classification and applications. Introduction to Conventional Manufacturing Techniques such as Casting Processes, Forging, Metal Joining Techniques (Welding, soldering, brazing). Introduction to Lathe machine and its operations. Introduction to Drilling machine (Radial drilling machine) and its classification. Definition and need for non-conventional manufacturing processes and Comparison with conventional manufacturing techniques; Introduction to CNC and concept of Industry 4.0.			
Exemplars / Practical Applications and usage: Use of casting process in automobile engine blocks, pumps, and valve bodies manufacturing; use of Metal Forming Processes (e.g., forging, rolling, extrusion) in rail, construction, and automotive industries, use of machining in precision components such as gears, tool dies, and aerospace parts; use of metal joining in automobile body assembly, pipeline construction, bridge fabrication, electronics assembly; prototyping for rapid development of design concepts, Customized prosthetics and implants			
Assignments: - After visiting the central workshop, prepare a detailed report on the machine tools available. Your report should include the names and types of machines observed, their key components, and the various operations that can be performed using each machine tool. Highlight at least one practical application or use-case for each tool based on your observations during the visit. - Demonstration of CNC Machine and comparison with conventional machining. Understand automation, CNC programming concepts and productivity improvement. - Demonstration of Additive Manufacturing (3D Printing) and Industry 4.0-enabled manufacturing. Introduce smart manufacturing and digital production systems.			
Textbooks: - V B Bhandari, "Design of machine elements", Tata McGraw-Hill Publisher Co. Ltd. - R.S. Khurmi & J.K. Gupta, "Machine Design", S. Chand Publishing. - Nag P. K., "Engineering Thermodynamics", Tata McGraw-Hill Publisher Co. Ltd. - Khurmi, R.S., and Gupta, J. "A Textbook of Thermal Engineering", K, S. Chand & Sons P. K. Nag., "Basic and Applied Thermodynamics" (Different edition focused more on applications), Tata McGraw-Hill Publisher Co. Ltd. - Chaudhari and Hajra, "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers, Mumbai3. - P.N. Rao, "Manufacturing Technology" – Vol-I &II, McGraw Hill Education. - Kripal Singh, "Automobile Engineering" Vol-I &II, Standard Publishers Distributors. M.L. Mathur & R.P. Sharma, "Internal Combustion Engines", Dhanpat Rai & Sons. - G D Rai, "Non-conventional energy sources", Khanna publication, New Delhi. - D.P. Kothari, K.C. Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI Learning.			
Reference Books: - Richard G. Budynas & J.K. Nisbett, "Shigley's Mechanical Engineering Design", Tata McGraw-Hill Publisher Co. Ltd. - Robert C. Juvinall & Kurt M. Marshek, "Machine Component Design", Wiley India. - Ganeshan, V., "Internal Combustion Engines", McGraw Hill Jack Erjavec, "Automotive Technology – A Systems Approach", Cengage Learning. - R.K. Rajput, "Manufacturing processes", Laxmi Publications Pvt. Ltd. - P.C. Sharma, "Production Technology", S. Chand Publishing.			

4/10/25

R. G. G. G.



16. Anderson, Curtis Darrel and Anderson, Judy, “Electric and Hybrid Cars: A History”, 2nd Ed., McFarland.
17. Boyle, Godfrey, “Renewable Energy”, 2nd Ed., Oxford University Press
18. S.P. Sukhatme, “Electric Vehicles and Renewable Energy”, Universities Press

MOOCs Links and additional reading material:

7. Design engineering <https://www.nptel.ac.in/courses/112105124>
8. Thermodynamics <https://www.nptel.ac.in/courses/127106135>
9. Renewable energy sources <https://www.nptel.ac.in/courses/127107001>
10. Fundamental of electrical vehicles <https://www.nptel.ac.in/courses/108106170>
11. Fundamental of manufacturing process <https://nptel.ac.in/courses/112107219>
12. Electric vehicles https://onlinecourses.swayam2.ac.in/ntR26_ed127/preview

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2										1	2		
CO2	2	1			1	2	2				1		2	
CO3	2				2	2	2				1		2	
CO4	2	1	1	1	2	2	2			1	1		3	
CO5	2				2	2	2		1	1	1			2
Avg.	2	1	1	1	2	2	2		1	1	1	2	2	2

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

Assessment Table:

EXAM	Particular	CO1	CO2	CO3	CO4	CO5
Knowledge and Attitude Profile (WK)						
CCE	CT1	8	8			
	CT2					
	Assignments				8	
	Course Project					
	Field Activity / Case Study					8
	Quiz / presentation etc.			8		
ESE		12	12	12	12	12
Total		20	20	20	20	20

Unit wise Weightage:

Exam	Unit1	Unit2	Unit3	Unit4	Unit5
CT1	8	8			
CT2					
CCE Assessment by Teacher			8	8	8
ESE	12	12	12	12	12



Total	20	20	20	20	20
-------	----	----	----	----	----

This course serves as a prerequisite for / maps with the following future courses:
Machine Design, Strength of Materials, Engineering Thermodynamics, Applied Thermodynamics, HVAC, Advanced Manufacturing Processes, IC Engines and Automobile engineering, Power Plant Engineering.

Job Mapping:

Job opportunities that one can get after learning this course:

6. Technical Assistant / Technician Trainee: Basic machine operations, CAD drawing support, Workshop/lab assistant roles
7. Manufacturing/Production Helper: Roles in small manufacturing firms, Machine shop assistant, Assembly line work
8. Apprenticeships / Internships: Many industries offer ITI-level apprenticeships for candidates with basic technical knowledge, PSU apprentice schemes under the National Apprenticeship Promotion Scheme (NAPS)
9. Field Technician: Jobs in installation and maintenance of machinery, HVAC, plumbing, or mechanical services for buildings.
10. Customer Service Support (Technical): Call center support for mechanical tools or software, Sales assistant in hardware/tool shops.



Program:		F. Y. B. Tech		Semester:		II	
Course:		Basic Mechanical Engineering Lab		Course Code:		R26-ME-PCC-121-TW	
Teaching Scheme (Hrs./week)			Credits (PR)	Examination Scheme			
Lecture	Practical	Tutorial		CCE	ESE	TW	PR
-	2	-	1	-	-	50	-
Course Description and Relevance: This course introduces students to the foundational concepts of mechanical engineering systems, providing a broad understanding of key domains such as machine elements, drives, thermal systems and heat transfer, manufacturing processes, automobile systems, and power plant engineering. Through conceptual learning, real-life examples, and system-level thinking, students will explore how mechanical components and subsystems function individually and in integration. The course not only lays the groundwork for advanced engineering subjects but also helps students appreciate the interdisciplinary nature of modern engineering solutions. Mechanical engineering plays a pivotal role in the design and operation of physical systems that underpin all branches of engineering. A basic understanding of these systems benefits students from all disciplines by enhancing their ability to analyze and contribute to the development of physical and integrated systems. This foundational knowledge supports participation in interdisciplinary work involving technologies like IoT, automation, and robotics, while also nurturing problem-solving skills and engineering intuition. The course highlights mechanical engineering’s critical role in industries such as aerospace, energy, healthcare, construction, and product development, preparing students to collaborate and innovate across diverse engineering domains.							
Prerequisite: 1. Basic Physics for understanding mechanics, energy systems, and machine elements. 2. Basic Mathematics for analysing motion, forces in mechanisms, and solving simple design problems. 3. Understanding of 2D/3D views, simple orthographic projections to visualize mechanisms, assemblies, machine elements and mechanical systems.							
Bridge Content: Basic concepts of physics, mathematics, and engineering drawing will be reinforced to help students understand mechanics, energy systems, machine elements, and visualize mechanical systems.							
Course Objectives: 15. To introduce the classification, functions, working principles, and practical applications of basic machine elements and power transmission systems used in mechanical and automotive engineering. 16. To enable students to understand the fundamentals of thermal systems by exploring the core principles of thermodynamics, heat transfer, refrigeration, and air conditioning, with an emphasis on their practical applications in various engineering fields. 17. To develop an understanding of conventional and renewable energy resources, power generation technologies, their environmental impacts, and emerging sustainable energy solutions. 18. To introduce the fundamentals of IC engines, automobile systems, electric and hybrid vehicles, and emerging smart mobility technologies such as autonomous vehicles and ADAS. 19. To equip students with fundamental knowledge of conventional and unconventional manufacturing processes and their applications.							
Course Outcomes: After learning the course, students will be able to:							
CO	Course Outcome					Bloom’s Level	

4/10/25

R. G. G. G.



CO1	EXPLAIN the functions of basic machine and power transmission elements such as shafts, keys, bearings, couplings, and drives.	2
CO2	DESCRIBE the fundamental principles of thermal systems, encompassing thermodynamic concepts, heat transfer modes, and the operation of basic refrigeration and air conditioning systems.	2
CO3	IDENTIFY various energy sources, their working principles, environmental impacts, and emerging trends in sustainable power generation.	2
CO4	UNDERSTAND the basic working principles and classifications of IC engines and automobiles, and DEMONSTRATE awareness of emerging vehicle technologies.	2
CO5	DEMONSTRATE an understanding of conventional and unconventional manufacturing processes.	2

List of Practical:

Experiment No.1	Identification and Study of Basic Machine Elements and Power Transmission Systems	4 Hrs.	CO1
------------------------	--	---------------	------------

Objective:

1. To identify the basic machine elements used in mechanical systems.
2. To understand the construction and working principles of power transmission systems.

Associated Task:

1. Identify different machine elements such as bolts, nuts, screws, keys, couplings, bearings, shafts, gears, pulleys, belts, chains, and springs.
2. Observe the construction and operation of power transmission systems.

Exemplars:

1. Spur gear assembly
2. V-belt and pulley arrangement
3. Roller chain and sprocket setup
4. Flange coupling model
5. Ball bearing cut section

Utility:

Helps in understanding:

1. Used in automobiles, motorcycles, and bicycles.
2. Essential in industrial machinery and manufacturing equipment.
3. Found in conveyors, elevators, and cranes.
4. Used in agricultural machines such as tractors and harvesters.
5. Applied in machine tools like lathes, milling machines, and drilling machines.

Experiment No.2	Study of household refrigerator and window Air-Conditioning System	4 Hrs.	CO2
------------------------	---	---------------	------------

Objective:

To Understand the construction and working principle of a household refrigerator.

Associated Task:

1. Identify and study the main components such as compressor, condenser, evaporator, capillary tube, thermostat, and refrigerant.
2. Identify indoor and outdoor components, airflow path, and cooling process.
3. Inspect electrical connections, clean air filters and condenser coils, and follow safety precautions.

**Exemplars:**

1. Accurately explains the four stages: compression, condensation, expansion, and evaporation.
2. Demonstrates understanding of air-conditioning operation and component functions.
3. Performs maintenance activities safely and correctly

Utility:

Helps in understanding:

1. Provides fundamental knowledge of refrigeration and air-conditioning systems.
2. Develops practical skills in identifying, operating, and maintaining household cooling appliances.
3. Enhances troubleshooting and preventive maintenance abilities.
4. Prepares students for careers in HVAC (Heating, Ventilation, and Air Conditioning), refrigeration servicing, and electrical maintenance

Experiment No.3	Study of Water tube & Fire tube Boiler	4 Hrs.	CO2
------------------------	---	---------------	------------

Objective:

1. Understand the working principles of water tube and fire tube boilers.
2. Identify the major components (mounting & accessories). and explain their functions.

Associated Task:

1. Study the layout and working of water tube and fire tube boilers.
2. Identify and explain components such as boiler shell, furnace, fire tubes, water tubes, steam drum, mud drum, superheater, and safety valves.
3. Observe and compare the flow of water and hot gases, steam generation process, and operating conditions of both types of boilers.

Exemplars:

1. Babcock and Wilcox Boiler – Water Tube Boiler.
2. Lancashire Boiler – Fire Tube Boiler.

Utility:

1. Helps understand the fundamentals of steam generation in thermal systems.
2. Provides practical knowledge of boiler construction, operation, and safety.
3. Supports the selection of suitable boilers for industrial applications.

Experiment No.4	Study and Comparison of IC Engine, Electric Vehicle and Hybrid Vehicle	4 Hrs.	CO4
------------------------	---	---------------	------------

Objective:

1. Understand the working principle of IC Engine, Electric Vehicle (EV), and Hybrid Vehicle (HV).
2. Study maintenance and operating costs.
3. Analyze performance characteristics.

Associated Task:

1. Identify and explain the operating mechanism of each vehicle type.
2. Compare power, torque, acceleration, efficiency, and driving range.
3. Calculate fuel economy and energy consumption for each vehicle

Exemplars:

3. Four-stroke petrol engine, Battery Electric Vehicle (Tesla Model 3)
4. IC engine with piston-cylinder, EV with battery and motor, Hybrid with engine + motor.
5. EV: High torque; IC Engine: High range; Hybrid: Balanced performance.

Utility:

1. Builds fundamental knowledge of modern automobile technologies.

4/10/25

R. G. G. G.



2. Helps understand design differences and component integration. 3. Supports sustainable and eco-friendly transportation awareness.			
Experiment No.5	Demonstration and Study of Conventional Manufacturing Processes and Machine Tools	4 Hrs.	CO5
Objective: - Understand the working principles of conventional manufacturing processes. - Identify the major parts and functions of conventional machine tools. - Demonstrate basic machining operations safely. Associated Task: - Observe and explain the operation of lathe, drilling, milling, shaping, and grinding machines. - Label machine components and describe their functions. - Perform simple machining operations under supervision while following safety procedures. Exemplars: - Lathe machine turning operation; drilling a hole using a pillar drill. - Headstock, tailstock, chuck, carriage of a lathe; milling cutter and table. - Facing, turning, drilling, tapping, milling, and grinding operations. Utility: - Develops fundamental knowledge of manufacturing processes used in industries. - Builds practical machining skills and promotes workplace safety. - Helps in selecting the most suitable manufacturing process for a given job.			
Experiment No.6	Introduction to CNC, IoT and Industry 4.0.	6 Hrs.	CO5
Objective: - Understand the basic concepts of CNC, IoT, and Industry 4.0. - Identify the role of automation and smart manufacturing in modern industries. - Differentiate between conventional and CNC-based manufacturing systems. - Explain how IoT connects machines for monitoring and control. - Recognize the benefits and applications of Industry 4.0 technologies Associated Task: - Identify the main components of a CNC machine. - Observe a CNC machine or simulation and list its functions. - Explore an IoT-enabled manufacturing setup through videos or demonstrations. - Compare conventional machining with CNC machining. - Prepare a flowchart showing the integration of CNC, IoT, and Industry 4.0 in a smart factory. Exemplars: - CNC Turning Centre - CNC Vertical Machining Centre (VMC) - Smart Factory using IoT sensors - Automated production line with robotic arms - Real-time machine monitoring dashboard Utility: - Improves manufacturing accuracy and productivity.			

- 2) Enables remote monitoring and predictive maintenance.
- 3) Reduces production time, waste, and human errors.
- 4) Supports data-driven decision-making.
- 5) Enhances employability in advanced manufacturing industries.

Strength of CO-PO-PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	1	2	2	2
CO2	3	2	1	1	2	–	–	–	–	–	1	3	3	3
CO3	2	2	2	1	3	–	–	1	–	–	1	3	3	3
CO4	2	3	1	2	2	–	–	–	–	–	1	2	2	2
CO5	2	2	1	1	3	–	–	–	–	–	1	3	3	3
Avg.	3	2	1	1	2	–	–	1	–	–	1	3	3	3

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

This course serves as a prerequisite for / maps with the following future courses:

This course serves as a foundation for advanced courses related to Engineering Mechanics Strength of Materials (Mechanics of Materials) Theory of Machines (Kinematics and Dynamics of Machines) Machine Design Manufacturing Processes / Production Engineering Thermal Engineering (Thermodynamics, Heat Transfer, IC Engines, Refrigeration & Air Conditioning) Fluid Mechanics and Hydraulic Machines Materials Science and Engineering

Job Mapping:

If a student completes First Year B. Tech Mechanical Engineering and exits after First Year, the following are the job mapping, rather than assigning full-fledged Mechanical Engineer roles.

- CNC Machine Operator
- Machine Shop Technician
- Assembly Technician
- Maintenance Technician
- Quality Inspection Technician
- Automobile Service Technician
- Production Assistant
- Automotive Service Assistant



Program:		F. Y. B. Tech.			Semester:		II	
Course:		Programming in C Lab			Course Code:		R26-IT-PCC-119	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	01	-	-	25	-	
Course Description: This course introduces students to the fundamentals of C programming language, emphasizing structured and modular programming techniques. It covers essential programming constructs such as operators, control structures, arrays, strings, functions, and structures. Students will learn problem-solving through algorithmic thinking and coding practices. The course provides extensive hands-on experience via lab experiments and mini-projects. It lays a strong foundation for learning advanced programming and software development concepts.								
Course Relevance: C programming forms the backbone of Information Technology Engineering. The course equips students with logical reasoning and analytical skills essential for software development. It enhances students’ ability to design and implement efficient computational solutions. Knowledge of C is crucial for understanding modern languages like C++, Java, and Python. The skills gained are highly relevant for placements, technical interviews, and future courses in data structures, algorithms, and system programming.								
Prerequisite: 1. Basics of Computers 2. Basic Mathematics								
Course Objectives: 1. UNDERSTAND the fundamental Concepts of C Programming 2. ACQUIRE knowledge and Compare usage of Operators and Expressions in C Programming 3. APPLY Control Flow structures in C Programming for Problem solving 4. DESIGN a solution using Arrays, Character and String Arrays in C programming 5. DESIGN a develop solution for simple computational problems using User Defined Functions and structures in C Programming								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome					Bloom’s Level		
CO1	Use algorithms for simple computational problems.					3		
CO2	Use mathematical, Logical Operators and Expressions.					3		
CO3	Apply Control Flow structures for decision making.					3		
CO4	Apply a solution using Arrays, Character and String Arrays.					3		
CO5	Apply user defined functions and structures.					3		
List of Assignments								
Group A (Any Five)								
Experiment No. 1	To accept the number and Compute a) Square root of number, b) Square of number, c) Cube of number d) Check for prime, d) Factorial of number e) Prime factors.					2 Hrs	CO1, CO3	
Objective: 1. To understand and implement basic mathematical computations using programming. 2. To develop logical thinking for performing number-based operations.								



3. To enhance problem-solving skills in mathematics and computer science.

Associated Tasks:

Accept an integer input from the user. Compute the square root of the number, square and cube of the number, factorial of the number. Check whether the number is a prime number & display all prime factors of the number.

Exemplars and Utility:

1. Useful for students to understand fundamental programming constructs and control structures.
2. Supports mathematical logic understanding in competitive exams and coding interviews.

Experiment No. 2	To accept the Fibonacci numbers from user to be generated and print the Fibonacci series.	2 Hrs	CO1,CO4
-------------------------	---	-------	---------

Objective:

To develop a program that Accepts a user input for the number of terms in the Fibonacci sequence, Generate and display the Fibonacci series up to the specified number of terms.

Associated Tasks:

Prompt the user to input a number. Validate the input to ensure it is a positive integer. Use an iterative or recursive approach to generate the Fibonacci sequence of 'n' terms.

Exemplars and Utility:

1. Understanding Recursion and Iteration
2. Mathematical Insight
3. Problem Solving

Experiment No. 3	Write a C program using appropriate loops to generate following shapes on display screen using * characters: a. Square b. Rectangles c. Right Angle Triangle	2 Hrs	CO1,CO4
-------------------------	---	-------	---------

Objective:

To understand the usage of nested loops in C. To apply logic for pattern generation.

To gain experience with user input and conditional logic.

Associated Tasks:

Accept dimensions (side/length/height) from the user. Display each pattern using * characters.

Exemplars and Utility:

1. Useful for understanding loop nesting.
2. Forms a foundation for graphical logic in text-based output.

Experiment No. 4	Write a C program that accepts a string from the user and performs the following string operations - a. Calculate length of string b. String reversal c. Equality check of two Strings d. Check palindrome e. Check substring	2 Hrs	CO1,CO3
-------------------------	---	-------	---------

Objective:

To understand and implement basic string operations in C. To develop skills in using character arrays and string handling functions. To practice string comparison, manipulation, and logical checking through programming.

Associated Tasks:

1. Accept strings as input from the user. Calculate the length of the input string. Reverse the string and display it. Accept a second string and check for equality.

Amrutvahini

R. G. G. G.



2. Accept another string and check whether it is a sub-string of the first string. Exemplars and Utility: 1. Enhances string handling skills in C. 2. Fundamental for programming interviews and competitive coding.			
Experiment No. 5	Implement array as following: 1. Find given element in array 2. Find Max and Min element 3. Find frequency of given element in array 4. Find Average of elements in Array.	2 Hrs	CO1,CO4
Objective: To understand basic operations on arrays in C. To enhance logical thinking through search, comparison, and statistical computation on arrays. Associated Tasks: 1. Accept elements into an array from the user. 2. Calculate the average of array elements. Exemplars and Utility: 1. Forms the foundation for data manipulation in programming. 2. Prepares students for array-based problem-solving in interviews and competitive programming.			
Experiment No. 6	Menu-Driven C Program for finding areas of following shapes: a. To find area of Circle b. To find area of rectangle, c. To find area of square d. To find area of triangle e. To find area of a Regular Hexagon	2 Hrs	CO1,CO2
Objective: To understand and apply mathematical formulas for computing areas of shapes. To improve modular programming and logical structuring skills. Associated Tasks: 1. Accept appropriate inputs (e.g., radius, length, base) from the user. 2. Allow the user to perform multiple operations until they choose to exit. Exemplars and Utility: 1. Strengthens understanding of geometry in programming context. 2. Helps in developing reusable and modular code structures.			
Experiment No. 7	Write a C program for Matrix Operations that accept two 3x3 matrices. Perform the following using functions: a. Display Matrices b. Addition of two matrices c. Subtraction of two matrices	2 Hrs	CO1,CO2
Objective: To understand matrix representation and operations in C. To develop function-based modular programming skills. To apply arithmetic operations (addition and subtraction) on matrices. Associated Tasks: 1. Accept two 3x3 matrices from the user.			



2. Use appropriate loops and function calls to structure code modularly.

Exemplars and Utility:

1. Forms the base for higher-level operations like matrix multiplication, transposition, and determinant calculation.
2. Promotes clean, modular, and reusable code using functions.

Group B (Any Five)

Experiment No. 1	Write a program for Student Attendance Tracker system: Accept attendance of N students for a week. a. Use two-dimensional array to store attendance (1=Present, 0=Absent) b. Display attendance report (Roll Number and Present-Absent) c. Calculate percentage attendance of students.	2 Hrs	CO1, CO5
-------------------------	---	-------	----------

Objective: Tracks and reports student attendance over a week (5 working days), enabling attendance management and performance analysis.

Associated Tasks:

1. Accept number of students (N).
2. Input daily attendance (1 = Present, 0 = Absent).
3. Display student-wise attendance.
4. Calculate and show attendance percentage.

Exemplars and Utility:

1. Helps automate and analyze weekly attendance.
2. Supports easy extension for monthly or term tracking.

Experiment No. 2	Write a C program to calculate monthly electricity bill based on units consumed: ▪ For first 100 units – ₹4.5/unit ▪ 101 to 300 units – ₹7.0/unit ▪ Above 300 units – ₹12/unit ▪ Add ₹120 fixed charge for all customers. ▪ Use simple structure to store Customer ID, name, units and bill amount.	2 Hrs	CO2
-------------------------	--	-------	-----

Objective: To calculate the monthly electricity bill of a customer based on units consumed using a structure C program and fixed slab rates.

Associated Tasks:

1. Define a structure to store customer details.
2. Accept input: Customer ID, Name, Units Consumed.
3. Display the final bill amount.

Exemplars and Utility:

1. Helps utility companies quickly compute electricity bills.
2. Helps students understand conditional logic and structure usage in C.

Experiment No. 3	Design Library Management System using array of structure: Maintain each book ID, title, author, and availability (Yes/No) & Implement following Operations: a. Add new books b. Display book list	2 Hrs	CO2, CO5
-------------------------	---	-------	----------

Amrutvahini

R. G. G. G.



	c. Search by title or author (Use linear search) d. Count available books		
Objective: Design a simple Library Management System using array of structure to store and manage book records. Associated Tasks: 1. Define a Structure to hold book data: ID, Title, Author, and Availability. 2. Implement Add Operation to add new books to the array. 3. Implement Display Operation to list all books. 4. Implement Search Operation (linear search) to find books by title or author. 5. Implement Count Operation to count the number of available books. Exemplars and Utility: 1. Educational: Understand array of structures, linear search, and basic data management. 2. Practical: Simulates how small library systems maintain book records.			
Experiment No. 4	Write C program using array of structure for Bank Account Management System: Accept and display account holder information: Account Number, Name, Balance. Perform operations: a. Deposit Amount b. Withdraw Amount c. Display account balance d. Search by account number	2 Hrs	CO2, CO5
Objective: Design a Bank Account Management System in C using an array of structures to store customer account details and perform basic banking operations like deposit, withdraw, search, and balance check. Associated Tasks: 1. Define a structure to store account details: Account Number, Name, Balance. 2. Accept data for multiple customers. Exemplars and Utility: 1. Educational: Demonstrates structured data handling using arrays and functions. 2. Practical: Simulates mini banking system for understanding transactions and data handling.			
Experiment No. 5	Write a C program using user defined functions. Create separate functions to perform each of the following options and call them using a switch-case. a. Number is even or odd b. Check if number is prime c. Calculate power of the given number	2 Hrs	CO3, CO5
Objective: Design a menu-based C program using user-defined functions to perform basic mathematical operations like checking even/odd, prime, power. Associated Tasks: 1. Create a menu-driven program using switch-case. 2. Implement the above functionalities in separate functions. Exemplars and Utility: 1. Demonstrates use of modular programming with functions. 2. Reusable and easy to manage for various mathematical tasks.			

4/11/25

R. G. G. G.



Experiment No. 6	Accept angle and perform following operations using user defined functions: a. Find sin(angle) b. Find cos(angle) c. Find tan(angle)	2 Hrs	CO2, CO5
Objective: To develop a C program using user-defined functions that accepts an angle in degrees and calculates its trigonometric values such as sin, cos, tan. Associated Tasks: 1. Accept an angle in degrees from the user. 2. Convert the angle from degrees to radians. 3. Implement separate user-defined functions for above. Exemplars and Utility: 1. Understand how to use the math library and user-defined functions. 2. Useful in fields like physics, engineering, and computer graphics.			
Experiment No. 7	Write a C program to develop an Income Tax Calculator that accepts the annual income of an individual and calculates the total tax payable based on applicable income tax slabs. - Income range: Up to ₹12.0 lakh:: Tax:Nil - Income range: ₹12.0 lakh – ₹16.0 lakh:: Tax:15% - Income range: ₹16.0 lakh – ₹20.0 lakh:: Tax:20% - Income range: Above ₹20.0 lakh lakh:: Tax:30%	2 Hrs	CO3, CO5
Objective: To design a C program that calculates the total income tax payable by an individual based on their annual income, using progressive tax slabs as per simplified Indian income tax rules. Associated Tasks: 1. Accept the annual income from the user. 2. Apply the appropriate tax slabs 3. Calculate total tax payable by accumulating slab-wise tax. 4. Display the final tax amount to the user. Exemplars and Utility: 1. Demonstrates conditional logic and arithmetic in C programming. 2. Can be used for rough estimation of income tax liability.			
Group B: Mini Projects (Any One)			
Statement 1: Generate Result of N students in a class using array of structure: Enter following details of N students a class: Roll Number, Name of student, Marks of 5 subjects. Calculate Total, Percentage, Grade of each student. Display Congratulation message for class topper. ▪ If student scores aggregate greater than 75%, then the grade is distinguished. ▪ If aggregate is 60>= and <75 then the Grade of first division. ▪ If aggregate is 50>= and <60, then the grade is second division. ▪ If aggregate is 40>= and <50, then the grade is third division.			
Statement 2: User Friendly Calculator application			

4/10/25

R. G. G. G.



Design the calculator application that performs basic arithmetic operations along with advanced scientific and engineering calculations.

- Basic Arithmetic Operations: Addition of two numbers, Subtraction, Multiplication, Division, Modulus (remainder)
- Advanced Mathematical Operations: Power function (x^y), Factorial of a number, Square and Cube of a number, Square Root, Logarithmic function, Trigonometric functions (sin, cos, tan), Percentage calculation, Absolute value
- Provide User Interface (Console-based): The interface will:
 - Display a main menu with categorized options
 - Accept user input and validate it
 - Display results clearly
 - Loop until the user exits the application

Statement 3: Online Shopping Cart System (Mini Billing System)

Accept multiple products with name, quantity, unit price. Use array of structure

- Calculate bill per product
- Apply 10% discount if bill > ₹500
- Display total payable amount
- Display most frequently sold products
- Display monthly profit

Statement 4: Simple Calendar Generator

The generation of the calendar view for a given month and year by calculating:

- The number of days in the entered month.
- The starting day of the week for the month.
- Appropriate formatting using spaces and loops to align dates with weekdays.

0

- E. Balagurusamy, Programming in ANSIC, 8th Edition.
- H. M. Deitel and P. J. Deitel, C: How to Program, Pearson Education, 2015, 8th ed.
- B. S. Gottfried, Programming with C (Schaum's Outline Series), McGraw-Hill, 1996, 2nd ed.

Reference Books:

- B. W. Kernighan and D. M. Ritchie, The C Programming Language, UK: Prentice Hall, 1988, 2nd ed.
- S. C. Kochan, Programming in C, Sams Publishing, 2004, 3rd ed.
- W. Kernighan and B. Pike, The Practice of Programming, UK: Addison-Wesley, 1999.
- P. Prinz & T. Crawford, C in a Nutshell: The Definitive Reference, O'Reilly Media, 2016, 2nd ed.

MOOCs Links and additional reading material:

- Introduction to Programming in C- NPTEL / Swayam (IIT Kanpur)**
https://onlinecourses.nptel.ac.in/noc25_cs119/preview NPTEL Online Courses
- C Programming and Assembly Language-NPTEL / Swayam**
https://onlinecourses.nptel.ac.in/noc25_cs114/preview NPTEL Online Courses

4/10/25

R. G. G. G.

**3. Introductory C Programming Specialization-Coursera**<https://www.coursera.org/specializations/c-programming> Coursera**Simplilearn's Free C Programming Course**<https://www.simplilearn.com/free-c-course-skillup> Simplilearn.com**4. C Fundamentals**<https://www.w3schools.com/c/>**Strength of CO-PO Mapping**

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

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

This course serves as a prerequisite for / maps with the following future courses:

Data Structures, Computer Graphics, Design and Analysis of Algorithms, Problem Solving & Design.

Job Mapping:

Job opportunities that one can get after learning this course:

1. Embedded Software Developer (Trainee/Junior)

Writing firmware for micro controllers.

Industries: Consumer electronics, IoT, Automotive.

2. System Programmer (Junior)

OS-level programming, device drivers, utilities.

Industries: Operating Systems, Compilers, Networking.

3. Application Support Engineer

Debugging and maintaining legacy C applications.

Industries: Banking, Telecom, Government systems.



Program:		F. Y. B. Tech (A&R)		Semester:		II	
Course:		Digital Technology Lab		Course Code:		R26-AR-VSEC-115	
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
--	2	--	1	--	--	--	50
Course Description: This course offers practical experience in essential digital technologies related to automation and robotics. Students engage in simulations, hardware interfacing, programming, and prototyping through hands-on experiments.							
Course Relevance: The competencies acquired are directly applicable to establishing foundational expertise in automation, thereby equipping students for advanced studies in robotics, embedded systems, and artificial intelligence applications in the subsequent semesters.							
Prerequisite: Basic knowledge of Physics, simple mathematics, and fundamentals of computer usage.							
Bridge Content: 1. Introduction to basic electronics and microcontroller concepts. 2. Overview of coordinate systems and simple robot movement principles. 3. Familiarization with simulation tools (GeoGebra, MATLAB, Python) and basic safety protocols in robotics labs.							
Course Objectives: 1. DEVELOP proficiency in designing and simulating robotic-arm movements utilizing software tools. 2. ACQUIRE hands-on experience in operating robotic interfaces and hardware for various applications. 3. COMPREHEND and IMPLEMENT electronic circuits for robotic systems using microcontrollers. 4. Programming techniques are applied to CONTROL and SIMULATE robotic systems. 5. INVESTIGATE advanced robotic platforms while adhering to safety protocols. 6. Functional prototypes are FABRICATED using 3D printing and everyday materials.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom's Level
CO1	DESIGN and SIMULATE robotic arm movements using basic simulators, demonstrating geometric and kinematic principles.						3
CO2	OPERATE robotic systems like Rotorix and ABB IRB 1410 for tasks such as printing and industrial applications, adhering to safety protocols.						3
CO3	BUILD and PROGRAM Arduino-based circuits and robots, including LED blinking and light/line-following robots, integrating hardware and software						3
CO4	IMPLEMENT and VERIFY digital logic circuits, such as flip-flops, using breadboards and logic trainers						3
CO5	DEVELOP robotic applications using MATLAB and PROGRAM humanoid robots (UBTECH Yanshee/AiNex) for advanced control tasks						3
CO6	FABRICATE functional automation prototypes using 3D printing and everyday materials like cardboard and syringes, showcasing creativity and prototyping skills						6



List of Practical: (Any ten out of twelve)			
Experiment No.1	Basic frame transformations using RoboAnalyzer	2 Hrs.	CO1
Objective: To understand basic frame by visualizing and computing them using RoboAnalyzer Associated Tasks: 1. Input DH Parameters in HTM Module 2. Visualize Local and Global Frames 3. Compute HTMs Using HTM Module 4. Analyze difference between Local vs. Global Frame transformation Exemplars and Utility: 1. Provide clear examples to contrast local and global frame transformations, using HTM 2. Interpret HTM components (rotation and translation) to understand frame differences.			
Experiment No.2	3D Printing of mechanical component using RotricsDexArm	2 Hrs.	CO2,CO4
Objective: Learn 3D Printing technology used for bringing ideas into reality in the form of products. Associated Tasks: 1. Calibrate the Rotorix arm. 2. Import .dxf file of requisite geometric shapes. 3. Generate G-code and print job. Exemplars and Utility: 1. Building prototype components before actual manufacturing. 2. Develops skills in additive manufacturing use for component manufacturing.			
Experiment No.3	Robotic Laser Engraving on Wooden Pallet	2 Hrs.	CO2
Objective: To integrate robotic control with laser engraving technology. Associated Tasks: 1. Configure laser settings. 2. Program engraving paths. 3. Ensure safe operation. Exemplars and Utility: 1. Branding furniture or gift boxes in small woodworking shops. 2. Demonstrates automated customization and traceability in production.			
Experiment No.4	LED Blinking and Timer-based Circuit using Arduino	2 Hrs.	CO3
Objective: To implement timing-based control circuits for robotic indicators. Associated Tasks: 1. Connect LED and timer via Arduino. 2. Write loop code for blinking intervals. 3. Test timing accuracy. Exemplars and Utility: 1. Status indicator lights on robotic arms in factories. 2. Teaches basic Arduino I/O control for machine status monitoring.			



Experiment No.5	Building a Light-following or Line-following Robot using Arduino	2 Hrs.	CO4
Objective: To design autonomous robots for path navigation. Associated Tasks: Install IR sensors. Program following algorithms. Test on different paths. Exemplars and Utility: Line-following robots in warehouse inventory transport. Provides foundation for autonomous guided vehicle (AGV) systems.			
Experiment No.6	Flip-Flop Circuit Implementation & Truth Table Verification	2 Hrs.	CO3
Objective: To design basic sequential logic circuits for robotic control. Associated Tasks: Assemble flip-flop circuit. Verify operation against truth table. Test toggling control with pushbuttons. Exemplars and Utility: Gripper open/close control in packaging systems. Builds understanding of digital control logic for automation.			
Experiment No.7	Robotics Application using MATLAB	2 Hrs.	CO1,CO4
Objective: To simulate robotic motions and trajectories in MATLAB. Associated Tasks: Model arm kinematics. Define motion paths. Plot and analyze trajectories. Exemplars and Utility: Component sorting in small electronics workshops. Enhances computational skills for robot motion planning.			
Experiment No.8	Simulation of Robotic Arm Movement in 2D Space using Python	2 Hrs.	CO2,CO4
Objective: To apply Python programming for robotic motion simulation. Associated Tasks: Write motion simulation script. Visualize arm trajectory. Optimize movement path. Exemplars and Utility: Tool-picking automation in local machine shops. Strengthens coding skills for simulation and path optimization.			



Experiment No.9	Hands-on Programming with Humanoid Robot (UBTECH Yanshee/AINex)	2 Hrs.	CO2,CO4
Objective: To program humanoid robots for interactive tasks. Associated Tasks: 1. Load movement scripts. 2. Sync gestures with speech. 3. Test interaction flow. Exemplars and Utility: 1. Customer greeting robots in retail spaces. 2. Demonstrates human-robot interaction applications in service robotics.			
Experiment No.10	Familiarization with ABB Industrial Robotic Arm & Safety Procedures	2 Hrs.	CO5
Objective: To operate industrial robotic arms while adhering to safety protocols. Associated Tasks: 1. Power up and calibrate ABB IRB 1410. 2. Explore movement modes (Joint, Linear, Reorient). 3. Learn emergency stop procedures. Exemplars and Utility: 1. Circuit board assembly using ABB arms. 2. Prepares students for safe and efficient industrial robot operations.			
Experiment No.11	Fabrication of Functional Prototype using 3D Printing for Automation Application	2 Hrs.	CO6
Objective: To design and produce custom robotic attachments. Associated Tasks: 1. Model part in CAD software. 2. Configure 3D printer. 3. Assemble with robot. Exemplars and Utility: 1. Sensor holders in sorting robots. 2. Introduces rapid prototyping for robotic customization.			
Experiment No.12	Constructing a Basic Robotic Arm Using Everyday Materials	2 Hrs.	CO6
Objective: To demonstrate mechanical design principles using low-cost materials. Associated Tasks: 1. Build structure from cardboard and syringes. 2. Create pneumatic or manual actuation. 3. Test movement with light objects. Exemplars and Utility: 1. Educational robot models in schools. 2. Encourages creativity and mechanical problem-solving with minimal resources.			



Course Projects:

1. Line-Following Delivery Robot

- **Description:** Design and build an Arduino-based robot that follows a designated path (black tape on white surface) to deliver small payloads between two points.
- **Skills Covered:** Arduino programming, sensor integration, motor control, path optimization.
- **Real-World Link:** Similar to robots used in small warehouses for moving items between storage areas.

2. Robotic Arm Simulation & 3D-Printed End-Effector

- **Description:** Simulate a 2D robotic arm in MATLAB or Python for pick-and-place tasks, then 3D print a custom gripper or holder designed for a specific object.
- **Skills Covered:** Kinematic simulation, CAD design, 3D printing, motion planning.
- **Real-World Link:** Used in manufacturing to develop custom tooling for robotic manipulators.

3. Interactive Humanoid Robot Greeter

- **Description:** Program a humanoid robot (UBTECH Yanshee/AiNex) to greet users, provide simple instructions, and respond to voice commands.
- **Skills Covered:** Humanoid robot programming, HRI (Human-Robot Interaction), embedded control.
- **Real-World Link:** Mimics customer service robots deployed in retail or reception areas.

Textbooks:

7. M. P. Groover. (2015). Automation, Production Systems, and Computer-Integrated Manufacturing (4thed.). Pearson. ISBN: 978-9332572492
8. S. B. Niku. (2020). Introduction to Robotics: Analysis, Control, Applications (3rded.). Wiley. ISBN: 978-1-119-52760-2
9. S. R. Deb & S. Deb. (2017). Robotics Technology and Flexible Automation(2nded.). Tata McGraw-Hill Education. ISBN: 978-0070077911
10. S. K. Saha. (2024). Introduction to Robotics, (3rded.). McGraw Hill Education (India) Pvt. Ltd.ISBN:978-9355326461
11. John J. Craig. (2022). Introduction to Robotics Mechanics and Control, (4thed.) Pearson.ISBN:978-9356062191
12. Malvino, A. P., & Leach, D. P. (2014). Digital Principles and Applications, (8thed.) McGraw-Hill Education.978-9339203405
13. Monk, S. (2023). Programming Arduino: Getting Started with Sketches, (3rded.). McGraw-Hill Education. ISBN: 9781264676989

Reference Books:

3. Y. Koren. (1985). Robotics for Engineers. McGraw-Hill. ISBN: 978-0070353992
4. Robert J. Schilling. (2015), Fundamentals of Robotics Analysis and Control, Pearson, ISBN: 9789332555235
5. Spong, M. W., Hutchinson, S., & Vidyasagar, M. (2020). Robot Modeling and Control. (2nded.). Wiley. ISBN: 978-1-119-52404-5
6. Bolton, W. (2010). Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, (4thed.) Pearson.ISBN:978-8131732533

MOOCs Links and additional reading material:

1. Introduction to Robotics – Coursera (University of Pennsylvania)
<https://www.coursera.org/learn/robotics>
2. Control of Mobile Robots – Coursera (Georgia Institute of Technology)

4/10/25

R. G. G. G.



- <https://www.coursera.org/learn/mobile-robot>
3. Arduino Platform and C Programming – Coursera (University of California, Irvine)
<https://www.coursera.org/learn/arduino-platform>
 4. Robotics: Kinematics and Mathematical Foundations – edX (IIT Bombay)
https://onlinecourses.nptel.ac.in/noc24_me140
 5. 3D Printing and Additive Manufacturing – Coursera (University of Illinois)
<https://www.coursera.org/learn/3d-printing>
 6. Digital Systems: From Logic Gates to Processors – edX (MITx)
<https://online-learning.mit.edu/course-catalog>
 7. Arduino Official Tutorials: <https://www.arduino.cc/en/Tutorial/HomePage>
 8. GeoGebra Robotics Simulations: <https://www.geogebra.org/>
 9. Tinkercad Circuits & 3D Design: <https://www.tinkercad.com/>
 10. MATLAB Robotics Toolbox Documentation: <https://www.mathworks.com/help/robotics/>
 11. UBTECH Robotics Platform: <https://www.ubtrobot.com/>
 12. ABB RoboAnalyzer (Simulation Software): <http://www.roboanalyzer.com/>
 13. Raspberry Pi + Python Robotics Guides: <https://projects.raspberrypi.org/>
 14. IEEE Robotics and Automation Society Resources: <https://www.ieee-ras.org/>

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	1	1	1	2	1	3	2	2
CO2	2	2	3	2	3	3	2	2	2	3	2	3	3	2
CO3	3	3	3	3	3	1	1	1	1	2	1	3	3	3
CO4	3	3	3	2	3	1	1	1	1	2	1	3	2	3
CO5	3	3	3	3	3	1	1	1	1	2	1	3	3	3
CO6	3	3	3	3	3	2	2	2	2	3	2	3	3	3
Avg.	3	3	3	3	3	2	1	1	1	2	1	3	3	3

Note - 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

1. Builds foundation for Control Systems, Mechatronics, Embedded Systems, Robotics Kinematics & Dynamics, Industrial Automation, and AI in Robotics.
2. Skills directly link to advanced labs in Robot Programming, Machine Vision, and 3D Printing Applications.

Job Mapping: Job opportunities that one can get after learning this course:

1. Robotics Analyst / Programmer
2. Automation Engineer / PLC Programmer
3. Embedded Systems Developer
4. CAD/3D Printing Designer for Robotics
5. Field Service Engineer (Automation & Robotics)
6. AI/ML Developer in Automation Applications

Amrutvahini

R. G. G. G.



Program:		F. Y. B. Tech (Computer)		Semester:		II	
Course:		Digital Technology Lab		Course Code:		R26-CO-VSEC-115	
Teaching Scheme(Hrs./week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	2	-	1	-	-	50	-
Course Description: Digital Technology Lab provides hands-on experience in basic computing, networking, operating systems, hardware, and cloud tools. It introduces first-year engineering students to essential digital concepts and practical skills through interactive lab sessions.							
Course Relevance: This course builds the foundational digital competencies required for advanced engineering studies and real-world technical applications. It helps students understand core technologies, boosts their problem-solving skills, and prepares them for future technical courses and industry environments.							
Prerequisite: Basic Computer Literacy							
Bridge Content: -							
Course Objectives: 1. To INTRODUCE students to basic installation and configuration of operating systems and software tools. 2. To DEVELOP hands-on skills in assembling computer hardware and identifying components. 3. To ENABLE students to understand and apply basic networking concepts and commands. 4. To FAMILIARIZE students with the use of virtual machines, cloud storage, and antivirus tools. 5. To ENHANCE students' ability to use digital tools like Google Forms and Excel for data handling and documentation.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome					Bloom's Level	
CO1	DESCRIBE the process of installing and configuring various operating systems and software tools.					1	
CO2	EXPLAIN the function and connectivity of computer hardware components and peripherals.					2	
CO3	DEMONSTRATE the ability to configure basic networking settings and use network diagnostic commands.					3	
CO4	INSTALL AND CONFIGURE cloud storage services, virtual machines, and system security tools.					3	
CO5	CREATE AND MANAGE digital documents, forms, and data using productivity tools like Google Forms and Excel.					6	
List of Experiments (Perform any 8 experiments):							
Experiment No.1		Installation and Configuration of Windows Operating System				2 Hrs	CO1
Objective: To perform installation and basic configuration of the Windows operating system.							
Associated Tasks: 1. Creating a bootable USB drive using tools like Rufus. 2. Booting the system from the USB drive. 3. Installing Windows and configuring regional settings.							
Exemplars and Utility:							



1. Installing Windows 11 on PC. 2. Builds confidence in handling OS-level issues independently			
Experiment No.2	Installation and Setup of Open-Source Operating Systems (Ubuntu/Fedora/Red Hat)	2 Hrs.	CO1
Objective: To install and set up open-source operating systems like Ubuntu, Fedora, or Red Hat on a PC. Associated Tasks: 1. Create a bootable USB drive with the selected Linux distribution. 2. Install the OS and configure basic system settings (user, time zone, updates). Exemplars and Utility: 1. Installing Ubuntu alongside Windows for a dual-boot setup. 2. Setting up Fedora.			
Experiment No.3	Computer Security Essentials: Installation and Usage of Free Antivirus Software	2 Hrs.	CO4
Objective: To install and use free antivirus software for protecting a computer system from security threats. Associated Tasks: 1. Download and install a trusted free antivirus program (e.g., Avast, AVG). 2. Perform system scans and update virus definitions Exemplars and Utility: 1. Installing antivirus software on a newly set up Windows PC. 2. Running a full system scan to detect and remove malware.			
Experiment No.4	PC Assembly and Hardware Component Identification with Functional Overview	2 Hrs.	CO2
Objective: To identify, assemble, and understand the function of key computer hardware components. Associated Tasks: 1. Identify and explain the purpose of components like CPU, RAM, motherboard, and power supply. 2. Assemble the components to build a working desktop PC. Exemplars and Utility: 1. Assembling a desktop system for lab or personal use. 2. Replacing or upgrading components like RAM or hard drive.			
Experiment No.5	Networking Fundamentals: Exploring IP/MAC Addresses and Basic Network Commands	2 Hrs.	CO3
Objective: To understand IP and MAC addresses and use basic network commands for connectivity testing. Associated Tasks: 1. Identify IP and MAC addresses using commands like ipconfig or ifconfig. 2. Use ping and traceroute to test and trace network connections. Exemplars and Utility: 1. Diagnosing network issues using ping and traceroute. 2. Builds foundational skills in network troubleshooting.			
Experiment No.6	LAN Cable Preparation: Demonstration of RJ-45 Connector Crimping Process	2 Hrs.	CO3

**Objective:**

To demonstrate the crimping process for preparing LAN cables using RJ-45 connectors.

Associated Tasks:

1. Arrange cable wires as per T568A or T568B standards.
2. Use ping and traceroute to test and trace network connections.
3. Crimp the RJ-45 connector using a crimping tool and test connectivity.

Exemplars and Utility:

1. Creating a custom Ethernet cable for a lab network setup.
2. Repairing a damaged LAN cable by re-crimping connectors.

Experiment No.7**Installation and Configuration of MySQL Server for Database Connectivity****2 Hrs.****CO4****Objective:**

To install and configure MySQL Server for enabling database creation and connectivity.

Associated Tasks:

1. Download and install MySQL Server and Workbench.
2. Configure root user, create a sample database, and test connectivity.

Exemplars and Utility:

1. Setting up MySQL for a student record management project.
2. Builds foundational skills in database setup and management.

Experiment No.8**Virtualization Setup: Creating and Configuring Virtual Machines using VirtualBox/VMware****2 Hrs.****CO4****Objective:**

To create and configure virtual machines using VirtualBox or VMware for simulating multiple operating systems.

Associated Tasks:

1. Install VirtualBox/VMware and set up a new virtual machine.
2. Configure OS installation, memory, and storage settings within the VM.

Exemplars and Utility:

1. Running Ubuntu on a Windows PC using VirtualBox.
2. Creating a testing environment for software without affecting the host OS.

Experiment No.9**Cloud Storage Integration: Installation and Configuration of Dropbox Service****2 Hrs.****CO4****Objective:**

To install and configure Dropbox for cloud-based file storage, access, and synchronization.

Associated Tasks:

1. Download, install, and sign in to the Dropbox desktop application.
2. Upload, sync, and share files between devices using Dropbox.

Exemplars and Utility:

1. Backing up project files from a local PC to Dropbox.
2. Sharing lab reports or documents with team members via cloud.

Experiment No.10**Peripheral Device Setup: Installation and Configuration of Printers, Scanners, and Related Hardware****2 Hrs.****CO2****Objective:**

To install and configure hardware peripherals like printers and scanners for effective system integration.

Associated Tasks:



1. Connect and install drivers for printers or scanners on a computer.
2. Configure device settings and perform test operations (print/scan).

Exemplars and Utility:

1. Develops practical skills in handling essential peripheral devices.
2. Setting up a wireless printer in a computer lab

Experiment No.11	Digital Branding Assignment	2 Hrs.	CO5
-------------------------	------------------------------------	---------------	------------

Objective:

To build a strong personal digital identity by creating and managing an online presence across platforms (LinkedIn, portfolio, etc.).

Associated Tasks:

1. Create/upscale LinkedIn profile, design a personal logo, write a bio/vision statement.
2. Integrate all into a professional portfolio or blog.

Exemplars and Utility:

1. Enhances visibility and credibility in academic and professional circles.
2. Supports networking, career opportunities, and personal branding.

Experiment No.12	Build a Personal Portfolio Website	2 Hrs.	CO5
-------------------------	---	---------------	------------

Objective:

To design and develop a **personal portfolio website** that showcases a student's skills, experiences, and achievements through structured sections including a **resume**, **blog**, and **project portfolio**.

Associated Tasks:

1. Design and develop a responsive portfolio with sections for resume, blog, and projects. Add navigation, contact info.
2. Deploy it online.

Exemplars and Utility:

1. Design and develop a responsive portfolio with sections for resume, blog, and projects.
2. Add navigation, contact info, and deploy it online.

Strength of CO-PO-PSO Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	-	-	-	-	2	3	3	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2	3	2	2
CO3	2	3	2	-	3	-	-	-	-	-	-	2	2	3	2
CO4	2	3	2	-	3	-	-	-	-	-	-	2	2	3	2
CO5	2	2	2	-	3	-	-	-	-	-	-	2	-	2	3
Avg.	2	2	2	-	3	-	-	-	-	-	-	2	3	3	2

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Job Mapping:

Job opportunities that one can get after learning this course:

IT Support Technician / Helpdesk Support, System Administrator (Junior Level), Hardware Technician, Data Entry & Document Management Executive.

Amrutvahini

R. G. G. G.



Program:	F. Y. B. Tech (Electrical)			Semester:	II		
Course:	Digital Technology Lab			Course Code:	R26-EE-VSE-115		
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	02	-	1	-	-	50	-
Course Description: This course introduces first-year engineering students to fundamental concepts and practical skills in electrical engineering. It covers basic wiring systems, domestic earthing, and safety practices, along with control of induction motors using various starters. Students learn repair and maintenance of household electrical appliances and gain exposure to smart net metering in renewable energy systems. The course also introduces MATLAB/Simulink for basic calculations, circuit simulations, solving ODEs, and analyzing electrical signals, including RMS values of waveforms.							
Course Relevance: The course equips students with essential practical and analytical skills required in electrical engineering. It emphasizes safe electrical installations, motor control, and appliance maintenance while familiarizing students with modern renewable energy systems. The MATLAB component strengthens problem-solving and simulation abilities, bridging theory with real-world applications in circuit analysis, signal processing, and electrical system modeling.							
Prerequisite: Basic knowledge of Physics, Familiarity with fundamental Mathematics, Basic computer literacy							
Bridge Content: Revision of basic concepts of current, voltage, resistance, and power, Introduction to series and parallel circuits with simple numerical examples, Basic idea of AC vs. DC supply. Recap of safety precautions while handling electrical equipment, Introduction to basic computer usage and MATLAB environment for simple calculations and plots.							
Course Objectives: 1. UNDERSTAND basic electrical wiring, earthing, and safety practices. 2. UNDERSTAND the operation and control of induction motors using different starters. 3. APPLY repair and maintenance techniques for domestic electrical appliances. 4. UNDERSTAND the concept and benefits of smart net metering. 5. APPLY MATLAB for basic circuit simulation, ODE solving, and signal analysis.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom's Level
CO1	APPLY knowledge to design and implement basic electrical wiring systems safely.						3
CO2	APPLY techniques to operate and test induction motors using different starters						3
CO3	EXPLAIN how various domestic electrical appliances function and the causes of common faults.						3
CO4	DESCRIBE how smart net metering works and its advantages for efficient energy management.						3
CO5	USE MATLAB/Simulink to perform basic circuit simulations, solve ODEs, and analyze electrical signals						2



List of Practical:			
Experiment No. 1	Wiring scheme for 1. Domestic wiring, 2. Stair case wiring, 3. Godown wiring.	2Hrs	CO1
Objective: To understand, design, and implement basic electrical wiring schemes (domestic, staircase, and godown) using proper connections, safety measures, and practical applications in real-life situations.			
Associated Tasks: 1. Draw neat circuit and wiring diagrams for domestic, staircase, and godown wiring. 2. Identify and select electrical components (switches, lamps, fuse, MCB, sockets, etc.). 3. Perform wiring connections on a training board or lab setup. 4. Test and verify correct operation of each wiring scheme using tester/multimeter. 5. Observe safety precautions during wiring work.			
Exemplars and Utility: 1. Used in every household for daily needs and safe electricity usage.			
Experiment No. 2	Demonstration of domestic earthing.	2Hrs	CO1
Objective: To understand the necessity, construction, and working of domestic earthing, and to demonstrate how earthing provides safety by preventing electric shock and protecting appliances.			
Associated Tasks: 1. Study the need and principle of earthing. 2. Identify the materials used (earth electrode, GI/copper plate, charcoal, salt, earthing wire). 3. Draw the schematic diagram of a plate or pipe earthing system. 4. Demonstrate the earthing setup on a model/training kit or observe a real installation. 5. Measure earth resistance using an earth tester. 6. Record observations and relate to safety standards (IS codes)			
Exemplars and Utility: 1. Demonstration of earthing connection in an actual building. 2. Ensures safety of human life by avoiding electric shock. 3. Protects household and industrial appliances from damage due to leakage current or lightning			
Experiment No. 3	Study of Starters	2Hrs	CO1
Objective: To study and demonstrate the control of induction motors using different types of starters (Direct-On-Line, Star-Delta, Auto-transformer, etc.) and understand their role in safe starting and protection of motors.			
Associated Tasks: 1. Identify the need for starters in motor control (high starting current problem). 2. Study the working principle of common starters (DOL, Star-Delta, Auto-transformer, Resistance starter). 3. Draw neat wiring/circuit diagrams for each type of starter. 4. Connect a motor to different starters in the laboratory under supervision. 5. Operate and observe the motor starting characteristics (current drawn, speed rise). 6. Record observations and compare performance between different starters. 7. Relate the application of each starter to industry use-cases.			
Exemplars and Utility: 1. Widely used in industries, pumps, elevators, and conveyors			



Experiment No. 4	Repairing and maintenance of domestic electrical home appliances.	2Hrs	CO3
Objective: To learn the basic principles, common faults, and repair/maintenance procedures of domestic electrical appliances.			
Associated Tasks: 1. Identify different home appliances and their working principles. 2. Study the internal parts and wiring of selected appliances. 3. Learn the use of basic tools (screwdriver, plier, tester, multimeter, soldering iron). 4. Diagnose common faults such as loose connections, blown fuse, damaged wire, or heating element failure. 5. Carry out minor repairs (e.g., rewiring, fuse replacement, cleaning, and lubrication of fan bearings). 6. Test the repaired appliance for safe and proper working. 7. Record safety precautions and preventive maintenance tips			
Exemplars and Utility: 1. Reduces cost of maintenance and dependency on technicians			
Experiment No. 5	Learn Smart Net metering.	2Hrs	CO4
Objective: To understand the concept, working, and benefits of smart net metering in renewable energy systems, and to learn how it enables two-way power flow between consumers and the utility grid.			
Associated Tasks: 1. Study the principle of net metering and its role in grid-connected solar PV systems. 2. Identify key components: smart meter, solar panel, inverter, utility grid. 3. Draw the block diagram showing power flow (consumer ↔ grid). 4. Demonstrate data monitoring on a smart energy meter or simulator. 5. Record sample readings of energy consumption vs. energy export. 6. Discuss safety, regulatory guidelines, and energy-saving benefits.			
Exemplars and Utility: 1. Demonstration using a smart energy meter connected to a solar PV trainer kit 2. Helps consumers reduce electricity bills by exporting surplus solar power.			
Experiment No. 6	Learn MATLAB software used in Electrical engineering	2Hrs	CO5
Objective: To introduce MATLAB software as a computational and simulation tool, enabling students to perform basic calculations, plotting, and simple circuit/system analysis in electrical engineering.			
Associated Tasks: 1. Learn the MATLAB interface, command window, and script editor. 2. Perform basic arithmetic and matrix operations. 3. Write simple scripts for solving electrical equations (Ohm's law, KVL, KCL). 4. Plot graphs of voltage, current, and power vs. time using MATLAB plotting functions. 5. Simulate basic electrical circuits using Simulink (resistive circuit, RC/RL response). 6. Save, run, and debug MATLAB programs. 7. Document results and interpret outputs for engineering problems.			
Exemplars and Utility: 1. Provides a strong foundation for advanced subjects like power systems, machines, and control engineering.			



Experiment No. 7	Solution of ordinary differential equation using MATLAB.	2Hrs	CO5
Objective: To learn how to solve ordinary differential equations (ODEs) using MATLAB programming and built-in functions, and to apply it to basic electrical engineering problems such as RLC circuits and system responses. Associated Tasks: 1. Recall the form of a first-order and second-order ODE (e.g., RC charging, RLC oscillations). 2. Learn MATLAB functions for ODE solving (ode45, ode23, etc.). 3. Write a MATLAB function file to represent the given ODE. 4. Use the solver to compute the solution over a defined time interval. 5. Plot the solution (e.g., voltage across capacitor vs. time). 6. Verify results with analytical (manual) solution if possible. 7. Interpret physical meaning of results (charging curve, transient response). Exemplars and Utility: 1. Helps analyze dynamic behavior of electrical systems (transients in circuits, machine dynamics, and control systems).			
Experiment No. 8	Perform arithmetical operation of electrical signals	2Hrs	CO5
Objective: To understand and perform basic arithmetical operations (addition, subtraction, multiplication, and scaling) on electrical signals using experimental setups or MATLAB/Simulink, and analyze their results Associated Tasks: 1. Study the nature of input signals (sinusoidal, square, triangular, etc.). 2. Generate electrical signals using function generator / MATLAB. 3. Perform addition and subtraction of signals using an op-amp adder/subtractor circuit or MATLAB. 4. Perform multiplication (AM modulation demo or multiplier IC) and scaling (amplification/attenuation). 5. Observe the resultant signals on CRO/oscilloscope or plot in MATLAB. 6. Compare the output waveforms with theoretical expectations. 7. Record observations and note practical applications. Exemplars and Utility: 1. Addition of two sine waves of different frequencies to form a composite signal.			
Experiment No. 9	Calculation of RMS value of waveform by simulation model.	2Hrs	CO5
Objective: To understand and calculate the Root Mean Square (RMS) value of electrical waveforms (sinusoidal, square, triangular) using a simulation model in MATLAB/Simulink or equivalent software. Associated Tasks: 1. Recall the formula of RMS value: 2. Generate different waveforms (sine) using a function block in the simulation software. 3. Build a simulation model that squares the signal, averages it over one cycle, and takes the square root. 4. Use RMS measurement blocks/tools (e.g., Simulink RMS block). 5. Compare the simulated RMS values with theoretical values 6. Record simulation results in tabular form. 7. Interpret the importance of RMS value in power calculations. Exemplars and Utility:			

4/10/25

R. G. G. G.



1. Essential for AC circuit analysis

Experiment No. 10	Application of 12-0-12 volt center tapped step down transformer.	2Hrs	CO2
--------------------------	--	-------------	------------

Objective:

To study the working and applications of a 12-0-12 V center-tapped step-down transformer and demonstrate its role in AC to DC power supply circuits

Associated Tasks:

1. Identify all loops and junctions in a given electrical circuit.
2. Draw the construction and circuit symbol of a center-tapped transformer.
3. Connect the transformer with AC mains (under safe conditions).
4. Measure the secondary voltages: 12 V–0 V and 12 V–12 V using a multimeter.
5. Demonstrate its application in a full-wave rectifier circuit.
6. Observe and record the rectified output waveform using a CRO/oscilloscope.
7. Discuss its role in regulated DC power supply design

Exemplars and Utility:

1. Used in regulated DC power supplies for electronic devices.

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3		2	2	3		2	-	-	3	2	-
CO2	3	3	2	2	3	2		2	2	-	-	3	-	-
CO3	2	2	-	-	2	3	3	-	2	-	2	2	-	-
CO4	2	2	2	-	3	3	-	-	2	-	3	-	3	-
CO5	3	2	2	3	3	-	-	-	2	2	3	3	2	3
Avg.	2.6	2.2	2.2	2.5	2.6	2.5	3	2	2	2	2.6	2.75	2.3	3

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Unit wise Weightage: This course serves as a prerequisite for / maps with the following future courses:

Electrical Machines, Power Systems, Power Electronics & Drives, Renewable Energy Systems, Electric Vehicle Technology, Control Systems, and Simulation Tools in Electrical Engineering.

Job Mapping:

Electrical Technician / Wiring Supervisor, Maintenance Engineer, Junior Design/Simulation Engineer.

Amrutvahini

R. G. G. G.



Program:		F. Y. B. Tech (IT)			Semester:		II	
Course:		Digital Technology Lab			Course Code:		R26-IT-VSE-115	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	01	-	-	50	-	
Course Description The Digital Technology Lab provides engineering students with practical exposure to fundamental and emerging areas of digital technologies. The course covers hands-on activities related to computer hardware assembly, networking, operating systems, cloud storage, data analysis, Internet of Things (IoT), virtualization, version control using Git and GitHub, and the application of artificial intelligence tools. It enables students to understand the functioning and integration of various hardware and software components while developing essential technical and analytical skills required for modern digital systems.								
Course Relevance: This course is highly relevant to engineering education as it bridges theoretical knowledge with real-world applications of digital systems. It equips students with multidisciplinary competencies that are essential for careers in information technology, computer engineering, and electronics. By working with contemporary tools and technologies, students develop problem-solving abilities, technical adaptability, and innovation skills aligned with industry 4.0 requirements. The lab serves as a foundation for advanced courses in computer networks, data analytics, IoT, and AI, thereby enhancing employability and professional readiness in the engineering domain.								
Prerequisite: Fundamental knowledge and basics of computer.								
Bridge Content Computer System Components Overview- Recap on hardware components and their functions								
Course Objectives: 1. UNDERSTAND computer hardware and peripherals with hands-on system assembly and troubleshooting. 2. LEARN basic networking concepts, components, configurations, and data communication. 3. EXPLORE IoT sensors, OS fundamentals, and virtualization techniques. 4. GAIN practical skills in Google Drive, mobile app, Git, GitHub for cloud storage and version control. 5. PERFORM data analysis in Excel and apply basic AI tools for content generation.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome						Bloom's Level	
CO1	IDENTIFY the functionality and integration of essential computer hardware components and peripheral devices						2	
CO2	UNDERSTAND networking components and network configurations, protocols, and data transmission mechanisms.						2	
CO3	IDENTIFY IoT sensors and UNDERSTAND key operating system components along with virtualization techniques						2	
CO4	APPLY basic development tools to build a mobile app and Git, GitHub Repository						3	
CO5	DEMONSTRATE Data analysis using Microsoft Excel, AI Tools and AI Generation						3	



List of Practical:			
Experiment No.1	Assembling Computer System by identifying and assembling components	2 Hrs.	CO1
Objective: To enable students to identify, select, and assemble essential computer hardware components to build a fully functional personal computer system. Associated Tasks: - Students will be provided with various hardware components such as the CPU, RAM, motherboard, power supply, storage devices, and cooling systems. - They must correctly identify each component, explain its function, and assemble a fully functional computer. - The assembled system will be tested for successful boot-up and basic functionality. Exemplars and Utility: - Identify and describe the functions of CPU, RAM, motherboard, SMPS, HDD/SSD, GPU, etc. - Mount the motherboard in the cabinet and connect the power supply.			
Experiment No.2	Installing, Configuring & Demonstrating Functionality of Peripheral Devices	2 Hrs	CO1
Objective: To enable students to install, configure, and demonstrate the working of various peripheral devices such as input, output, and storage devices used in a computer system. Associated Tasks: - Students will install, configure peripheral devices: monitors, keyboards, webcam/digital Camera, printers, scanner, speaker, projectors. - Students will install and configure external storage devices: Disk Drives, Pen Drives and Memory Cards. - They must troubleshoot common connection issues like display resolution issues, install necessary drivers, and verify device functionality using appropriate software tools. Exemplars and Utility: - Install and test printers (inkjet/laser), monitors, speakers, and projectors. - Power on the system, listen for POST beeps, and troubleshoot basic errors.			
Experiment No.3	Setting Up a Local Area Network (LAN)	2 Hrs.	CO2
Objective: To enable students to design, configure, and implement a Local Area Network (LAN) by connecting multiple devices using appropriate hardware, IP addressing, and testing connectivity, thereby demonstrating basic networking concepts and practical skills. Associated Tasks: - Students will set up a basic LAN using Twisted Pair cables and switches. - Students will Learn Crimping Process required for LAN Setup - Test the LAN using LAN Tester - They must configure IP addresses, subnet masks for LAN setup. - Test network connectivity using ping and tracert(trace route) commands Exemplars and Utility: - Identify the number of systems, select topology (star, bus), and list required devices (switch, router, cables). - Create and test straight-through and crossover Ethernet cables using RJ-45 connectors.			
Experiment No.4	Understanding Network Protocols and Packet Transmission	2 Hrs	CO2
Objective: To enable students to understand the structure, function, and behavior of various network protocols and to analyze packet transmission processes across layers in a network, including encapsulation,			

4/10/25

R. G. G. G.



addressing, and routing.

Associated Tasks:

1. Students will use a network analyzer (e.g. Wireshark) to inspect data packet transmission between devices.
2. Fundamentals of TCP/IP(Transmission Control Protocol/Internet Protocol) to data is transmission
3. The lab will involve troubleshooting basic network issues in data transmission

Exemplars and Utility:

1. Use Cisco Packet Tracer to simulate client-server communication (e.g., web browsing, email).
2. Use ping and tracert/traceroute to observe packet journey, round-trip time, and route hops.

Experiment No.5	Exploring IoT Sensors and Data Collection	2 Hrs	CO3
------------------------	--	--------------	------------

Objective: To introduce students to the functioning of IoT sensors, their interfacing with microcontrollers, and the process of collecting, transmitting, and analyzing sensor data for real-world applications.

Associated Tasks:

1. Students will work with various IoT sensors such as temperature, humidity, motion, and light sensors.
2. Interfacing of sensors with Arduino or Raspberry Pi to collect real-time data.
3. The lab will involve analyzing sensor outputs, visualizing data

Exemplars and Utility:

1. Study and demonstrate basic IoT sensors such as temperature (DHT11), humidity, motion (PIR), light (LDR), gas, etc.
2. Connect sensors to Arduino/Raspberry Pi and collect readings via code.

Experiment No.6	Exploring Operating System and Virtualization	2 Hrs	CO3
------------------------	--	--------------	------------

Objective: To familiarize students with the **core functions of an Operating System (OS)** and provide practical exposure to **virtualization technologies**, enabling them to install, configure, and manage multiple virtual machines (VMs) using hypervisors.

Associated Tasks:

1. Students will install and configure an operating system (e.g., Windows, Linux) on a computer machine.
2. They should navigate OS functions: file system management, process handling, command-line operations.
3. Students will use virtualization software (e.g.VirtualBox, VMware) to configure virtual machines (VMs).
4. Running Windows and Linux on the same physical machine using VMware

Exemplars and Utility:

1. Install VirtualBox, VMware Workstation, or Hyper-V on a host system.
2. Demonstrate how to run multiple VMs and enable networking between them (e.g., NAT, bridged).

Experiment No.7	Android App Development	2 Hrs	CO4
------------------------	--------------------------------	--------------	------------

Objective: To introduce students to basic Android app development using a visual or text-based development environment, and to help them design, implement, and test a functional calculator app for basic arithmetic operation

Associated Tasks:

1. **Understanding Android App Components** – Activity, UI Layout, Event Listeners.
2. **Designing User Interface (UI):** Using drag-and-drop components in MIT App Inventor or XML in Android Studio.
3. **Implementing Functionality:** Basic arithmetic logic (Add, Subtract, Multiply, Divide).
4. **Testing the App** – Using emulator or real Android device.

Exemplars and Utility:

1. **Interactive UI Development** – Students learn to build clean and responsive user interfaces.

Amrutvahini

R. G. G. G.



2. Logical Thinking – Students apply basic programming logic in a real-world application.			
Experiment No.8	Demonstrating Git and GitHub Repository	2 Hrs	CO4
Objective: To equip students with the knowledge and skills to use Git for version control and manage code repositories on GitHub, enabling collaborative software development and project tracking. Associated Tasks: 1. Introducing version Control System 2. Git Installation on Windows/Linux • Creating GitHub account and GitHub repository 3. Use example command of GitHub 4. Students should able to manage repositories Exemplars and Utility: 1. Set up Git on a local machine, configure user credentials, and initialize a new repository (git init) 2. Perform git add, git commit, and git status to track file changes and save versions.			
Experiment No.9	Demonstrating data analysis using Microsoft Excel	2 Hrs	CO5
Objective: To enable students to perform basic to intermediate data analysis using Microsoft Excel tools such as formulas, functions, charts, PivotTables, and data visualization features, supporting informed decision-making. Associated Tasks: 1. Apply essential formulas like SUM, AVERAGE, IF, VLOOKUP, COUNTIF, CONCATENATE, etc. 2. Create bar charts, pie charts, line graphs, and combo charts for visual representation of data. 3. Apply Goal Seek, Scenario Manager, and Data Tables for forecasting and decision analysis. Exemplar & Utility: Useful for creating sales analysis sheets, student result dashboards, inventory trackers, and financial forecasting models, helping students understand real-world data handling, visualization, and decision making using Excel.			
Experiment No.10	Exploring AI Tools and AI Generation	2 Hrs	CO5
Objective: To introduce students to modern AI tools and platforms that enable AI-generated content, and to develop the ability to evaluate and apply these tools for creative, analytical, and productivity tasks. Associated Tasks: 1. Exploring AI Chatbots – Use of ChatGPT and Gemini 2. Creative Designing with Generative AI Tools: DALL-E 3. Automated Report Writing with AI Tools: like ChatGPT /Notion AI / GrammarlyGO Exemplars and Utility: 1. Generate code, auto-complete functions, and debug using AI assistance in IDEs. 2. Automate data interpretation and generate charts or forecasts with AI help.			

Textbooks:

1. Scott Mueller, Upgrading and Repairing PCs, Pearson Education, 22nd Edition.
2. David Wolber, et al., App Inventor 2: Create Your Own Android Apps, O'Reilly, 2nd Edition.
3. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press (VPT), 2015.

Reference Books:

1. Kurose, Ross, Computer Networking: A Top-Down Approach, Pearson, 8th (2021).
2. Internet of Things: Principles and Paradigms – Rajkumar Buyya & Amir Vahid Dastjerdi
3. Operating Systems: Three Easy Pieces – Remzi H. Arpaci-Dusseau & Andrea C. Arpaci-Dusseau
4. Reema Thareja, Computer Fundamentals and Programming in C, Oxford University Press, 2nd



(2017)

MOOCs Links and additional reading material:**NPTEL- Android app using Kotlin - Course**https://onlinecourses.swayam2.ac.in/aic20_sp02/preview**NPTEL- Introduction to Computer and Network Performance Analysis using Queuing Systems - Course**https://onlinecourses.nptel.ac.in/noc25_cs126/preview**Tutorials Point : Output Devices PDF -Output Devices in Computers**https://www.tutorialspoint.com/computer_fundamentals/computer_output_devices.htm**Strength of CO-PO-PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	-	2	1	-	1	1	-	2	3	3	2
CO2	3	3	2	2	3	1	-	2	1	-	2	3	3	2
CO3	3	2	2	2	2	2	1	1	1	-	3	3	3	2
CO4	2	2	3	2	3	1	2	3	3	2	3	2	2	3
CO5	2	2	2	3	3	3	3	2	2	2	3	3	3	3
Avg	2.6	2.4	2	2.25	2.6	1.6	2	1.8	1.6	2	2.6	2.8	2.8	2.4

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

This lab is a direct prerequisite for Computer Networks, Operating Systems, and Internet of Things (IoT). It also provides foundational skills for Data Science, Artificial Intelligence, and Software Engineering courses.

Job Mapping:

Job opportunities that one can get after learning this course:

This course prepares you for entry-level roles like IT Support Specialist, Network Technician, and IoT Trainee Engineer, while building a foundation for careers in Data Analysis, Software Development, and AI Prompt Engineering.



Strength of CO-PO mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	-	1	1	1	1	2	-	3
CO2	3	2	2	1	2	1	-	1	1	1	1	-	-	3
CO3	2	3	2	1	3	1	-	1	1	1	1	2	-	3
CO4	2	3	2	1	3	1	-	1	1	1	1	2	-	3
Avg.	2	2	2	1	3	1	-	1	1	1	1	2	-	3

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

Machine Design, Computer Aided Manufacturing, Advanced Manufacturing Processes

Job Mapping:

Job opportunities that one can get after learning this course:

1. Technical Assistant / Technician Trainee: Basic machine operations, CAD drawing support, Workshop/lab assistant roles
2. Manufacturing/Production Helper: Roles in small manufacturing firms, Machine shop assistant, Assembly line work
3. Apprenticeships / Internships: Many industries offer ITI-level apprenticeships for candidates with basic technical knowledge, PSU apprentice schemes under the National Apprenticeship Promotion Scheme (NAPS)
4. Field Technician: Jobs in installation and maintenance of machinery,
5. Customer Service Support (Technical): Call center support for mechanical tools or software, Sales assistant in hardware/tool shops.



Program:	F. Y. B. Tech (Mechanical)			Semester:	II		
Course:	Digital Technology Lab			Course Code:	R26-ME-VSEC-115		
Teaching Scheme (Hrs./Week)				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	2	-	1	-	-	50	-
Course Description This introductory laboratory course is designed for first-year B.Tech Mechanical Engineering students to help them understand the basics of digital manufacturing. The course provides hands-on practice with modern engineering tools and processes such as Solid Modeling, Assembly Design, CNC Programming, 3D Printing, and Digital Manufacturing workflows. Students will use industry-standard CAD and CAM software to create 3D models of mechanical parts, build assemblies, simulate simple operations, and generate basic CNC codes. They will also fabricate small prototypes using 3D printing.							
Course Relevance: The course highlights key concepts such as geometric reasoning, parametric modeling, toolpath generation, and digital process planning. By linking theory to practice, it builds a strong foundation for higher-level courses in mechanical, manufacturing, and mechatronic engineering, while giving students early exposure to industry-relevant technologies.							
Prerequisite: 1. Basic understanding of orthographic projections, isometric representations, and standard dimensioning practices to accurately interpret and create technical drawings. 2. Prior exposure to commonly used machine elements - such as bolts, nuts, shafts, bearings, flanges, and keys is essential for effective modeling, assembly, and functional analysis of mechanical systems. 3. Basic Manufacturing knowledge							
Course Objectives: 1. INTRODUCE students to Computer-Aided Design (CAD) by creating simple 3D models of mechanical parts and combining them into basic assemblies. 2. PROVIDE a basic understanding of CNC (Computer Numerical Control) technology and hands-on practice in writing, editing, and simulating simple CNC programs using standard G-codes and M-codes. 3. GIVE students practical experience in 3D printing (Additive Manufacturing) using Fused Deposition Modeling (FDM), including model preparation, slicing, G-code generation, and prototype fabrication. 4. FAMILIARIZE students with Digital Manufacturing and Computer-Aided Manufacturing (CAM) tools, highlighting their role in improving accuracy, efficiency, and process planning in modern production systems.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom's Level
CO1	CREATE simple 3D models of mechanical parts and combine them into assemblies using CAD tools.						3
CO2	WRITE AND SIMULATE basic CNC programs using standard G-codes and M-codes for simple machining operations.						3
CO3	PREPARE AND FABRICATE small prototypes using FDM-based 3D printing, including model slicing and G-code generation.						3



CO4	EXPLAIN AND DEMONSTRATE the role of CAM and Digital Manufacturing tools in improving accuracy, efficiency, and process planning.	2
List of Experiments (4 Experiments):		
Experiment No.1	Modelling and Assembly	8 Hrs. CO1
Objective: To develop the ability to create solid models of basic mechanical components and assemble them using Computer-Aided Design (CAD) tools.		
Associated Tasks: 2-D sketching with geometrical and dimensional constraints - Solid modeling for simple mechanical components - Assembly modeling (Output file as Assembly drawing and detailing) of the parts modeled - Using proper assembly constraint conditions and generation of exploded view for assemblies.		
Exemplars and Utility: - Enhances spatial visualization and geometric reasoning. - Builds proficiency in parametric modeling and design intent - Prepares students for roles in mechanical design, product development, and manufacturing. - Aligns with CAD workflows in tools like SolidWorks, Autodesk Inventor, Creo, and Fusion 360.		
Experiment No.2	Computerized Numerical Control (CNC)	8 Hrs. CO2
Objective: Students will be able to interpret and generate CNC programs for basic machining tasks, demonstrating proficiency in G-code and M-code syntax and simulation		
Associated Tasks: - Identify and label key components: control panel, drive system, spindle, tool changer. - Write CNC program (Lathe Machine) for basic components using part drawings (2D). - Develop a complete CNC program for a stepped shaft or flange		
Exemplars and Utility: - Builds fluency in CNC programming language. - Develops confidence in interpreting and debugging code. - Prepares students for roles in CNC operation, process planning, and automation. Can be extended to CAD/CAM workflows and post-processing.		
Experiment No.3	3D Printing Technology	6 Hrs. CO3
Objective: To design, slice, and fabricate 3D printed components using FDM technology		
Associated Tasks: - Create 3D Models in CAD Software. Convert CAD models to STL format - Import STL into Slicer Software. Generate G-code. - Prepare FDM Printer - Start the Print. Remove Supports and Clean Print		
Exemplars and Utility: - Builds understanding of additive manufacturing workflows. - Prepares students for roles in prototyping, product design, and manufacturing.		
Experiment No.4	Digital Manufacturing	2 Hrs. CO4
Objective: Evaluate digital manufacturing workflows and CAM toolpaths to optimize production accuracy, efficiency, and		



collision avoidance.

Associated Tasks:

1. Identify stages: CAD → CAM → Simulation → CNC → Post-processing
2. Simulate Toolpaths in CAM Software. Use simulation to detect tool-part, tool-fixture, and tool-machine collisions.

Exemplars and Utility:

1. Prepares students for roles in process engineering, CAM programming, and digital manufacturing
2. Enhances understanding of CAM logic and CNC safety

Textbooks:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 53rd Edition, ISBN: 978-9380358963
2. Ibrahim Zeid, Mastering CAD/CAM, Tata McGraw-Hill, ISBN: 978-0070265103.
3. P. N. Rao, Computer Aided Manufacturing. Tata McGraw-Hill, ISBN: 978-0070583733,
4. M. P. Groover, Fundamentals of Modern Manufacturing, Wiley India, ISBN: 978-8126547371

Reference Books:

1. P. Radhakrishnan, S. Subramanyan, and V. Raju, CAD/CAM/CIM, New Age International, 4th Edition, ISBN: 978-8122439809
2. T. K. Kundra, P. N. Rao, and N. K. Tewari, Numerical Control and Computer-Aided Manufacturing, Tata McGraw-Hill, ISBN: 978-0074516218
3. C. K. Chua, K. F. Leong, and C. S. Lim, Rapid Prototyping: Principles and Applications, Tata McGraw-Hill India Edition, ISBN: 978-8120348288.
4. Serope Kalpakjian and Steven Schmid, Manufacturing Engineering and Technology, Pearson India, ISBN: 978-9332549814.
5. M. Adithan, Computer Aided Manufacturing, PHI Learning, ISBN: 978-8120347496.

MOOCs Links and additional reading material:

1. Fundamentals of Additive Manufacturing Technologies By Prof. Sajan Kapil, IIT Guwahati: <https://nptel.ac.in/courses/112103306>
2. The Future of Manufacturing Business: Role of Additive Manufacturing, By Prof. R. K. Amit, Prof. U. Chandrasekhar, IIT Madras: https://onlinecourses.nptel.ac.in/noc20_mg70/preview
3. Computer Integrated Manufacturing, BY Prof. J. Ramkumar Prof. Amandeep Singh IIT Kanpur: https://onlinecourses.nptel.ac.in/noc22_me10/preview
4. Computer Aided Design and Manufacturing, By Prof. Anoop Chawla, Prof. P.V. Madhusudan Rao IIT Delhi: nptel.ac.in/courses/112102101

Amrutvahini

R. G. G. G.



Program:		F. Y. B. Tech			Semester:		II	
Course:		Cocurricular Course- II Creative Arts & Design			Course Code:		R26-SH-CC-117.1	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	01	-	-	25	-	
Course Description. This course provides students with advanced techniques in visual and textile arts, paper crafts, clay modelling , and eco-friendly creative practices. It emphasizes hands-on learning, creative expression, and sustainability. Students will learn to plan, execute, and present individual and group projects, culminating in exhibitions that reflect both skill development and aesthetic understanding.								
Course Relevance Arts & Craft enhances creativity, fine motor skills, and aesthetic appreciation. It fosters innovative thinking and promotes environmentally conscious practices. This course is relevant for students pursuing careers in design, teaching, fine arts, and sustainable crafts, while also nurturing cultural and personal expression.								
Course Objectives 1. Develop advanced skills in drawing, painting, and mixed media. 2. Create decorative and functional art using paper, textiles, clay, and recycled materials. 3. Apply design principles, color theory, and texture in practical projects. 4. Plan, execute, and present individual and collaborative creative projects. 5. Promote sustainable practices through eco-friendly art and craft.								
CO	Course Outcome						Bloom’s Level	
CO1	Demonstrate proficiency in advanced drawing and painting techniques.						3	
CO2	Construct complex paper crafts and textile-based art pieces.						3	
CO3	Produce clay and sculptural works with proper finishing and design aesthetics.						3	
CO4	Integrate sustainable materials into creative projects.						3	
CO5	Organize and present art projects effectively in an exhibition setting						3	
Course Contents								
Unit 1	Advanced Drawing & Painting Techniques				4 Hrs.	CO1		
- Perspective drawing (one-point, two-point) - Light & shadow, advanced shading technique - Color mixing, harmonies & contrasts (complementary, analogous, triadic) - Brushwork: wet-on-wet, dry-brush, glazing, impasto - Mixed media painting: combining drawing, water-based paints, inks, and collage elements								
Unit 2	Paper Craft, Origami & Decorative Paper Art				4 Hrs.	CO2		
- Complex origami models: modular origami, tessellations - Paper cutting and layering: silhouette art, kirigami - Decorative paper items: pop-up cards, 3D paper sculptures, paper quilling								

4/10/25

R. G. G. G.



Designing decorative wall panels, journal covers, gift packaging			
Unit 3	Textile & Fabric Art – Intermediate	4 Hrs.	CO3
- Tie-dye: spirals, mandalas, shibori patterns - Block printing: designing blocks, multiple colour prints - Fabric painting: resist techniques, stenciling - Embroidery: chain stitch, satin stitch, French knots; combining with painting - Upcycling fabric: bags, wall hangings, soft furnishings from textile waste			
Unit 4	Clay, Modeling & Pottery – Intermediate	4 Hrs.	CO4
- Hand-building: slab, coil, pinch-and-combine methods - Sculpting: figurative modeling, relief work - Wheel-throwing introduction or using molds - Surface decoration: glazing, under-painting, texture tools - Functional pottery: bowls, cups, planters; decorative sculptures			
Unit 5	Recycled & Eco-Friendly Craft – Advanced Projects	4 Hrs.	CO5
- Using sustainable materials: cardboard, plastic bottles, fabrics, newspaper/magazines - Concept-to-creation: eco-themed craft items - Collaborative large-scale installations or community projects - Reflection on environmental impact: documenting process and materials			

Strength of CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	3	1	-	-	-	-	-	1	-
CO2	1	-	3	1	-	-	1	-	-	-	-
CO3	1	-	3	2	-	-	-	-	-	-	-
CO4	1	-	2	-	-	-	3	-	-	-	-
CO5	-	-	2	-	-	-	-	-	3	3	2
Average	1.0	1.0	2.6	1.3	-	-	2.0	-	3.0	2.0	2.0



Program:		F. Y. B. Tech			Semester:		II	
Course:		Cocurricular Course- II Wellness & Lifestyle Education			Course Code:		R26-SH-CC-117.2	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	01	-	-	25	-	
Course Description This course builds on the foundational concepts introduced in Semester 1 by deepening students’ understanding of nutrition across life-stages, application of physical fitness, mental health and social wellness, preventive lifestyle practices, and wellness programmes and interventions. Students will learn both theoretical frameworks and practical strategies to design, implement and evaluate wellness in personal, community and institutional settings.								
Course Relevance In today’s fast-paced world, there is an increased burden of lifestyle diseases, mental health challenges, sedentary living and nutritional imbalances. This course is relevant because it equips students with the knowledge and skills needed to maintain and promote wellness across all life stages — infancy to elderly — and in diverse contexts (school, workplace, community). It helps them become informed individuals who can both manage their own well-being and contribute to the wellness of others.								
Course Objectives 1. Understand nutrition requirements and challenges across the life cycle, from infancy to elderly. 2. Design and implement personalised fitness programmes incorporating aerobic, strength, flexibility and functional fitness components. 3. Apply advanced stress-management, mindfulness, and social-emotional wellness techniques to enhance mental health and resilience. 4. Recognise, prevent and manage lifestyle risks, addictions, sleep disorders and safety issues; practise first aid and create safe living environments. 5. Explore and implement wellness programmes such as yoga, meditation, and technology-assisted wellness in educational, workplace and community settings.								
CO	Course Outcome						Bloom’s Level	
CO1	Analyse the nutritional needs at various life stages (infancy, childhood, adolescence, adulthood, elderly) and identify public-health nutrition challenges such as malnutrition, over-nutrition and micronutrient deficiencies.						3	
CO2	Develop and evaluate personal fitness programmes appropriate for different age groups and special populations (pregnant women, elderly) including assessment, planning and monitoring.						3	
CO3	Apply strategies for mental and social wellbeing including mindfulness, relaxation, breathing techniques, positive psychology, digital-wellbeing and resilience building.						3	
CO4	Demonstrate preventive-health practices including sleep hygiene, addiction avoidance, screening, first aid, safe living environments and ergonomics in daily/academic/work settings.						3	
CO5	Design and implement wellness practices and programmes (yoga, meditation, wellness campaigns, use of technology/wearables) in workplace, educational or						3	



	community contexts.	
Course Contents		
Unit 1	Advanced Nutrition & Life Stages	4 Hrs. CO1
- Nutrition through the life-cycle: infancy, childhood, adolescence, adulthood, elderly - Maternal & prenatal nutrition; infant feeding (breast vs formula); complementary feeding - Nutritional needs & challenges in ageing (eg. sarcopenia, bone health) - Public-health nutrition issues: under-nutrition, over-nutrition, micronutrient deficiencies		
Unit 2	Application of Physical Fitness & Exercise	4 Hrs. CO2
- Designing personal fitness programmes: assessment, planning (aerobic, strength, flexibility, functional) - Exercises for different age-groups and special populations (pregnant, elderly) - Injury prevention, posture correction, ergonomics in daily/academic/office life - Monitoring fitness progress: body composition, VO₂ max, strength tests		
Unit 3	Mental Health, Well-being & Social Dimensions	4 Hrs. CO3
- Deep stress-management: mindfulness, relaxation, breathing techniques, cognitive strategies - Mental health across life-stages; coping with transitions (college, work); building resilience - Social & emotional wellness: relationships, peer-pressure, digital/social-media impact - Work/education-life balance; positive psychology; self-care strategies		
Unit 4	Preventive Health, Lifestyle & Safety	4 Hrs. CO4
- Sleep hygiene, circadian rhythms, shift-work challenges - Addictions & lifestyle risks: tobacco, alcohol, substance use, screen time - Preventive practices: screenings, vaccinations, lifestyle-disease prevention (diabetes, hypertension, metabolic syndrome) - First aid advanced topics: basic CPR, disaster-preparedness, safety in environment (home, campus, workplace)		
Unit 5	Wellness Practices & Programmes	4 Hrs. CO5
- Yoga, meditation, pranayama: history, philosophy, advanced practices - Wellness in workplace/educational settings: designing & implementing wellness programmes - Community wellness initiatives: peer-education, health-promotion campaigns - Technology & wellness: apps, wearable fitness-trackers, e-wellness platform		

Strength of CO-PO Mapping											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	–	2	–	–	2	–	–	–	–
CO2	2	–	3	2	–	2	–	–	1	–	–
CO3	–	–	–	–	–	3	–	–	1	2	–
CO4	–	–	–	–	–	3	2	–	–	2	–
CO5	2	–	2	–	1	2	–	–	2	2	2
Average	2.33	3.00	2.33	2.00	1.00	2.50	2.00	–	1.33	2.00	2.00

4/10/25

R. G. G. G.



Program:		F. Y. B. Tech			Semester:		II	
Course:		Cocurricular Course- II Fire and Safety			Course Code:		R26-SH-CC-117.3	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	01	-	-	25	-	
Course Description. This course provides comprehensive training in fire safety, emergency response, and occupational safety practices. It combines theoretical knowledge with hands-on practical exercises to equip learners with skills to prevent, manage, and respond to fire hazards in residential, commercial, and industrial environments. Course Relevance Fire accidents can cause significant loss of life and property. This course is relevant for: • Workplace safety officers • Industrial personnel • Facility managers • Individuals interested in fire safety awareness • It addresses regulatory compliance, equips learners with emergency preparedness skills, and ensures adherence to national fire safety standards.								
Course Objectives: After learning the course, the student will 1. Understand the fundamentals of fire and its hazards. 2. Identify fire risks and implement preventive measures. 3. Operate fire-fighting equipment and conduct fire drills safely. 4. Respond effectively to fire emergencies and provide first aid. 5. Comply with fire safety laws, regulations, and reporting procedures.								
CO	Course Outcome						Bloom’s Level	
CO1	Identify and explain fundamental concepts of fire safety, including fire behaviour, fire classification, and basic fire science terminology.						3	
CO2	Recognize fire hazards and apply preventive measures to reduce risks in residential, commercial, and industrial environments.						3	
CO3	Demonstrate the correct selection and operation of fire extinguishers and suppression equipment using standard procedures.						3	
CO4	Execute safe and effective emergency response actions, including evacuation planning, fire drill participation, and rescue techniques.						3	
CO5	Administer basic first aid for fire-related injuries and use essential safety gear and breathing apparatus during rescue situations.						3	

Course Contents			
Unit 1	Introduction to Fire Safety	4 Hrs.	CO1
• Understanding fire: definition, causes, and effects • Fire triangle (fuel, oxygen, heat) and fire behaviour • Classification of fires (Class A, B, C, D, etc.)			

4/10/25

R. G. G. G.



Basic fire science terminology			
Unit 2	Fire Prevention Techniques	4 Hrs.	CO2
- Hazard identification and risk analysis (residential, commercial, industrial) - Good housekeeping practices and safe storage of combustible materials - Electrical fire precautions and chemical fire hazards - Fire safety signage, escape routes, emergency lighting			
Unit 3	Fire Extinguishing Methods & Equipment	4 Hrs.	CO3
- Types and classifications of fire extinguishers (water, foam, CO₂, dry-powder, etc.) - Fire hoses, hydrants, sprinkler systems, wet/dry risers - PASS technique (Pull, Aim, Squeeze, Sweep) for extinguisher operation - Inspection, maintenance, and servicing of fire safety equipment			
Unit 4	Emergency Response & Evacuation Procedures	4 Hrs.	CO4
- Fire alarm and detection systems - Evacuation planning: exit routes, assembly points, role of fire warden - Planning and execution of fire drills - Rescue operations: ladders, ropes, and safe evacuation techniques			
Unit 5	First Aid & Rescue Basics	4 Hrs.	CO5
- First response to burns, smoke inhalation, and fire-related injuries - CPR (Cardio-pulmonary Resuscitation) and basic life-saving techniques - Use of breathing apparatus and protective clothing - Safe handling of rescue tools and equipment			

Strength of CO-PO Mapping											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	–	–	–	1	–	–	–	–	–
CO2	2	2	1	–	–	2	2	–	–	–	–
CO3	1	–	3	1	–	–	–	–	–	–	–
CO4	2	1	2	2	–	1	1	–	–	1	–
CO5	2	–	1	1	–	2	1	–	–	1	1
Avg.	1.8	1.3	1.8	1.3	-	1.5	1.3	-	-	1	1



Program:		F. Y. B. Tech			Semester:		II	
Course:		Cocurricular Course- II Self Defense			Course Code:		R26-SH-CC-117.5	
Teaching Scheme (Hrs./Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	01	-	-	25	-	
Course Description - This course provides students with practical, easy-to-learn self-defense skills focused on awareness, prevention, and effective physical techniques. Through a combination of instruction, drills, and scenario-based practice, participants will learn how to recognize potential threats, set personal boundaries, and respond confidently under stress. The curriculum emphasizes real-world safety, empowering students to use verbal de-escalation, strategic movement, and simple, high-percentage techniques to escape common grabs, holds, and attacks. Ground defense, striking fundamentals, and safe use of reasonable force are taught in a controlled, supportive environment. By the end of the course, students will have the knowledge and capability to enhance their personal safety and make informed decisions in challenging situations. Course Relevance In an increasingly unpredictable world, personal safety skills are essential for individuals of all ages and backgrounds. This course equips students with practical tools to recognize danger early, avoid risky situations, and respond effectively if confronted with aggression. Beyond physical techniques, learners gain valuable life skills—such as situational awareness, boundary-setting, stress management, and confident communication—that carry over into everyday interactions. The course supports personal empowerment, enhances physical and mental resilience, and fosters a proactive mindset toward safety. Whether for personal development, professional requirements, or general preparedness, the knowledge gained in this course is directly applicable to real-life environments such as schools, workplaces, public spaces, and daily routines.								
Course Objectives: Demonstrate situational awareness and identify potential safety risks in everyday environments. Apply verbal de-escalation and boundary-setting skills to reduce or prevent conflict before physical action becomes necessary. Use basic self-defense techniques—including striking, movement, and escape skills—in a controlled and safe manner. Execute defensive responses to common grabs, holds, and attempts at restraint using simple, effective, and lawful methods. Perform basic ground-defense movements to protect themselves and create opportunities to escape.								
CO	Course Outcome						Bloom’s Level	
CO1	Identify potential safety risks and environmental hazards using situational awareness.						2	
CO2	Explain the principles of de-escalation, boundary-setting, and personal safety strategies.						2	
CO3	Demonstrate basic self-defense movements such as stance, footwork, and protective positioning						3	
CO4	Apply simple, safe escape techniques against common non-dangerous grabs and holds in a controlled environment.						3	
CO5	Analyze real-world scenarios to determine appropriate safety responses, including disengagement options.						4	

4/10/25

R. G. G. G.



Course Contents			
Unit 1	Awareness & Prevention	4 Hrs.	CO1
- Situational awareness - Risk recognition - Boundary setting & assertive communication - De-escalation tools			
Unit 2	Foundations of Movement	4 Hrs.	CO2
- Defensive stance - Footwork (step, pivot, retreat) - Guarding and covering - Basic balance and posture			
Unit 3	Safe Striking Fundamentals	4 Hrs.	CO3
- Palm strikes - Hammer-fist motions - Elbow and knee mechanics - Low defensive kicks			
Unit 4	Escape & Ground Defense Techniques	4 Hrs.	CO4
Escape Techniques - Wrist-grab releases - Clothing-grab responses - Bear-hug escape principles - Choke defense basics (safety-based) Ground Defense - Falling safely - Shrimping, bridging - Using legs defensively - Technical stand-up			
Unit 5	Scenario Integration & Application	4 Hrs.	CO5
- Environment-based scenarios - Communication + movement + escape - Managing adrenaline and stress - Final review and practice			

Strength of CO-PO Mapping											
CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	1	-	1	-	-	-
CO2	1	-	-	-	-	2	-	1	-	1	-
CO3	-	-	2	-	-	-	-	1	1	-	-
CO4	-	-	3	-	-	-	-	1	1	-	-
CO5	1	-	2	2	-	1	1	2	-	1	-
Avg.	1	-	2.33	2	-	1.33	1	1.2	1	1	-

Amrutvahini

R. G. G. G.



Program:		F. Y. B. Tech		Semester:	II		
Course:		Entrepreneurship Essential - II		Course Code:	R26-ME-PCC-117.6		
Teaching Scheme (Hrs./week)			Credits (PR)	Examination Scheme			
Lecture	Practical	Tutorial		CCE	ESE	TW	PR
-	2	-	1	-	-	50	-
Course Description and Relevance: This course introduces students to the fundamentals of entrepreneurship through practical and activity-based learning. It develops the ability to generate, screen and communicate entrepreneurial ideas and understand the relationship between engineering, innovation and technology. Students explore real-world entrepreneurial stories, identify problems and customers, develop possible solutions, and present their own entrepreneurial ideas. The course is relevant for developing creativity, problem-solving, teamwork, communication and an entrepreneurial mindset among engineering students. The practical activities include brainstorming, idea selection, engineering innovation case studies, entrepreneurial communication and development of an entrepreneurial idea.							
Prerequisite: No prior knowledge of entrepreneurship or business is required.							
Bridge Content: The course begins with basic concepts of entrepreneurship and gradually connects them with engineering, innovation and technology. Students are introduced to problem identification, brainstorming, idea screening, customer/user identification, solution development, teamwork and entrepreneurial communication before developing and presenting their own entrepreneurial idea.							
Course Objectives: 20. To understand the basic concepts and importance of entrepreneurship and entrepreneurial thinking. 21. To understand techniques for generating, screening and selecting promising entrepreneurial ideas. 22. To understand the relationship between engineering, innovation, technology and real-world problem solving. 23. To understand the importance of teamwork, communication and presentation in developing entrepreneurial ideas.							
Course Outcomes: After learning the course, students will be able to:							
CO	Course Outcome					Bloom's Level	
CO1	Explain basic concepts of entrepreneurship and describe techniques for generating entrepreneurial ideas.					2	
CO2	Explain suitable criteria for screening and selecting promising entrepreneurial ideas and relate them to engineering innovation.					2	
CO3	Explain the role of engineering, innovation, technology, customers and problem identification in entrepreneurial opportunities.					2	
CO4	Explain the importance of teamwork, communication and presentation in communicating an entrepreneurial idea.					2	
List of Practical:							
Experiment No.1		Idea Generation				4 Hrs.	CO1
Learning Objectives • Generate several solutions for one problem. • Understand brainstorming.							



- Avoid judging ideas too early.
- Encourage creative and unconventional solutions.

Activity: Brainstorming Challenge

Teams select one problem and generate **at least 10 possible solutions**.

Rules:

1. No criticism during brainstorming.
2. Quantity first, quality later.
3. Build on others' ideas.
4. Encourage unusual ideas.

Optional Technique: SCAMPER (Substitute, Combine , Adapt , Modify , Put to another use , Eliminate , Reverse)

Practical: 10-Idea Challenge Sheet

Experiment No.2	Idea Screening	4 Hrs.	CO2
Learning Objectives • Understand that not every idea is equally useful. • Compare ideas using simple criteria. • Select one promising idea. • Justify why their idea was selected.			
Score each idea from 1–5:			
	Criteria	Score	
	Solves a real problem	/5	
	Useful to customers	/5	
	Feasible	/5	
	Innovative	/5	
	Affordable	/5	
	Engineering relevance	/5	
Activity: Idea Selection Matrix			
Teams compare their 10 ideas and select one idea .			
Practical: Selected Entrepreneurial Idea			
Experiment No.3	Engineering, Innovation and Technology	4 Hrs.	CO2

**Learning Objectives**

- Understand the relationship between engineering and entrepreneurship.
- Recognize how technology can solve social and industrial problems.
- Identify examples of engineering innovations.
- Connect engineering knowledge with real-world needs.

Activity “Engineering Solution Case Study”

Each team selects one example, such as: Electric vehicles , Solar products , 3D printing , Smart agriculture , Waste management , Assistive devices , Water-saving systems , Smart home products

Practical: One-Page Innovation Case Study

Experiment No.4	Teamwork and Entrepreneurial Communication	4 Hrs.	CO4
------------------------	---	---------------	------------

Learning Objectives

- Understand the importance of teamwork.
- Identify different roles within a team.
- Practice communication and listening.
- Explain an idea clearly to others.

Activity: “60-Second Idea Pitch”

Each student/team explains: “We identified _____ problem for _____ users. Our proposed solution is _____.”

Practical Output: Elevator Pitch

Experiment No.5	Entrepreneurial Story / Startup Case Study	4 Hrs.	CO5
------------------------	---	---------------	------------

Learning Objectives

- Understand the entrepreneurial journey.
- Recognize that successful ventures often begin with a problem.
- Understand challenges, failures and persistence.
- Identify lessons that can be applied to their own ideas.

Activity: Each team studies one entrepreneur/startup and prepares a short presentation:

1. Who started it?
2. What problem did they identify?
3. What was their solution?
4. Who were their customers?
5. What challenges did they face?
6. What can students learn from them?

**Practical: 5-Slide Entrepreneurial Story**

Experiment No.6	My Entrepreneurial Idea		4 Hrs.	CO5
------------------------	--------------------------------	--	---------------	------------

Learning Objectives

- Clearly define a problem.
- Identify the target user/customer.
- Explain their proposed solution.
- Explain the innovative aspect of their idea.
- Present an idea confidently.

Final Team Presentation: Each team presents: “My Entrepreneurial Idea”**1. Problem**

What problem are we solving?

2. Customer/User

Who faces this problem?

3. Need

Why is this problem important?

4. Solution

What are we proposing?

5. Innovation

What is new/different?

6. Benefits

How will the solution help?

7. Future Possibility

How could this idea be developed further?

Presentation: 3–5 minutes/team

Strength of CO-PO-PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	–	1	1	1	1	1	2	2	1	1	2
CO2	2	3	2	1	2	2	1	1	2	2	2	2	2	2
CO3	2	3	3	1	2	3	2	1	2	3	2	3	3	2
CO4	1	1	1	–	1	1	1	2	3	3	2	2	1	2
Avg.	1.75	2.00	1.75	0.50	1.50	1.75	1.25	1.25	2.00	2.50	2.00	2.00	1.75	2.00

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

Gaurav

R. Gaurav



This course serves as a prerequisite for / maps with the following future courses:

Entrepreneurial Thinking and Innovation

Job Mapping:

Job opportunities that one can get after learning this course: Entrepreneur / Startup Founder,
Incubation Program Associate.