VIT Vidyalankar Institute of Technology
Accredited A+ by NAAC

Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Bachelor of Technology

in

Electronics & Telecommunication Engineering

First Year Scheme and Syllabus (R-2026)

(As per NEP 2020, with effect from the Academic Year 2026-27)

Preamble

The National Education Policy (NEP) framework aims to break the mould from teacher centric to student centric educational practices. It empowers the students with flexibility in terms of choosing courses across different faculties and mode of learning.

This multidisciplinary approach will encourage learners to follow their passion and inherent interests. The learner is free to learn at a pace that he is comfortable with and this enables life long learning. It also enhances the scope for holistic personality development.

This premise is truly reflected in preamble of the NEP document, "The future of nation is decided in the classrooms of the schools and colleges today".

Details of implementation:

NEP curriculum framework enables us to accelerate change, redesign systems with equity in mind, respond to feedback, encourage collaboration, catch and pollinate ideas and create a culture of research and development. It will allow us to offer the required academic flexibility which will focus on improving competency level of students with diverse strengths.

The curriculum planned by VIT has vertical Program Courses consisting of core courses (PCC) of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. This vertical also includes Programme elective courses (PEC) which offer flexibility and diversity to learners to choose specialization from a basket of recent developments in their field of technology. The selection of unique programme elective courses based on industrial requirements and organizing them into tracks is a special feature of this curricula ensuring employability. The vertical Multidisciplinary Courses consists of Open Elective (OE) courses and multidisciplinary minor (MD M) courses. Special vocational and skill development courses are included as a part of Skill courses vertical that make student capable to work in industrial environment.

The student is expected to demonstrate their ability through course in Experiential Learning Courses vertical like internships/On Job Training, Community Engagement Project, Real Industry Project/ research problem. Our curriculum also introduces Social Service Internship and Internship with institutes abroad along with courses like Design Thinking. This will lead to creation of products and/ or patents through this program.

For holistic development of students, apart from technical courses, Ability Enhancement Courses, Entrepreneurship/Economics/Management Courses, Indian Knowledge System and Value Education courses from vertical Humanities and Social Science and Management develop the required soft-skills and attitude amongst learners.

In Liberal Learning vertical. courses like Various Dance Forms, Global citizenship Education, Facets of Astronomy etc. aims to create balance in brain hemispheres and hence improve learners' clarity in thoughts and responses.

In addition to core courses, professional and open electives; our framework offers honor degree in each programme of engineering. It includes specialized courses along with field/ domain study that make student capable of working on industry relevant problems.

Chairman, Board of Studies
Department of Electronics and Telecommunication Engineering
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

Course Structure and Assessment Guidelines

for

F. Y. Bachelor of Technology

in

Electronics and Telecommunication Engineering

First Year B. Tech. Electronics and Telecommunication Engineering **Semester: I**

Course Structure and Assessment Guidelines

Vertical_Sub-Vertical	Course Code	Course Name	Required Prerequisite	Prerequisite for	KSA Mapping	Hours Per Week			Credits	Assessment Guidelines (Marks)				Preparedness for Industry-Level Certification$
						Theory	Practical	Tutorial		Total ISA	Total MSE	Total ESE	Total Marks (Passing @40%)	
BSES_BSC	BSC11T	Engineering Chemistry	NIL	NIL	K	2	-	-	2	15	20	40	075	
BSES_BSC	BSC11P	Engineering Chemistry Lab	NIL	NIL	S	-	2	-	1	25	-	25	050	
BSES_BSC	BSC12	Engineering Mathematics-I	NIL	NIL	K	2	-	-	3	20	30	50	100	
BSES_ESC	ESC02T	Engineering Mechanics	NIL	NIL	K	-	2	-	2	15	20	40	075	
BSES_ESC	ESC02P	Engineering Mechanics Lab	NIL	NIL	S	2	-	-	1	25	-	25	050	
BSES_ESC	ESC06T	Basic Electrical & Electronics Engineering	NIL	PCET01T, PCET101T	K	-	2	-	2	15	20	40	075	Y
BSES_ESC	ESC06P	Basic Electrical & Electronics Engineering Lab	NIL	PCET01P, PCET101P	S	2	-	-	1	25	-	25	050	
SC_VSEC	VSEC01T	Structured Programming	NIL	DAML Track	K	-	2	-	2	15	20	40	075	Y
SC_VSEC	VSEC01P	Structured Programming Lab	NIL	DAML Track	S	2	-	-	1	25	-	25	050	
HSSM_AEC	AECXXT*	Any HSSM_AEC Course	NIL	NIL	K	-	2	-	2	15	20	40	075	
HSSM_AEC	AECXXP*	Any HSSM_AEC Course	NIL	NIL	K	2	-	-	1	25	-	25	050	
LLC_CC	CC013	Wellness: Introduction to MOJO and Yoga	NIL	CEP01	A	-	1	-	0 .5	25	-	-	025	
Total						**12**	**12**	**0**	**18.5**	**220**	**130**	**375**	**725**	

ISA=In Semester Assessment: This will involve evaluation based on thought provoking assignments/ experiments/ class tests/ take home tests/ open book tests/ quizzes/ certification course etc... activities which will be assigned on weekly basis during the semester.

MSE= Mid Semester Examination: This will be a proctored examination conducted in the semester. Syllabus will be based on the percentage of syllabus completed till the exam.

ESE= End Semester Examination: This examination will be conducted after the end of academic session covering 100% syllabus of the course.

nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Ability Enhancement Courses (AEC)

Sr. No.	Course Code	Course Name	Offered in				Required Prerequisite	Prerequisite for	Course Level (as per NCrF)	KSA Mapping	Hours Per Week			Credits	Preferred Semester
			Fall	Spring	Summer	Winter					Theory	Practical	Tutorial		
1	AEC01 T	Effective Communication	-	-	-	-	NIL	NIL	4	S & A	2	-	-	2	1
2	AEC01 P	Effective Communication Lab	-	-	-	-	NIL	NIL	4	S & A	-	2	-	1	1
5	AEC04	Technical Communication	-	-	-	-	NIL	NIL		K	-	2	-	1	3
Total offered Credits														**4**	

Liberal Learning Courses (LLC)- Co-curricular Courses (CC)

Course Code	Course Name	Required Prerequisite	Prerequisite for	KSA Mapping	Hours Per Week			Credits	Assessment Guidelines (Marks)				Preparedness for Industry-Level Certification$
					Theory	Practical	Tutorial		Total ISA	Total MSE	Total ESE	Total Marks (Passing @40%)	
CC01	Various Dance Forms	-	-	K	2	-	-	2	25	-	50	075	
CC02	Corporate and Social Etiquettes	-	-	K	2	-	-	2	25	-	50	075	
CC03	Global Citizenship Education	-	-	K	2	-	-	2	25	-	50	075	
CC04	Wellness – Body, Mind & Spirit	-	-	K	2	-	-	2	25	-	50	075	
CC05	IQ vs EQ	-	-	K	2	-	-	2	25	-	50	075	
CC06	Nutrition and Physical Wellness	-	-	K	2	-	-	2	25	-	50	075	
CC07	Facets of Astronomy	-	-	K	2	-	-	2	25	-	50	075	
CC08	Railways - Wonders of Infrastructure	-	-	K	2	-	-	2	25	-	50	075	
CC09	Financial Literacy for Engineers	-	-	K	2	-	-	2	25	-	50	075	
CC10	Mastering Advanced Excel	-	-	K	2	-	-	2	25	-	50	075	
CC11	Personal Grooming Essentials	-	-	K	2	-	-	2	25	-	50	075	
CC12	Various Music Forms	-	-	K	2	-	-	2	25	-	50	075	

CC13	Wellness: Introduction to MOJO and YOGA	-	-	K	-	2	-	0.5	25	-	-	025	
CC14	Wellness: Joy of Giving	-	-	K	-	2	-	0.5	25	-	-	025	
CC15	Wellness: Sports and Hobbies	-	-	K	-	2	-	0.5	25	-	-	025	
CC16	Wellness: Nutrition and Healthy Eating	-	-	K	-	2	-	0.5	25	-	-	025	

First Year B. Tech. Electronics and Telecommunication Engineering **Semester: II**

Structure and Assessment Guidelines

Vertical_Sub-Vertical	Course Code	Course Name	Required Prerequisite	Prerequisite for	KSA Mapping	Hours Per Week			Credits	Assessment Guidelines (Marks)				Preparedness for Industry-Level Certification$
						Theory	Practical	Tutorial		Total ISA	Total MSE	Total ESE	Total Marks (Passing @40%)	
BSES_BSC	BSC10T	Engineering Physics	NIL	NIL	K	2	-	-	2	15	20	40	075	
BSES_BSC	BSC10P	Engineering Physics Lab	NIL	NIL	S	-	2	-	1	25	-	25	050	
BSES_BSC	BSC14	Engineering Mathematics-II	BSC12	BSC06	K	2	-	1	3	20	30	50	100	
BSES_ESC	ESC01T	Engineering Graphics	NIL	NIL	K	2	-	-	2	15	20	40	075	
BSES_ESC	ESC01P	Engineering Graphics Lab	NIL	NIL	S	-	2	-	1	25	-	25	050	
BSES_ESC	ESC07T	Logic Circuits	NIL	NIL	K	2	-	-	2	15	20	40	075	Y
BSES_ESC	ESC07P	Logic Circuits Lab	NIL	NIL	S	-	2	-	1	25	-	25	050	
SC_VSEC	VSEC02T	Object Oriented Programming	VSEC01T	NIL	K	2	-	-	2	15	20	40	075	Y
SC_VSEC	VSEC02P	Object Oriented Programming Lab	VSEC01P	NIL	S	-	2	-	1	25	-	25	050	
HSSM_VEC	VECXXT	Any HSSM_AEC Course	NIL	NIL	K	2	-	-	2	15	20	40	075	
HSSM_VEC	VECXXP	Any HSSM_AEC Course	NIL	NIL	K	1	-	-	1	25	-	25	050	
HSSM_IKS	IKSXX*	Any HSSM_IKS course	NIL	NIL	K	2	-	-	2	25	-	50	075	
LLC-CC	CCXX*	Any one CC offered in the semester	NIL	NIL	K	2	-	-	2	25	-	50	075	
LLC_CC	CC014	Wellness: Joy of Giving	NIL	CEP01	A	-	1	-	0.5	25	-	-	025	
Total						**17**	**8**	**1**	**22.5**	**300**	**130**	**475**	**900**	

ISA=In Semester Assessment: This will involve evaluation based on thought provoking assignments/ experiments/ class tests/ take home tests/ open book tests/ quizzes/ certification course etc… activities which will be assigned on weekly basis during the semester.

MSE= Mid Semester Examination: This will be a proctored examination conducted in the semester. Syllabus will be based on the percentage of syllabus completed till the exam.

ESE= End Semester Examination: This examination will be conducted after the end of academic session covering 100% syllabus of the course.

Value Education Courses (VEC)

Sr. No.	Course Code	Course Name	Offered in				Required Prerequisite	Prerequisite for	Course Level (as per NCrF)	KSA Mapping	Hours Per Week			Credits	Preferred Semester
			Fall	Spring	Summer	Winter					Theory	Practical	Tutorial		
1	VEC02	E-Waste and Environmental Management	-	-	-	-	NIL	NIL	4	K	2	-	-	2	Any
2	VEC01T	Professional Skills	-	-	-	-	NIL	NIL	4	K	2	-	-	2	Any
3	VEC01P	Professional Skills Lab	-	-	-	-	NIL	NIL	4	K	-	2	-	1	Any
4	VEC03	Universal Human Values	-	-	-	-	NIL	NIL		K	2	-	-	2	Any
5	VEC04	Responsibility towards sustainable environment	-	-	-	-	NIL	NIL		K	2	-	-	2	Any
6	VEC05	Four Pillars of Democratic Nation	-	-	-	-	NIL	NIL		K	2	-	-	2	Any
Total offered Credits														**11**	

Indian Knowledge System Courses (IKS)

Sr. No.	Course Code	Course Name	Offered in				Required Prerequisite	Prerequisite for	Course Level (as per NCrF)	KSA Mapping	Hours Per Week			Credits	Preferred Semester
			Fall	Spring	Summer	Winter					Theory	Practical	Tutorial		
1	IKS03	Exploring Indian Art	-	-	-	-	NIL	NIL		K	2	-	-	2	Any
2	IKS01	Indian Traditional Knowledge System	-	-	-	-	NIL	NIL		K	2	-	-	2	Any
3	IKS02	Indian Constitution	-	-	-	-	NIL	NIL		K	2	-	-	2	Any
Total offered Credits														**6**	

Liberal Learning Courses (LLC)- Co-curricular Courses (CC)

Course Code	Course Name	Required Prerequisite	Prerequisite for	KSA Mapping	Hours Per Week			Credits	Assessment Guidelines (Marks)				Preferred Semester
					Theory	Practical	Tutorial		Total ISA	Total MSE	Total ESE	Total Marks (Passing @40%)	
CC01	Various Dance Forms	-	-	K	2	-	-	2	25	-	50	075	1/2
CC02	Corporate and Social Etiquettes	-	-	K	2	-	-	2	25	-	50	075	1/2
CC03	Global Citizenship Education	-	-	K	2	-	-	2	25	-	50	075	1/2
CC04	Wellness – Body, Mind & Spirit	-	-	K	2	-	-	2	25	-	50	075	1/2
CC05	IQ vs EQ	-	-	K	2	-	-	2	25	-	50	075	1/2
CC06	Nutrition and Physical Wellness	-	-	K	2	-	-	2	25	-	50	075	1/2
CC07	Facets of Astronomy	-	-	K	2	-	-	2	25	-	50	075	1/2
CC08	Railways - Wonders of Infrastructure	-	-	K	2	-	-	2	25	-	50	075	1/2
CC09	Financial Literacy for Engineers	-	-	K	2	-	-	2	25	-	50	075	1/2
CC10	Mastering Advanced Excel	-	-	K	2	-	-	2	25	-	50	075	1/2
CC11	Personal Grooming Essentials	-	-	K	2	-	-	2	25	-	50	075	1/2
CC12	Various Music Forms	-	-	K	2	-	-	2	25	-	50	075	1/2
CC13	Wellness: Introduction to MOJO and YOGA	-	-	K	-	2	-	0.5	25	-	-	025	1/2
CC14	Wellness: Joy of Giving	-	-	K	-	2	-	0.5	25	-	-	025	1/2
CC15	Wellness: Sports and Hobbies	-	-	K	-	2	-	0.5	25	-	-	025	3/4
CC16	Wellness: Nutrition and Healthy Eating	-	-	K	-	2	-	0.5	25	-	-	025	3/4

Detailed syllabus of First Year Semester - I

Course Name: Engineering Chemistry

Course Code: BSC11T & BSC11P

Vertical/ Sub-Vertical: Basic Science (BS)

K-S-A Mapping: Knowledge

Pre-requisite required: Nil

Pre-requisite for: PCET18T, PEEC39T

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
BSC11T	2	-	2	-
BSC11P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (BSC11T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (BSC11P)	25 (50%)	-	25 (50%)	50 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

This course imparts students sound knowledge on the fundamentals of chemistry which can be applied in various courses and projects taken in Electronics and Computer Science, Electronics and Telecommunication and Biomedical Engineering.

Course Objectives:

1. The contents of this course will aid in quantification and understand the applications of several concepts in Chemistry.
2. To appreciate the need for and importance of engineering chemistry for industrial and domestic use.
3. To gain the knowledge on existing and future upcoming materials used in device

fabrication.

4. To impart knowledge of green chemical technology and its applications.
5. To enhance the thinking capabilities in line with the modern trends in engineering and technology.

Course Outcome:

Student will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Interpret properties, synthesis, and uses of important materials in various engineering applications.	Understand
CO2	Apply the fundamentals of electrochemistry in prevention & control measures related to corrosion of structures and devices.	Apply
CO3	Rationalise different types of batteries and their real-life engineering applications.	Analyse
CO4	Analyse different spectroscopic techniques and study fundamentals of electromagnetic spectrum.	Analyse
CO5	Associate Green Chemistry principles in product development knowledge.	Apply

Detailed Syllabus:

Module no	Module name	Content	No of Hours
1	Polymer Chemistry	***Learning Objective:*** *To understand the types, properties, and synthesis methods of polymers used in various engineering applications. (CO1).* **Contents:** Introduction to Polymer, Properties of Polymers- Molecular weight, numerical problems on molecular weight, Glass transition temperature Methods of polymerization, Synthesis, Properties and Uses of commercially important polymers, Study of Speciality polymers like Conducting polymers, Liquid Crystal Polymer etc., Applications of Polymers ***Learning Outcomes:*** *A learner will be able to:* *1.1 Describe types and properties of polymers. (PI 1.1.1) (CO1)* *1.2 Illustrate synthesis processes and correlate structure with properties. (PI 1.2.1) (CO1)*	6

Module no	Module name	Content	No of Hours
2	Electrochemistry and Corrosion	***Learning Objective:*** *To explore electrochemical principles and their application in understanding and preventing corrosion. (CO2).* **Contents:** Electrochemistry- Basics, Types of electrochemical cells, Electrochemical series and Galvanic series, Nernst equation, Numerical problems, Construction & Application of various electrodes Corrosion- Chemical and Electrochemical corrosion, Mechanism, Types- Differential aeration, Galvanic, Stress, Intergranular, Microbial, Soil corrosion etc., Prevention and control Measures, Case studies like- Corrosion in human body implants & Corrosion in electronic gadgets ***Learning Outcomes:*** *A learner will be able to:* *2.1 Apply Nernst equation and electrochemical cell concepts in real-life scenarios. (PI 2.1.2) (CO2)* *2.2 Analyse corrosion mechanisms and suggest appropriate prevention techniques. (PI 2.2.3) (CO2)*	6
3	Energy Storage systems	***Learning Objective:*** *To investigate the working, classification, and applications of modern batteries and fuel cells in sustainable engineering. (CO3).* **Contents:** Fundamentals of Energy storage, primary cells and secondary cells, Types of Batteries, Construction and application of Li-Ion battery Fuel cells- principle, components of fuel cell, types of fuel cell, applications, advantages and disadvantages, hydrogen production and hydrogen storage system Numerical problems ***Learning Outcomes:*** *A learner will be able to:* *3.1 Classify batteries based on chemistry and structure. (PI 1.3.1) (CO3)* *3.2 Evaluate suitability of energy storage devices for different applications. (PI 2.2.2) (CO3)*	4
4	Chemistry of Semiconductors	***Learning Objective:*** *To understand the properties and chemistry of semiconductor elements and compounds and their relevance in electronic applications. (CO1).* **Contents:**	3

Module no	Module name	Content	No of Hours
		Silicon & Germanium - Physical and chemical properties, Isotopes, Chemistry of compounds like GaAs, GaP, InP. InGaAs, ZrO, HfO and applications in industry ***Learning Outcomes:*** *A learner will be able to:* *4.1 Compare physical and chemical properties of Silicon and Germanium. (PI 1.1.1) (CO1)* *4.2 Describe isotopes and analyze semiconductor compounds such as GaAs, GaP, InP, InGaAs, ZrO, and HfO with industrial applications. (PI 1.2.1, PI 2.2.2) (CO1)*	
5	Engineering Materials	***Learning Objective:*** *To explore the structure, properties, and applications of advanced materials including nanomaterials, composites, shape memory alloys, and smart materials. (CO1)* **Contents:** **Nanomaterials:** Introduction, Graphene, Fullerenes, Carbon nanotubes, Electronic and Mechanical properties, Synthesis of CNT, Role of nano materials in electronics, Photonics, MEMS, Energy Nano-bio application **Composite Materials:** Types, properties, and industrial applications **Shape Memory alloys:** Principle, properties, super elasticity-One way and two-way shape memory effect, Austenite and martensite transformations, applications **Smart Materials:** Self-Assembled Nanostructures - Energy Harvesting Materials, Intelligent Materials – Magneto strictive Materials ***Learning Outcomes:*** *A learner will be able to:* *a. Explain structure, synthesis, and applications of nanomaterials such as graphene, fullerenes, and carbon nanotubes. (PI 1.1.1, PI 1.2.1) (CO1)* *b. Describe the types, properties, and uses of composite materials. (PI 2.2.2) (CO1)* *c. Illustrate the working and characteristics of shape memory alloys and their transformations. (PI 1.3.1, PI 2.1.2) (CO1)* *d. Evaluate functionalities and applications of smart materials like self-assembled nanostructures and magnetostrictive materials. (PI 7.2.1, PI 1.4.2) (CO1)*	5
6	Spectroscopic techniques	***Learning Objective:*** *To understand the basic principles and applications of spectroscopic techniques in structural elucidation and analysis. (CO4)* **Contents:**	4

Module no	Module name	Content	No of Hours
		Fundamentals of Spectroscopy, Electromagnetic spectrum, Different Forms of Spectroscopy, Beer-Lambert's law- Numerical problems, Techniques, Instrumentation and applications in Medicines and electronics ***Learning Outcomes:*** *A learner will be able to:* *6.1 Explain principles of UV-Vis, IR, and NMR spectroscopy. (PI 1.1.1) (CO4)* *6.2 Analyse spectra and infer structural information. (PI 1.4.2) (CO4)*	
7	Green Chemistry	***Learning Objective:*** *To apply the principles of Green Chemistry in developing environmentally benign processes and materials. (CO5).* **Contents:** 12 Principles of Green Chemistry & application in green computing & Green Electronics, Numerical problems ***Learning Outcomes:*** *A learner will be able to:* *7.1 Identify and explain 12 principles of Green Chemistry. (PI 7.1.1) (CO5)* *7.2 Propose eco-friendly alternatives to conventional processes. (PI 7.2.1) (CO5)*	2

Suggested List of Practicals:

Sr. No.	Suggested Topic(s)
1.	To determine free acid pH of different solutions using pH meter ***Learning Outcomes:*** *A learner will be able to:* *Determine and interpret pH values of various solutions using instrumentation. (P.I. – 1.3.1, 1.4.2)*
2.	To determine the Wavelength of Maximum Absorbance using colorimeter. ***Learning Outcomes:*** *A learner will be able to:* *Identify λ and analyze the electronic transitions in solutions. (P.I. – 1.1.1, 1.4.2)*
3.	To determine metal ion concentration using colorimeter. ***Learning Outcomes:*** *A learner will be able to:* *Apply Beer-Lambert's law to quantify unknown metal ions. (P.I. – 2.2.2, 1.4.2)*
4.	To determine Molecular weight of polymers by Oswald Viscometer. ***Learning Outcomes:*** *A learner will be able to:* *Calculate intrinsic viscosity and determine polymer molecular weight. (P.I. 1.2.1, 1.3.1)*
5.	To synthesize UF, PF, Nylon 66.

Sr. No.	Suggested Topic(s)
	Learning Outcomes: *A learner will be able to:* *Perform polymer synthesis and understand polymerization mechanisms. (P.I. – 1.1.1, 1.2.1)*
6.	To synthesize biodegradable polymer. ***Learning Outcomes:*** *A learner will be able to:* *Understand green polymer alternatives and eco-friendly chemistry. (P.I. - 7.1.1, 7.2.1)*
7.	To determine Viscosity of oil by Redwood Viscometer ***Learning Outcomes:*** *A learner will be able to:* *Measure and interpret the viscosity of lubricants for industrial applications. (P.I. – 1.3.1, 1.2.1)*
8.	To separate pigments using paper chromatography. ***Learning Outcomes:*** *A learner will be able to:* *Apply separation techniques for analyzing mixtures and identifying compounds. (P.I. – 1.4.2, 2.1.2)*
9.	To determine total, temporary, and permanent hardness of water sample by EDTA method. ***Learning Outcomes:*** *A learner will be able to:* *Analyze water samples using complexometric titration and distinguish types of hardness. (P.I. – 2.2.3, 2.1.2)*
10.	To construct the battery and measure potential difference across two terminals ***Learning Outcomes:*** *A learner will be able to:* *Construct electrochemical cells and evaluate voltage output. (P.I. – 2.1.2, 2.2.2)*
11.	To identify the materials and learn their properties ***Learning Outcomes:*** *A learner will be able to:* *Observe and analyze structure-property relationships of engineering materials. (P.I. – 1.1.1, 1.2.1)*
12.	To set up a galvanic cell ***Learning Outcomes:*** *A learner will be able to:* *Explain the principles of redox reactions and voltage generation in galvanic cells. (P.I. – 2.1.2, 1.3.1)*
13.	To set up an electrolytic cell and carry out electroplating ***Learning Outcomes:*** *A learner will be able to:* *Understand electrolysis and apply it for electroplating techniques. (P.I. – 1.4.2, 2.2.2)*
14.	To carry out etching of the Printed Circuit Board (PCB) ***Learning Outcomes:*** *A learner will be able to:* *Apply chemical etching processes in electronics fabrication. (P.I. – 1.3.1, 2.2.3)*
15.	To synthesize a nanomaterial and study its characterization ***Learning Outcomes:*** *A learner will be able to:* *Synthesize nanomaterials and interpret results using characterization tools. (P.I. – 1.2.1, 1.4.2)*
16.	To detect the adulteration in given milk sample

Sr. No.	Suggested Topic(s)
	Learning Outcomes: *A learner will be able to:* *Detect contaminants in food samples using chemical tests. (P.I. – 1.3.1, 2.2.2)*

Performance Indicators:

P.I.- 1.1.1: **Remembering**: Recall key mathematical formulas and concepts relevant to engineering problems.
P.I.- 1.2.1: **Understanding:** Explain how mathematical models are used to represent engineering systems or processes.
P.I.- 1.3.1: **Remembering**: List fundamental engineering principles (e.g., Ohm's law, Bernoulli's equation) and their applications.
P.I.- 1.4.2: **Understanding:** Explain the functions of specialized engineering systems in the computer engineering domain.
P.I.- 2.1.2: **Understanding:** Explain the key features and scope of a complex engineering problem.
P.I.- 2.2.2: **Understanding:** Describe the steps involved in formulating a solution plan for an engineering problem.
P.I.- 2.2.3: **Applying:** Develop a basic solution plan using a systematic approach to solve an identified problem.
P.I.- 7.1.1: **Understanding:** Explain how engineering activities and industrial practices affect the environment, society, and economy.
P.I.- 7.2.1: **Creating:** Propose sustainable solutions based on environmental criteria.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 1.2, 4.1, 4.2, 5.1, 5.2, 5.3 and 5.4
CO2	2.2 & 2.2
CO3	3.1 & 3.2
CO4	6.1 & 6.2
CO5	7.1 & 7.2

Mapping of Course Outcomes with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO7	PO8	PO9	P010	PO11	PO12
CO1	4/9	--	--	--	--	--	--	--	--	--	--
CO2	--	3/9	--	--	--	--	--	--	--	--	--
CO3	1/9	2/9	--	--	--	--	--	--	--	--	--

CO	PO1	PO2	PO3	PO4	PO5	PO7	PO8	PO9	P010	PO11	PO12
CO4	2/9	--	--	--	--	--	--	--	--	--	--
CO5	--	--	1/9	--	--	1/9	--	--	--	--	--

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: *Describe types and properties of polymers. (PI 1.1.1) (CO1)*	• Correctly identifies various polymer types with examples • Describes key physical and chemical properties of polymers • Analyzes how different types exhibit unique properties based on structure	ISA MSE ESE
LO 1.2: *Illustrate synthesis processes and correlate structure with properties. (PI 1.2.1) (CO1)*	• Explains common synthesis processes with correct steps and conditions • Explains how structure influences physical properties (e.g., crystallinity, Tg) • Illustrates synthesis processes accurately with key reactants and catalysts.	MSE ISA ESE
LO 2.1: *Apply Nernst equation and electrochemical cell concepts in real-life scenarios. (PI 2.1.2) (CO2)*	• Correctly writes and interprets the Nernst equation with standard notations and units. • Explains the function of an electrochemical cell with examples (e.g., Daniell cell) • Performs correct calculations of Ecell for given concentrations/conditions.	MSE ISA ESE
LO 2.2: *Analyse corrosion mechanisms and suggest appropriate prevention techniques. (PI 2.2.3) (CO2)*	• Identifies various corrosion types with relevant examples • Explains mechanisms using relevant concepts (oxidation/reduction, electrochemical cells) • Suggests appropriate techniques based on identified corrosion type • Selects techniques appropriate to corrosion type and environment.	MSE ISA ESE ESE
LO 3.1: *Classify batteries based on chemistry and structure. (PI 1.3.1) (CO3)*	• Classifies batteries by chemistry (e.g., alkaline, lead-acid, Li-ion, NiMH) • Relates battery types to appropriate applications (e.g., EVs, UPS, wearables) • Differentiates batteries based on structure	MSE ISA LAB
LO 3.2: *Evaluate suitability of energy storage devices for different applications. (PI 2.2.2) (CO3)*	• Categorizes various devices with basic characteristics (type, energy density, etc.) • Explains parameters like energy/power density, lifecycle, and efficiency	MSE ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 4.1: *Compare physical and chemical properties of Silicon and Germanium. (PI 1.1.1) (CO1)*	• Describes basic characteristics (group, period, type of element) • Lists and compares major physical properties (e.g., band gap, conductivity) • Describes chemical properties and typical reactions.	ISA ISA MSE
LO 4.2: *Describe isotopes and analyze semiconductor compounds such as GaAs, GaP, InP, InGaAs, ZrO, and HfO with industrial applications. (PI 1.2.1, PI 2.2.2) (CO1)*	• Describes isotopes with correct examples and basic applications (e.g., nuclear, medical) • Describes key properties like band gap, electrical behavior, and usage in devices.	ISA ISA
LO 5.1: *Explain structure, synthesis, and applications of nanomaterials such as graphene, fullerenes, and carbon nanotubes. (PI 1.1.1, PI 1.2.1) (CO1)*	• Explains synthesis methods with reactants, processes, and equipment • Explains how structure determines key properties (e.g., conductivity, strength) • Describes atomic/molecular structures of graphene, fullerenes, CNTs clearly.	ISA ISA ISA
LO 5.2: *Describe the types, properties, and uses of composite materials. (PI 2.2.2) (CO1)*	• Describes key mechanical, thermal, and chemical properties with some reasoning • Describes specific applications with context (e.g., "carbon fiber in aerospace panels")	ISA ISA
LO 5.3: *Illustrate the working and characteristics of shape memory alloys and their transformations. (PI 1.3.1, PI 2.1.2) (CO1)*	• Lists and explains key characteristics like superelasticity, pseudoelasticity • Uses appropriate terms like martensite, austenite, transformation temperature • Explains how SMA is used in engineering contexts (e.g., stents, actuators)	ISA ISA
LO 5.4: *Evaluate functionalities and applications of smart materials like self-assembled nanostructures and magnetostrictive materials. (PI 7.2.1, PI 1.4.2) (CO1)*	• Explains how these materials function under specific stimuli (e.g., magnetic field, pH, temperature) • Describes real-world engineering applications in detail (e.g., vibration control, nano-drug delivery)	ISA MSE
LO 6.1: *Explain principles of UV-Vis, IR, and NMR spectroscopy. (PI 1.1.1) (CO4)*	• Explains basic principle (electronic transitions, λmax) • Explains each spectroscopy type clearly • Uses basic correct terms (e.g., λmax, functional group region, chemical shift)	ISA MSE ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 6.2: *Analyse spectra and infer structural information. (PI 1.4.2) (CO4)*	• Uses correct principles (e.g., Beer–Lambert law, chemical shift rules) in analysis	ESE
LO 7.1: *Identify and explain 12 principles of Green Chemistry. (PI 7.1.1) (CO5)*	• Identifies most of the 12 principles with correct titles • Explains principles clearly with basic examples • Uses appropriate green chemistry terms in explanations	MSE ESE LAB
LO 7.2: *Propose eco-friendly alternatives to conventional processes. (PI 7.2.1) (CO5)*	• Clearly explains a conventional process, including its environmental impact • Applies basic green chemistry principles to suggest improvements.	MSE ESE

Textbooks:

1. Shashi Chawla, "A Textbook of Engineering Chemistry", Dhanpat Rai & Co. (PVT.) LTD., New Delhi (2004).
2. S. S. Dara, "Engineering Chemistry", Chand & Co, New Delhi (2006)
3. Jain and Jain, "Engineering Chemistry", Dhanpat Rai & Co (PVT.) LTD, New Delhi (2006).

Reference Books:

1. B.R. Puri and L.R. Sharma, "Principles of Physical Chemistry", 45th Edition, Vishal Publishing Co. 2012.
2. Peter Atkins, "Physical Chemistry", XI th ed, Oxford, United Kingdom, Oxford University Press, 2017
3. V. K. Ahluwalia, "Green Chemistry: A textbook", Alpha Science International
4. J. D. Lee, "Concise Inorganic Chemistry"
5. V.R.Gowariker, "Polymer Science", New Age International Publication
6. S.K.Kulkarni, "Introduction to Nanotechnology"
7. C. N. Banwell, Elaine M. McCash, "Fundamentals of Molecular Spectroscopy", (4th edition), Tata McGraw Hill.
8. Y.R. Sharma, "Elementary Organic Spectroscopy", S. Chand and Co.
9. William D. Callister, "Materials Science and Engineering: An Introduction", Wiley
10. Mel Schwartz, "Smart Materials", CRC Press New York, 2009
11. Dimitris C. Lagoudas, "Shape Memory Alloys", Springer, New York, 2008
12. Micky Rakotondrabe, "Smart Materials- Based Actuators at Micro/Nano-Scale", Springer Science + Business Media, New York, 2013

Related/ Equivalent MOOC and Associated Certification:

1. Nanotechnology: A Maker's course offered by Duke University, North Carolina State University The University of North Carolina at Chapel Hill
   https://www.coursera.org/learn/nanotechnology

2. Fundamentals of Material Science offered by Shanghai Jiao Tong University
   https://www.coursera.org/learn/fundamentals-of-materials-science
3. Smart materials: Microscale and macroscale approaches offered by Peter the Great St. Petersburg Polytechnic University and Kazan National Research Technological University
   https://www.coursera.org/learn/smart-materials-microscale-and-macroscale-approaches

Course Name: Engineering Mathematics-I

Course Code: BSC12

Vertical/ Sub-Vertical: BSES_BSC

K-S-A Mapping: Knowledge & Skill

Pre-requisite required:

Pre-requisite for: BSC14 (Engineering Mathematics-II), and higher-level mathematical courses.

Recommended Semester: I

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
BSC12	3	-	3	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	20 (~20%)	30 (~30%)	50 (~50%)	100 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

Engineering Mathematics-I provides a strong mathematical foundation for first-year engineering students by introducing essential concepts in complex analysis, discrete-time systems, multivariable calculus, and linear algebra. The course covers complex numbers, hyperbolic and logarithmic functions, Z-transforms, partial differentiation, matrix theory, and computational methods for solving linear systems. Emphasis is placed on developing analytical thinking, problem-solving skills, and the application of mathematical techniques to engineering and technological problems encountered across various disciplines.

Course Objectives:

- To recall and understand the fundamental concepts of complex numbers, hyperbolic functions, logarithmic functions, Z-transforms, partial differentiation, matrices, and linear systems.
- To develop proficiency in mathematical techniques used for solving engineering problems involving complex variables, discrete-time systems, and multivariable functions.
- To apply matrix methods and computational techniques for analyzing and solving systems of linear equations.
- To develop analytical skills for interpreting mathematical models and evaluating engineering systems using appropriate mathematical tools.
- To prepare learners for advanced engineering mathematics courses and their applications in various engineering domains.

Course Outcomes:

Learner will be able to:

Course Outcomes	Course Outcome Statement	Bloom's Level
CO1	Recall the definitions, properties, formulas, and theorems related to complex numbers, hyperbolic functions, logarithmic functions, Z-transforms, partial differentiation, matrices, and systems of linear equations.	Remember
CO2	Explain the concepts and underlying principles of complex numbers, hyperbolic and logarithmic functions, Z-transforms, partial differentiation, matrix operations, and linear systems.	Understand
CO3	Apply techniques of complex numbers, Z-transforms, partial differentiation, matrix methods, and computational methods to solve mathematical and engineering problems.	Apply
CO4	Analyze multivariable functions, discrete-time systems, matrix structures, and systems of linear equations using appropriate mathematical and computational techniques.	Analyze

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours	CO's Mapped
1	Complex Numbers	**Contents:** De Moivre's Theorem, expansion of sinnθ and cosnθ, powers and roots of complex numbers. **Learning Objective:** Understand the use of De Moivre's Theorem and the operations on complex numbers. (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 1.1 Recall De Moivres Theorem and related expansions. (CO1) 1.2 Explain power and roots of complex numbers. (CO2) 1.3 Apply De Moivres theorem to trigonometric identities. (CO3) **Self-Learning Topics**: Geometric representation of complex numbers	8	
2	Hyperbolic & Logarithmic Functions	**Contents:** Circular and hyperbolic functions, inverse functions, separation of real and imaginary parts, logarithmic functions. **Learning Objective:**	7	

		Understand circular, hyperbolic and logarithmic functions for real and complex inputs. (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 2.1 Recall definition of circular and hyperbolic functions. (CO1) 2.2 Explain inverse and logarithmic functions. (CO2) 2.3 Apply separation of real/imaginary parts in problems. (CO3) 2.4 Analyze logarithm of complex numbers. (CO4) **Self-Learning Topics**: Applications of Hyperbolic Functions in Signal Processing and Communication Systems.		
3	Z Transforms	**Contents:** Z-Transform of a sequence, Properties of Z-Transform, Examples based on properties of Z-Transform, Inverse Z- Transform, Inverse Z-Transform using Binomial method and convolution theorem. **Learning Objective:** To understand the Z-transform and its properties and apply methods to compute inverse Z-transforms using binomial expansion and convolution theorem for solving discrete systems. (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 3.1 Recall definition of Z-transform and its basic properties. (CO1) 3.2 Understand the significance of properties of Z-transform in discrete-time systems. (CO2) 3.3 Apply Z-transform techniques to compute inverse Z-transforms using binomial method and convolution theorem. (CO3) 3.4 Analyze inverse Z-transform computations by comparing different methods such as binomial expansion and convolution theorem. (CO4) **Self-Learning Topics**: Expansions of functions using Taylor's series.	7	
4	Partial Differentiation and	**Content:** Partial derivatives (first and higher order), composite functions, maxima and minima of	8	

	Applications	two-variable functions. **Learning Objective:** Apply partial derivatives and Euler's theorem to understand functions of several variables. (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 4.1 Recall formulae for partial derivatives. (CO1) 4.2 Understand conditions for maxima and minima of functions in two variables. (CO2) 4.3 Apply partial derivatives in multi-variable problems. (CO3) 4.4 Analyze extreme points using conditions of maxima & minima. (CO4) **Self-Learning Topics**: Euler's Theorem in two and three variables and its applications.		
5	Linear Algebra (Matrices)	**Contents:** Rank of matrix, evaluation of rank using echelon forms, reduction to normal form, PAQ forms. **Learning Objective:** To introduce the concept of rank of a matrix and various methods to compute it, and to compare these methods based on their application and interpretation. (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 5.1 Recall Definition of rank of matrix. (CO1) 5.2 Understand normal and echelon form of rank of matrix. (CO2) 5.3 Compute the rank using echelon form, normal form and PAQ normal form (CO3) 5.4 Analyze inverse of a matrix using its rank (CO4) **Self-Learning Topics**: Applications of Matrix Rank in Image Processing and Network Analysis.	8	
6	Linear Systems and Computational Methods	**Contents:** System of homogeneous and non-homogeneous equations their consistency and solution. Linear Independence and Dependence of Vectors. Computational Method - LU Decomposition Method. **Learning Objective:**	7	

		To develop an understanding of how matrix rank is applied to analyze and solve systems of linear equations and understand various computational methods. (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 6.1 Recall definition of solution of system of homogenous and non-homogeneous equations. (CO1) 6.2 Understand linear dependence and independence of vectors. (CO2) 6.3 Apply matrix methods to solve non-homogeneous and homogeneous linear systems. (CO3) 6.4 Analyze numerical stability & efficiency of a system using LU decomposition method. (CO4) **Self-Learning Topics**: Computational Implementation of LU Decomposition using MATLAB/Python.		
Total			45	

Performance Indicators:

P.I.–1.1.1: Applying, Understanding: Apply knowledge of discrete structures, linear algebra, statistics, and numerical techniques.
P.I.–1.1.2: Applying, Understanding: Apply concepts of probability, statistics, and queuing theory in modeling.
P.I.–1.2.1: Applying: Apply laws of natural science to an engineering problem.
P.I.–1.3.1: Applying: Apply engineering fundamentals to solve engineering problems.
P.I.–1.4.1: Applying: Apply theory and principles of computer science and engineering to solve engineering problems.
P.I.–2.1.1: Analyzing: Evaluate problem statements and identify objectives.
P.I.–2.1.2: Analyzing: Identify processes, modules, and algorithms of a system and parameters to solve the problem.
P.I.–2.2.1: Analyzing, Applying: Reframe the computer-based system into interconnected

subsystems.

P.I.–2.2.2: Analyzing: Identify functionalities and computing resources for the system.

P.I.–2.2.3: Analyzing: Identify existing solutions or methods to solve the problem, including justified approximations.

P.I.–2.3.1: Applying: Apply engineering principles to formulate modules of a system.

P.I.–2.4.1: Applying: Apply engineering mathematics to implement the solution.

P.I.–3.1.1: Defining, Applying: Define a precise problem statement with objectives and scope.

P.I.–3.1.2: Defining: Identify and document system requirements from stakeholders.

P.I.–3.1.3: Evaluating: Review state-of-the-art literature to synthesize system requirements.

P.I.–3.1.4: Evaluating: Choose appropriate quality attributes as defined by ISO/IEC/IEEE standards.

P.I.–3.1.5: Analyzing, Evaluating: Synthesize requirements from larger social and professional concerns.

P.I.–3.2.1: Creating, Evaluating: Explore design alternatives and analyze solutions.

P.I.–3.2.2: Creating, Evaluating: Produce a variety of potential design solutions to meet functional requirements.

P.I.–3.3.1: Evaluating: Perform systematic evaluation of design concepts based on criteria.

P.I.–3.3.2: Evaluating, Creating: Consult with domain experts to select the candidate engineering design for further development.

P.I.–3.4.1: Applying, Evaluating: Refine architecture design into a detailed design within the existing constraints.

P.I.–3.4.2: Applying, Creating: Implement and integrate modules into the design.

P.I.–3.4.3: Evaluating, Applying: Verify functionalities and validate the design.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 2.1, 3.1, 4.1, 5.1, and 6.1
CO2	1.2, 2.2, 3.2, 4.2, 5.2, and 6.2
CO3	1.3, 2.3, 3.3, 4.3, 5.3, and 6.3

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	6/18	-	-	-	-	-	-	-	-	-	-
CO2	5/18	1/18	-	-	-	-	-	-	-	-	-
CO3	-	6/18	-	-	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: *Recall De Moivres Theorem and related expansions. (P.I.- 1.1.1) (CO1)*	• The student can state De Moivre's Theorem accurately. • The student can apply De Moivre's Theorem to find powers and roots of complex numbers. • The student can recall and use identities related to trigonometric expansions from De Moivre's form.	MSE ISA ESE
LO 1.2: *Explain power and roots of complex numbers. (P.I.- 1.1.1) (CO2)*	• The student can express a complex number in polar form. • The student can calculate powers of complex numbers using De Moivre's Theorem. • The student can find all nth roots of a given complex number.	MSE ISA ESE
LO 1.3: *Apply De Moivres theorem to trigonometric identities. (P.I.- 2.4.1) (CO3)*	• The student can derive trigonometric identities using De Moivre's Theorem. • The student can express multiple-angle formulas using powers of complex numbers. • The student correctly applies identities in solving trigonometric problems.	MSE ESE ISA
LO 1.4: *Analyze different forms of complex numbers. (P.I.- 2.4.2) (CO4)*	• The student can identify and convert between rectangular, polar, exponential, and trigonometric forms. • The student can compare the advantages of using different forms in solving problems. • The student can interpret geometric meaning of complex numbers in various forms.	MSE ISA ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.5: *Evaluate powers and roots using De Moivres. (P.I.- 2.4.1) (CO5)*	• The student can write a complex number in polar/trigonometric form. • The student can correctly apply De Moivre's Theorem to compute powers of complex numbers. • The student can determine all nth roots and represent them geometrically.	MSE ISA ESE
LO 1.6: *Design Identities using Complex Numbers. (P.I.- 3.2.1) (CO6)*	• The student can construct trigonometric identities (e.g., cosnθ,sinnθ using De Moivre's Theorem. • The student is able to develop expressions for cosnθ, sinnθcosnθ, sinnθ etcetc., in terms of multiple angles. • The student can apply designed identities to simplify or solve trigonometric expressions.	MSE ISA ESE
LO 2.1: *Recall definition of circular and hyperbolic functions. (P.I.- 1.1.1) (CO1)*	• The student can define circular functions • The student can define hyperbolic functions • The student can write fundamental identities of both circular and hyperbolic functions. • The student can differentiate between circular and hyperbolic function definitions.	MSE ISA ISA ESE
LO 2.2: *Explain inverse and logarithmic functions. (P.I.- 1.1.1) (CO2)*	• The student can define inverse trigonometric and inverse hyperbolic functions.	MSE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	• The student can explain properties and domains/ranges of inverse and logarithmic functions. • The student can simplify expressions involving inverse and logarithmic functions	ISA ESE
LO 2.3: *Apply separation of real/imaginary parts in problems. (P.I.- 2.4.1) (CO3)*	• The student can express a complex function in terms of its real and imaginary parts. • The student is able to separate and simplify real and imaginary components in expressions involving exponential, trigonometric, or hyperbolic forms. • The student can apply Euler's formula to extract real and imaginary parts. • The student accurately solves problems involving separation and interpretation of parts.	MSE ISA ISA ESE
LO 2.4: *Analyze properties of complex numbers). (P.I.- 2.4.2) (CO4)*	• The student can state and verify properties of complex numbers (e.g., conjugate, modulus, argument, additive and multiplicative properties). • The student can analyze operations (addition, subtraction, multiplication, division) with respect to these properties. • The student can justify the behavior of complex numbers under transformation (rotation, scaling). • The student can solve problems by applying these properties meaningfully.	MSE ISA ESE ISA

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 2.5: *Evaluate Complex logarithmic problems. (P.I.-2.4.1) (CO5)*	• The student can define and interpret the logarithm of a complex number. • The student can express complex logarithms in standard form using modulus and argument. • The student can evaluate principal values and branches of complex logarithmic expressions. • The student can solve problems involving logarithmic identities and conversions.	MSE ISA ISA ESE
LO 3.1: *Recall formulae for partial derivatives. (P.I.-1.1.1) (CO1)*	• The student can define a partial derivative of a function of two or more variables. • The student can state standard formulae for first and second-order partial derivatives. • The student can differentiate functions partially with respect to one variable, treating others as constants. • The student can recall and apply symmetry of mixed partial derivatives under continuity conditions.	MSE ISA ISA ESE
LO 3.2: *Explain Eulers theorem and conditions for maxima and minima. (P.I.-2.1.1) (CO2)*	• The student can state and explain Euler's theorem for homogeneous functions. • The student can verify Euler's theorem for given functions. • The student can apply first and second derivative tests to identify maxima and minima of functions of two variables. • The student can justify the use of conditions (like the discriminant test) in classifying critical points.	MSE ISA ISA ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 3.3: *Apply partial derivatives in two variable problems. (P.I.- 2.4.1) (CO3)*	• The student can compute partial derivatives for functions of two variables. • The student can apply partial derivatives to solve problems involving total derivative, chain rule, and tangent planes. • The student can solve engineering-related problems using two-variable functions and partial differentiation.	MSE ISA ESE
LO 4.1: Recall the nth derivative of standard functions. (P.I.- 1.1.1) (CO1)	• Identify the nth derivative of exponential, trigonometric, and logarithmic functions. • Use general formulas for successive differentiation. • Apply Leibniz's rule in product differentiation problems.	MSE ISA ESE
LO 4.2: Explain the concept of Taylor and Maclaurin expansions. (P.I.- 1.2.2) (CO2)	• State Taylor and Maclaurin Theorems and their assumptions. • Identify the order of approximation for a given function expansion. • Explain the convergence behavior of these series near x = 0 or expansion point.	MSE ISA ESE
LO 4.3: Apply Taylor and Maclaurin series to expand given functions. (P.I.- 2.4.1) (CO3)	• Use series to approximate functions such as sin(x), log(1+x), tanh(x). • Expand a given function up to the nth term using Taylor or Maclaurin series. • Apply series to compute numerical values of functions near expansion points.	MSE ISA ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
5.1 Recall methods for finding rank of a matrix. (P.I.- 1.1.1) (CO1)	• Identify rank of a matrix using echelon and reduced row forms. • Perform elementary row operations to reduce matrices. • Use PAQ transformation for finding equivalent matrices.	MSE ISA ESE
5.2 Explain the PAQ form and consistency of systems. (P.I.- 1.2.2) (CO2)	• Explain consistency conditions for homogeneous and non-homogeneous systems. • Define PAQ form and its significance in simplifying systems. • Discuss the role of rank in determining solution uniqueness.	MSE ISA ESE
5.3 Apply Gaussian elimination and echelon form to find rank. (P.I.- 2.1.3) (CO3)	• Apply Gaussian elimination to solve systems of linear equations. • Use echelon and row-reduced form to determine solutions.	MSE ESE
6.1 Recall iterative methods for root finding and linear systems. (P.I.- 1.1.1) (CO1)	• Describe the steps in Newton-Raphson and Regula-Falsi methods. • Identify suitable starting points for iterative methods. • Recall limitations and advantages of each method.	MSE ISA ESE
6.2 Explain convergence criteria of Newton-Raphson, Regula-Falsi, Gauss-Jacobi, and Gauss-Seidel methods. (P.I.- 1.2.2) (CO2)	• Compare the rate of convergence of numerical methods. • Explain conditions for divergence or slow convergence. • Discuss how method selection affects solution accuracy.	MSE ISA ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
6.3 Apply Newton-Raphson and Regula-Falsi for root approximation. (P.I.- 2.1.3) (CO3)	• Set up and implement the Newton-Raphson and Regula-Falsi algorithms for given transcendental equations. • Perform iterative steps manually or computationally and interpret convergence toward the root. • Compare the results of both methods and justify the choice of method based on accuracy and iteration count.	MSE ISA ESE

Tools/ Technologies/ Programming Languages learnt:

- Python
- MATLAB
- MS Excel
- Desmos
- Scientific Calculator

Text Books:

1. Ramana B.V.,"Higher Engineering Mathematics",12th Edition, Tata MCGraw Hill,2017

Reference Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th ed. New Delhi, India: Khanna Publishers, 2017.
2. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, 3rd ed. New Delhi, India: S. Chand Publishing, 2014.
3. N. P. Bali and M. Goyal, A Textbook of Engineering Mathematics, 9th ed. New Delhi, India: Laxmi Publications, 2015.
4. K. A. Stroud, Engineering Mathematics, 7th ed. London, UK: Palgrave Macmillan, 2013.
5. S. Lipschutz and M. Lipson, Schaum's Outline of Linear Algebra, 5th ed. New York, NY, USA: McGraw-Hill, 2018.
6. E. Kreyszig, Advanced Engineering Mathematics, 10th ed. Hoboken, NJ, USA: John Wiley & Sons, 2011.

Online Reference Material:

1. P. Dawkins, Complex Numbers (Algebra & Trigonometric Form, De Moivre's Theorem). Lamar University, TX, USA, 2018. [Online].

Available: https://tutorial.math.lamar.edu/Classes/Alg/ComplexNumbers.aspx

2. P. Dawkins, Hyperbolic Functions and Logarithms. Lamar University, TX, USA, 2018. [Online]. Available: https://tutorial.math.lamar.edu/Classes/CalcII/HyperbolicFunctions.aspx
3. MIT OpenCourseWare, Multivariable Calculus (Partial Derivatives and Applications). Cambridge, MA, USA: Massachusetts Institute of Technology, 2010. [Online].

Available: https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/

4. MIT OpenCourseWare, Linear Algebra (Matrix Methods and Rank, Systems of Equations and LU Decomposition). Cambridge, MA, USA: Massachusetts Institute of Technology, 2005. [Online].

Available: https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/

5. MIT OpenCourseWare, Signals and Systems (Z-Transform Concepts). Cambridge, MA, USA: Massachusetts Institute of Technology, 2011. [Online].

Available: https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/

Course Name: Basic Electrical & Electronics Engineering

Course Code: ESC06T & ESC06P

Vertical/ Sub-Vertical: Basic and Engineering Science Courses

K-S-A Mapping: Knowledge and Skill

Pre-requisite required: Nil

Pre-requisite for: PCET01T and PCET01P, PCET101T and PCET101P

Recommended Semester:

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ESC06T	2	-	2	-
ESC06P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (ESC06T)	15(~20%)	20(~30%)	40(~50%)	75(100%)
Practical (ESC06P)	25(50%)	--	25(50%)	50(100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

This course introduces learners to basic techniques for electrical circuit analysis.

Course Objectives:

- To enable learners to gain understanding of the D.C circuit analysis and different network theorem.
- To facilitate learners in developing the skills analysing single and three phase AC circuits.
- To create awareness of single-phase transformer working.
- To introduce basic Electronics Devices applications.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Evaluate DC circuits using different network theorems.	Evaluating
CO2	Evaluate 1-Φ circuit and 3-Φ AC circuits.	Evaluating
CO3	Illustrate the constructional features and operation of 1-Φ transformer.	Illustration
CO4	Understand different types of electronic circuits.	Analysing

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	DC Circuits (Only Independent Sources)	***Learning Objective:*** *Introduce the concept of electrical engineering and DC circuits. (CO1).* ***Contents:*** Kirchhoff's Laws, Ideal and practical voltage and current Sources, Source Transformation, Star-Delta / Delta-Star Transformations, Mesh and Nodal Analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem. ***Learning Outcomes:*** *A learner will be able to:* 1. *Recall the basic definitions of electrical and electronics engineering. (P.I.-1.1.1 and 1.2.1) (CO1)* 2. *Explain principles of electrical and electronics engineering with examples. (P.I -1.2.3 and 1.3.2) (CO1, CO2)*	10
2	AC Circuits	***Learning Objective:*** *Understand the functionality, implementation, and applications of Single phase Series and Parallel circuits (CO2, CO3)* ***Contents:*** *AC Circuits: Generation of alternating voltage, basic definitions, average and R.M.S. values, phasor and phase*	8

Module No.	Module Name	Content	No. of Hours
		difference, sums on phasors. Single-phase ac series and parallel circuits consisting of R, L, C, RL, RC, RLC combinations, definitions - real, reactive and apparent power, admittance (Y), Series and parallel resonance, Q factor ***Learning Outcomes:*** *A learner will be able to:* 1. *Explain the generation of alternating voltage and define key terms such as frequency, period, amplitude, and phase angle. (P.I.- 1.3.2 and 1.3.6) (CO2)* 2. *Solve numerical problems involving phasor algebra and the use of complex numbers in AC analysis. (P.I.-1.2.4 and 1.2.5) (CO2, CO4)* 3. *Analyze single-phase AC circuits (series and parallel) composed of R, L, C, RL, RC, and RLC combinations using phasor and impedance methods. (P.I.-1.4.4) (CO2)*	
3	Three Phase AC circuits	***Learning Objective:*** *Understand the fundamental concepts of three-phase AC systems, including phase sequence, line and phase voltages, and current relationships. (CO2)* ***Contents:*** *Generation of Three-Phase Voltages, voltage & current relationships in Star and Delta Connections, Power Measurement* ***Learning Outcomes:*** *A learner will be able to:* 1. *Interpret the waveform and phasor representations of generated three-phase voltages. (P.I.-1.2.3, 1.4.1) (CO2)* 2. *Derive and apply the relationships between line and phase voltages and currents for Star and Delta configurations. (P.I.- 2.1.1, 2.3.1) (CO2 and CO4)*	3

Module No.	Module Name	Content	No. of Hours
		3. *Analyze how power measurements differ between balanced and unbalanced loads (P.I.-2.4.2, 3.1.1) (CO2)*	
4	Single Phase Transformer	***Learning Objective:*** *To understand the construction, working principle, and performance of a single-phase transformer, and to analyze its voltage, current, and power relationships under various operating conditions. (CO3)* ***Contents:*** *Working principle, EMF equation, Transformer losses, Comparison between Actual (practical) and ideal transformer, Performance parameters, Phasor diagram* ***Learning Outcomes:*** *A learner will be able to:* 1. *Analyze transformer operation under no-load and load conditions, and interpret phasor diagrams accordingly. (P.I.-1.2.4, 2.2.3) (CO3)* 2. *Perform calculations for voltage, current, and power in the primary and secondary windings of ideal and practical transformers. (P.I.-2.1.1, 2.1.4) (CO3)*	5
5	Applications of Basic Electronics Devices	***Learning Objective:*** *To understand, define and explain the basic characteristics of electronic devices such as diodes, transistors, and operational amplifiers. Diagnose faults in simple electronic circuits using multimeters and oscilloscopes. (CO4)* ***Contents:*** *Rectifier circuits using diodes, filter circuits using inductor and capacitor, voltage regulator using diode, Transistor as a switch.* ***Learning Outcomes:*** *A learner will be able to:*	4

Module No.	Module Name	Content	No. of Hours
		1. *Describe the working principles of half-wave, full-wave, and bridge rectifiers. (P.I.-2.1.1, 2.1.2) (CO4)* 2. *Design and implement simple capacitor, inductor, and LC filter circuits. (P.I.-2.2.6) (CO4)* 3. *Analyze the output waveform of filtered rectifier circuits using measurement tools. (P.I.- 1.3.4, 2.4.4) (CO4)*	
Total			**30**

Suggested List of Practicals:

Sr No.	Suggested Topic(s)
1.	Implement output voltage across load resistor using mesh and nodal analysis ***Learning Outcomes:*** *A learner will be able to:* *1.1 Apply Mesh and Nodal analysis techniques to determine the theoretical values of voltage across and current through a load resistor in a given electrical circuit. (P.I.-1.1.1, 1.2.2, 1.2.3) (CO1)*
2.	Implementation of Superposition Theorem. ***Learning Outcomes:*** *A learner will be able to:* *1.1 Analyze a given electrical circuit by considering the effect of each independent source acting alone, while replacing others with their internal resistances. (P.I.-1.1.4) (CO1)*
3.	Implementation of Thevenin's Theorem. ***Learning Outcomes:*** *A learner will be able to:* *1.3 Apply Thevenin's Theorem to reduce a linear two-terminal circuit to its equivalent form. (P.I.-1.3.2, 1.3.3) (CO1)*
4.	Implementation of Norton's Theorem ***Learning Outcomes:*** *A learner will be able to:*

Sr No.	Suggested Topic(s)
	2.1 Convert a complex circuit into its Norton equivalent using systematic steps. (P.I.-2.1.1, 2.1.5)(CO1)
5.	Implementation of Maximum Power Transfer Theorem ***Learning Outcomes:*** *A learner will be able to:* *2.3 Verify the theoretical predictions of maximum power transfer through practical measurement or circuit simulation. (P.I-.2.3.1, 2.3.3) (CO1)*
6.	Implement resonance conditions in a R-L-C series resonance circuit ***Learning Outcomes:*** *A learner will be able to:* *2.3 Interpret frequency response curves to observe resonance effects. (P.I.-2.3.2) (CO 2)*
7.	Implementation of three phase system (Star & Delta) ***Learning Outcomes:*** *A learner will be able to:* *2.3 Explain Phase vs. line voltage and current relationships in both Y and Δ systems. (P.I.-2.3.1) (CO2)*
8.	Implementation of Power and phase in three phase system by two wattmeter method. ***Learning Outcomes:*** *A learner will be able to:* *2.4 Interpret data and draw conclusions about system behaviour, power consumption, and efficiency. (P.I-2.4.1, 2.4.5) (CO3)*
9.	Implementation of OC and SC test on single phase transformer ***Learning Outcomes:*** *A learner will be able to:* *2.3 Determine voltage regulation, which indicates the change in secondary voltage from no-load to full-load conditions. (P.I.- 2.3.1, 2.3.4) (CO4)*

Performance Indicators:

PI 1.1.1 Remembering: Recall key mathematical formulas and concepts relevant to engineering problems.

PI 1.1.2 Understanding: Explain how mathematical models are used to represent engineering systems or processes.

PI 1.1.3 Applying: Solve engineering problems by applying appropriate mathematical models and methods.

PI 1.1.4 Analyzing: Break down a complex engineering problem into mathematical components to evaluate relationships

PI 1.2.1 Remembering: Identify core principles of physics and chemistry relevant to engineering.

PI 1.2.2 Understanding: Describe how basic science concepts apply to material behavior and engineering

PI 1.2.3 Applying: Use scientific laws (e.g., Newton's laws, conservation laws) to solve basic engineering

PI 1.2.4 Analyzing: Examine the interaction between scientific principles in multi-disciplinary engineering systems

PI 1.3.2 Understanding: Explain the relevance of basic engineering principles to real-world problems.

PI 1.3.3 Applying: Perform calculations and simulations to solve simple engineering tasks.

PI 1.3.4 Analyzing: Deconstruct engineering scenarios to identify fundamental principles at work.

PI 2.1.1 Remembering: Recall relevant engineering principles, theories, and concepts to identify a problem.

PI 2.1.2 Understanding: Explain the key features and scope of a complex engineering problem.

PI 2.1.4 Analyzing: Decompose a complex engineering problem into its constituent parts to identify critical aspects.

PI 2.1.5 Evaluating: Assess the relevance and significance of various problem aspects using evidence-based reasoning.

PI 2.2.3 Applying: Develop a basic solution plan using a systematic approach to solve an identified problem.

PI 2.2.6 Creating: Design a comprehensive and innovative solution plan, integrating multidisciplinary methods if necessary.

PI 2.3.1 Remembering: Identify the types of models (e.g., mathematical, physical, computational) used in engineering problem-solving.

PI 2.3.2 Understanding: Explain the purpose and assumptions of a model in the context of a specific engineering problem.

PI 2.3.3 Applying: Construct a basic model to represent a complex engineering system or process.

PI 2.3.4 Analyzing: Evaluate the model's validity by interpreting results and assessing assumptions.

PI 2.4.1 Remembering: Recall procedures and tools required for executing an engineering solution process.

PI 2.4.4 Analyzing: Examine the results of the solution process to determine trends, patterns, and inconsistencies.

PI 2.4.5 Evaluating: Critically assess the solution's accuracy and efficiency and propose improvements if necessary.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 1.2
CO2	1.2, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3
CO3	4.1, 4.2
CO4	2.2, 3.2, 5.1, 5.2, 5.3

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	2/24	-	-	-	-	-	-	-	-	-	-
CO2	9/24	3/24	-	-	-	-	-	-	-	-	-
CO3	1/24	3/24	-	-	-	-	-	-	-	-	-
CO4	1/24	4/24	-	-	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1.1: *Recall the basic definitions of electrical and electronics engineering. (P.I.-1.1.1 and 1.2.1) (CO1)*	• The student can define what are electrical and electronics circuit parameters	MSE ISA

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	• The student is able to list different electrical and electronics parameters • The student can able to understand the roles and applications of electrical and electronics engineering in real-world technology and infrastructure.	ESE
LO1.2: *Explain principles of electrical and electronics engineering with examples. (P.I -1.2.3 and 1.3.2) (CO1, CO2)*	• The student can **describe** the electrical and electronics principles. • The student provides **relevant examples** of kirchoff's current and voltage law • The student can **explain** AC v/s DC principle.	MSE ISA ESE
LO2.1: *Explain the generation of alternating voltage and define key terms such as frequency, period, amplitude, and phase angle. (P.I.- 1.3.2 and 1.3.6) (CO2)*	• The student can Identifies and defines key terms: frequency, period, amplitude, and phase angle. • The student can clearly explains the working principle of AC voltage generation using electromagnetic induction. • The student can demonstrates understanding by relating waveform features to definitions (e.g., sine wave graph)	ISA MSE ESE
LO2.2: *Solve numerical problems involving phasor algebra and the use of complex numbers in AC analysis. (P.I.- 1.2.4 and 1.2.5) (CO2, CO4)*	• The student can correctly converts sinusoidal quantities to phasor (polar or rectangular) form. • The student can accurately performs phasor operations	MSE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	(addition, subtraction, multiplication, division) • The student can correctly solves numerical problems involving AC quantities (impedance, voltage, current, power)	LAB ESE
LO2.3: *Analyze single-phase AC circuits (series and parallel) composed of R, L, C, RL, RC, and RLC combinations using phasor and impedance methods. (P.I.-1.4.4) (CO2)*	• The student is able to identify circuit components and configurations (series or parallel) • The student can calculate total impedance of R, L, C, RL, RC, or RLC combinations using complex numbers • The student is able to apply phasor algebra correctly to analyze voltages and currents in the circuit • Determines and interprets power quantities (active, reactive, apparent power and power factor)	LAB MSE ESE
LO 3.1: *Interpret the waveform and phasor representations of generated three-phase voltages. (P.I.-1.2.3, 1.4.1) (CO2)*	• The student can define Identify the characteristics of a balanced three-phase voltage waveform (magnitude, frequency, phase shift • The student is able to accurately sketches or interprets sinusoidal waveforms for three-phase voltages (R, Y, B) • The student explains the relationship between time-domain waveforms and phasor-domain representation	MSE ISA ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 3.2: *Derive and apply the relationships between line and phase voltages and currents for Star and Delta configurations. (P.I.- 2.1.1, 2.3.1) (CO2 and CO4)*	• The student is able to derives voltage and current relationships for Star (Y) and Delta (Δ) configuration • The student can Correctly applies relationships to solve numerical problems involving line and phase quantities in Y and Δ systems • The student can illustrates understanding with clear phasor diagrams or configuration schematics for Star and Delta connections	ISA MSE, LAB ESE
LO 3.3 *Analyze how power measurements differ between balanced and unbalanced loads (P.I.-2.4.2, 3.1.1) (CO2)*	• The student is able to clearly explains the characteristics of balanced and unbalanced three-phase loads • The student can Describes how power is calculated in balanced loads using appropriate formulas • The student can analyzes power measurement techniques for unbalanced loads (e.g., three-wattmeter vs two-wattmeter method)	MSE ISA ESE
LO 4.1: *Analyze transformer operation under no-load and load conditions, and interpret phasor diagrams accordingly. (P.I.-1.2.4, 2.2.3) (CO3)*	• The student is able to accurately explains transformer working principle and distinguishes between no-load and load conditions • The student can Analyzes behavior of primary and secondary voltages, currents, and	ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	flux under no-load and load conditions • The student can Draws or interprets accurate phasor diagrams for both no-load and loaded transformer conditions • The student can demonstrates correct application of transformer equivalent circuit concepts	ISA,LAB MSE, LAB MSE
LO 4.2: *Perform calculations for voltage, current, and power in the primary and secondary windings of ideal and practical transformers. (P.I.-2.1.1, 2.1.4) (CO3)*	• The student can correctly applies transformer voltage and current transformation equations for ideal transformers • The student can performs power calculations for primary and secondary windings considering ideal transformer conditions • The student is able to incorporates losses and efficiency factors to analyze practical transformer performance • The student can solve numerical problems involving voltage regulation and efficiency of transformers	ISA LAB, ISA MSE, ESE
LO 5.1: *Describe the working principles of half-wave, full-wave, and bridge rectifiers. (P.I.-2.1.1, 2.1.2) (CO4)*	• The student can clearly explains the basic operation of a half-wave rectifier, including input-output waveforms • The student can describes the working principle of full-wave rectifier (center-tapped and bridge types) with relevant diagrams	ISA, MSE MSE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	• The student is able to identify and explain the advantages and disadvantages of each rectifier type	MSE, ESE
LO 5.2: *Design and implement simple capacitor, inductor, and LC filter circuits. (P.I.-2.2.6) (CO4)*	• The student is able select appropriate components (capacitor, inductor values) based on filter type and design requirements	LAB
	• The student can design basic filter circuits (capacitor-only, inductor-only, and LC combinations: low-pass, high-pass)	LAB
	• The student can Correctly implements the designed filter circuit on simulation software or breadboard	LAB
	• The student is able test and analyze circuit behaviour, including cut-off frequency and signal attenuation	LAB
LO 5.3: *Analyze the output waveform of filtered rectifier circuits using measurement tools. (P.I.- 1.3.4, 2.4.4) (CO4)*	• The student is able Analyzes waveform shape (with and without filter) and explains the effect of filtering components	ESE
	• The student can able to compare filtered vs unfiltered waveforms and explains differences in ripple and DC output	ISA, MSE

Textbooks:

1. V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill, (Revised Edition) S. S. Dara, "Engineering Chemistry", Chand & Co, New Delhi (2006)

2. Vincent Del Toro "Electrical Engineering Fundamentals", PHI Second edition, 2011

3. Edward Hughes "Hughes Electrical and Electronic Technology", Pearson Education (Tenth edition)

4. D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering", PHI 13th edition 2011.

5. M. Naidu,S. Kamakshaiah "Introduction to Electrical Engineering" McGraw-Hill Education, 2004

6. B.R Patil "Basic Electrical Engineering" Oxford Higher Education, Revised Second Edition, 2018

Reference Books:

1. B.L.Theraja "Electrical Engineering " Vol-I and II.

2. S.N.Singh, "Basic Electrical Engineering" PHI , 2011Book

Related / Equivalent MOOC and Associated Certification:

Platform	Course / Topic	Format	Probable Start Dates (2026)	Certificate
NPTEL/SWAYAM	*Fundamentals of EE*	Instructor-led	Jul–Dec 2026 session (exams ~Oct/Nov)	Yes
edX / MOOC.org	Circuits & Electronics, Intro EE	Self-paced	Rolling enrolments throughout 2026	Optional

Course Name: Engineering Mechanics

Course Code: ESC02T & ESC02P

Vertical/ Sub-Vertical: Engineering Science

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: - Nil

Pre-requisite for: MDMRB01

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ESC02T	2	-	2	-
ESC02P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (ESC02T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (ESC02P)	25 (50%)	-	25 (50%)	50 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

To improve the skill sets of students for understanding forces and motions associated with particles and rigid bodies. This course also imparts and inculcates students to understand force system and its effects.

Course Objectives:

- To develop a fundamental understanding of force systems and their applications in engineering structures and machines.
- To enhance the ability to apply concepts of equilibrium, free-body diagrams, and support reactions for analysing static systems.

- To enable learners to compute centroids of simple and composite shapes and understand their practical implications in structural design.
- To impart knowledge on the laws of friction and its applications in mechanical systems, emphasizing real-life engineering scenarios.
- To provide an in-depth understanding of particle motion and its types, enabling learners to apply kinematic equations in various engineering and technological contexts.
- To introduce the motion analysis of rigid bodies using concepts like Instantaneous Centre of Rotation (ICR) and relate angular and linear velocities.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Ability to understand and analyse forces, force systems and equilibrium.	*Understand & Analyse*
CO2	Understand and verify law of Moments	*Understand & Apply*
CO3	Determine the centroid of plane lamina	*Apply*
CO4	Understand and apply basic concepts of Kinematics of particles and kinematics of rigid bodies.	*Understand & Apply*
CO5	Evaluate co-efficient of friction between the different surfaces in contact	*Evaluate*

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	System of Coplanar Forces	***Learning Objective:*** *This topic provides learner with the knowledge to find the resultant of a Coplanar force system. (C01, CO2).* **Contents:** Introduction to Force and Force systems (Concurrent, Parallel and General coplanar force system), resolution composition and resultant of force systems. Principle of	6

Module No.	Module Name	Content	No. of Hours
		transmissibility of a force, Moment of force about a point, Couples, Varignon's Theorem. Force couple system ***Self-Learning Topics***: *Newton's Laws of Motion* ***Learning Outcomes:*** *A learner will be able to:* 1. *Analyze and resolve different types of coplanar force systems. (PI 1.1.1) (CO1)* 2. *Apply the principle of transmissibility and calculate moment of force and couples. (PI 2.1.3) (CO2)* 3. *Determine resultant of concurrent, parallel, and general force systems using analytical methods. (PI 2.2.3) (CO1)* 4. *Use Varignon's Theorem to simplify moment calculations. (PI 1.3.2) (CO2)* 5. *Relate Newton's Laws of Motion to static force systems. (PI 1.1.1) (CO1)*	
2	Centroid	***Learning Objective:*** *This topic provides knowledge of centroid of plane area. (CO3)* **Contents:** First moment of Area, Centroid of Regular composite plane Laminas ***Self-Learning Topics****: NIL* ***Learning Outcomes:*** *A learner will be able to:* 1. *Compute the centroid of regular and composite laminas using the concept of the first moment of area. (PI 1.1.1) (CO3)* 2. *Develop mathematical models for centroidal calculations. (PI 2.3.4) (CO3)*	4

Module No.	Module Name	Content	No. of Hours
		3. *Solve real-life problems involving centroid locations (e.g., stability of structures). (PI 3.1.3) (CO3)* 4. *Apply the concept of centroid to structural and mechanical applications. (PI 1.3.2) (CO3)*	
3	Equilibrium	***Learning Objective:*** *On completion of this topic, students will be able to define the concept of equilibrium, understand various types of supports, and explain different types of loads. (CO1, CO2)* **Contents:** Equilibrium of rigid beams: Free body diagrams. Conditions of equilibrium. Types of supports & types of loads. Determination of supports reactions for different types of loads on the beams. ***Learning Outcomes:*** *A learner will be able to:* 1. *Draw free-body diagrams for various support conditions. (PI 2.1.3) (CO1, CO2)* 2. *Identify and classify types of supports and loads in a system. (PI 1.3.2) (CO1, CO2)* 3. *Analyze equilibrium conditions of beams under various loading systems. (PI 2.2.3) (CO1, CO2)* 4. *Calculate support reactions using conditions of equilibrium. (PI 2.3.4) (CO1, CO2)* 5. *Correlate theoretical results with practical structural applications. (PI 5.2.6) (CO1, CO2)*	5
4	Friction	***Learning Objective:*** *On completion of this topic, students will be able to understand the concept of friction, evaluate the frictional forces needed for static equilibrium, and recognize its significance in everyday applications. (CO5).* **Content:** Coefficient of static and dynamic friction, Laws of friction, Angle of Friction, Angle of Repose. Concept of Cone of	4

Module No.	Module Name	Content	No. of Hours
		friction. Equilibrium of bodies on horizontal & inclined plane. ***Learning Outcomes:*** *A learner will be able to:* 1. *Understand and differentiate between static and dynamic friction. (PI 1.1.1) (CO 5)* 2. *Apply laws of friction in analyzing equilibrium on horizontal and inclined planes. (PI 2.2.3) (CO5)* 3. *Evaluate the coefficient of friction and its effect on motion and design. (PI 3.2.4) (CO 5)* 4. *Use real-world case studies to appreciate design considerations involving friction. (PI 6.1.5) (CO 5)* 5. *Utilize simulation tools to visualize frictional effects. (PI 5.2.6) (CO 5)*	
5	Kinematics of particles	***Learning Objective:*** *This topic provides knowledge of the geometry of motion, enabling students to analyze various types of motion and apply this understanding in contexts such as video game development. (CO4).* **Content:** Uniformly accelerated motion along straight line, motion under gravity, Projectile Motion ***Learning Outcomes:*** *A learner will be able to:* 1. *Analyze rectilinear motion with uniform and non-uniform acceleration. (PI 1.2.2) (CO 4)* 2. *Apply equations of motion to particles under gravity. (PI 2.2.3) (CO 4)* 3. *Evaluate projectile motion and trajectory paths. (PI 3.2.4) (CO 4)*	7

Module No.	Module Name	Content	No. of Hours
		4. *Solve kinematic problems using analytical and graphical approaches. (PI 2.3.4) (CO 4)* 5. *Relate motion concepts to applications such as gaming, automation, or ADAS systems. (PI 6.2.5) (CO 4)*	
6	Kinematics of rigid bodies	***Learning Objective:*** *This topic provides knowledge of the geometry of motion, enabling students to locate the Instantaneous Centre of Rotation (ICR) and establish the relationship between linear and angular velocity. (CO4).* **Contents:** Introduction to different types of motion a Rigid body performs viz. Translation, Rotation and General Plane motion. Concept of Instantaneous Centre of rotation (ICR) for the finding velocity. Locating ICR for multiple link mechanism. Velocity analysis of rigid body using ICR. ***Learning Outcomes:*** *A learner will be able to:* 1. *Classify types of rigid body motion: translation, rotation, and general plane motion. (PI 1.3.2) (CO 4)* 2. *Locate the Instantaneous Centre of Rotation (ICR) for velocity analysis. (PI 2.2.3) (CO 4)* 3. *Apply velocity analysis methods to multi-link mechanisms. (PI 3.2.4) (CO 5)* 4. *Correlate angular and linear motion in rigid bodies. (PI 2.3.4) (CO 4)* 5. *Use ICR concepts in real-life applications such as robotics or vehicle systems. (PI 6.2.5) (CO 4)*	4
Total			**30**

Suggested List of Practicals:

Sr No.	Suggested Topic(s)
1.	Verification of principle of moment / Bell crank lever using simulation software ***Learning Outcomes:*** *A learner will be able to verify the principle of moments and analyze torque in practical systems. (P.I. – 1.4.1 and 2.1.3) (CO 2)*
2.	Determination of support reactions of simply supported beam using simulation software ***Learning Outcomes:*** *A learner will be able to analyse support conditions and calculate reactions for beams.* *(P.I. – 2.1.3 and 2.1.4) (CO 1).*
3.	Determination of coefficient of friction using inclined plane method ***Learning Outcomes:*** *A learner will be able to determine and analyze frictional forces acting on inclined surfaces. (P.I. – 2.2.2 and 2.1.3) (CO 5).*
4.	Projectile Motion – By using simulation software ***Learning Outcomes:*** *A learner will be able to analyze the motion of particles under gravity and determine projectile parameters. (P.I. 1.3.2 and 2.1.2) (CO 4)*
5.	Verification of Law of Polygon of Coplanar Concurrent Forces ***Learning Outcomes:*** *A learner will be able to apply polygon laws to solve coplanar force systems. (P.I. – 1.4.1 and 2.2.3) (CO 1)*
6.	Determine the Centroid of plane lamina using simulation software ***Learning Outcomes:*** *A learner will be able to compute centroids of various plane shapes and composite laminas. (P.I. - 1.4.2 and 1.3.1) (CO 3)*

7.	Determination of coefficient of kinetic friction using D-Alembert Principle ***Learning Outcomes:*** *A learner will be able to apply D'Alembert's Principle for dynamic friction analysis. (P.I. – 2.2.2. and 2.1.2) (CO 5)*

Sr No.	**Suggested Topic(s)**
8	Determination of stiffness of spring ***Learning Outcomes:*** *A learner will be able to determine stiffness using load-deformation characteristics. (P.I. – 1.3.2. and 2.1.4) (CO 1)*
9	Verification of Law of Polygon of Coplanar Non-Concurrent & Non-Parallel Forces ***Learning Outcomes:*** *A learner will be able to analyze and resolve general force systems using graphical methods. (P.I. – 2.1.4. and 2.2.3) (CO 1)*
10	Motion Curves – By using simulation software ***Learning Outcomes:*** *A learner will be able to interpret velocity-time and acceleration-time curves for linear motion. (P.I. – 1.4.4. and 1.3.2) (CO 4)*

Performance Indicators:

P.I. – 1.1.1: **Remembering**: Recall key mathematical formulas and concepts relevant to engineering problems.

P.I. – 1.2.2: **Understanding**: Interpret physical meaning and mathematical representation of engineering concepts.

P.I. 1.3.2: **Understanding**: Demonstrate understanding of engineering concepts through appropriate application in problem-solving.

P.I. – 1.3.2: **Understanding**: Illustrate engineering principles using examples, diagrams, or simulations.

P.I. – 1.4.3: **Applying:** Conduct experiments or use simulation tools to validate engineering principles.

P.I. – 1.4.4: **Analyzing**: Analyze results obtained from experiments or simulations for interpretation and validation.

P.I. – 2.1.3: **Applying**: Apply fundamental engineering and scientific principles to analyze real-world force systems.

P.I. – 2.1.4: **Analyzing**: Analyze systems using engineering fundamentals like equilibrium and motion.

P.I. – 2.1.3: **Applying**: Develop and interpret free body diagrams and apply to static systems.

P.I. – 2.1.3: **Applying**: Use suitable mathematical tools and methods to solve force and motion-related problems.

P.I. – 2.2.3: **Applying**: Solve particle motion problems using appropriate equations of motion.

P.I. – 2.2.3: **Applying**: Analyze forces considering friction and dynamic conditions.

P.I. – 2.2.4: **Analyzing**: Solve and interpret force and motion problems involving multiple force systems.

P.I. – 2.3.4: **Analyzing:** Construct and solve mathematical models for mechanical and structural systems.

P.I. – 3.1.3: **Applying**: Apply engineering knowledge to assess centroid and stability in real-life systems.

P.I. – 3.2.4: **Analyzing**: Apply motion analysis to dynamic systems like linkages and rigid bodies.

P.I. – 3.2.5: **Evaluating**: Evaluate effects of friction or projectile motion in system design or operation.

P.I. – 5.2.6: **Creating**: Use modern tools or simulations to visualize and verify engineering solutions.

P.I. – 6.1.5: **Evaluating**: Assess the significance of friction, stability, and safety in societal or design context.

P.I. – 6.2.5: **Evaluating**: Relate engineering mechanics concepts to applications in technology or industry (e.g., robotics, gaming, ADAS).

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1.1, 1.3.1, 2.1.2, 2.2.3, 2.3.2, 5.2.1
CO2	1.3.1, 2.1.1, 2.1.2, 2.2.3, 2.3.2, 5.2.1
CO3	1.1.1, 1.3.1, 2.3.2, 3.1.5
CO4	1.1.1, 2.2.3, 3.2.3, 5.2.1, 6.1.1
CO5	1.2.2, 1.3.1, 2.2.1, 2.2.2, 2.3.2, 3.2.1, 3.2.3, 6.2.1

Assessment Criterion of the Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria: The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: Analyze and resolve different types of coplanar force systems. (P.I.- 1.1.1) (CO1)	• Identify types of coplanar force systems (concurrent, parallel, general). • Resolve force systems graphically and analytically. • Calculate resultants using vector methods. • Interpret real-life situations using coplanar force systems.	ISA, MSE

Learning Outcomes: The Learner will:	**Assessment Criteria: The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.4: Navigate CAD software interface, menu systems, and toolbars. (P.I.- 1.4.2) (CO1)	• Open CAD software and locate interface components. • Use menu and toolbar options to initiate a new drawing. • Demonstrate a simple CAD sketch with basic tools. • Save, modify, and print a simple CAD file.	LAB, ISA
LO 2.1: Compute the centroid of regular and composite laminas. (P.I.- 1.1.1) (CO3)	• Define the concept of centroid and first moment of area. • Use standard formulas to calculate centroid of composite shapes. • Apply symmetry to reduce calculations. • Explain practical applications in structural design.	MSE, ESE
LO 3.1: Draw free-body diagrams for support conditions. (P.I.-2.1.3) (CO1, CO2)	• Identify all forces acting on a structure. • Use standard symbols for supports and loads. • Label all dimensions and directions of forces correctly. • Construct free-body diagrams for different beams.	ISA, MSE

LO 4.1: Understand and differentiate between static and dynamic friction. (P.I.- 1.1.1) (CO5)	• Define and compare static vs. dynamic friction. • Identify situations involving both types of friction. • Explain real-world examples of friction in design. • Interpret effects of friction on motion.	ISA, MSE, LAB
LO 5.1: Analyze rectilinear motion with uniform and non-uniform acceleration. (P.I.- 1.2.2) (CO4)	• Define acceleration and types of motion. • Solve numerical problems on uniformly accelerated motion. • Sketch motion graphs for given scenarios.	ISA, MSE, ESE

Learning Outcomes: The Learner will:	**Assessment Criteria: The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
	• Apply concepts to objects falling under gravity.	
LO 6.1: Locate the Instantaneous Centre of Rotation (ICR). (P.I.-2.2.3) (CO4)	• Define ICR and its role in velocity analysis. • Identify ICR in link mechanisms. • Use ICR to relate angular and linear velocities. • Solve practical problems using ICR method.	ISA, MSE, LAB

Tools / Technologies / Software Learnt:

• Simulation Tools: Autodesk ForceEffect, Algodoo, SimScale, PTC Creo Mechanism, PhET Interactive Simulations
• Engineering Analysis Tools: MATLAB (for solving equilibrium and kinematics), GeoGebra (for graphical solutions)
• Diagramming Tools: Microsoft Visio, Lucidchart, AutoCAD (for drawing Free Body Diagrams and force systems)
• Measurement & Lab Simulation Tools: Virtual Labs (by MHRD), Online Inclined Plane Simulators, Projectile Motion Simulators
• Learning Platforms for Mechanics: NPTEL, MIT OCW, LearnEngineering YouTube Channel
• Assessment & Practice Tools: Edmodo, Google Forms with Auto-Grading, Labster Physics Simulations
• Kinematics Visualization Tools: Tracker Video Analysis Software, Physlets, Interactive Physics

Textbooks:

1. R.S. Khurmi, *"Engineering Mechanics"*, 23rd Edition, S. Chand Publishing, 2021

2. S.S. Bhavikatti, *"Engineering Mechanics"*, 5th Edition, New Age International, 2020

Reference Books:

1. F.L. Singer and K. Manicka Selvam, *"Engineering Mechanics"*, 3rd Edition, Harper Collins, 2017
2. Timoshenko and Young, *"Engineering Mechanics"*, 5th Edition, McGraw Hill Education, 2013
3. A.K. Tayal, *"Engineering Mechanics (Statics and Dynamics)"*, 14th Edition, Umesh Publications, 2019

Related / Equivalent MOOC and Associated Certification:

1. Engineering Mechanics – Statics and Dynamics – Core Certification Course
   • Platform: NPTEL (National Programme on Technology Enhanced Learning)
   • Link: https://nptel.ac.in/courses/112103109
2. Engineering Mechanics – Equivalent Introductory Course
   • Platform: Coursera (offered by Georgia Institute of Technology)
   • Link: https://www.coursera.org/learn/engineering-mechanics-statics
3. Engineering Statics – Foundational Course
   • Platform: edX (offered by Georgia Tech)
   • Link: https://www.edx.org/course/engineering-statics
4. Mechanics / Dynamics – Advanced Visual Learning Series
   • Platform: MIT OpenCourseWare
   • Link: https://ocw.mit.edu/courses/mechanical-engineering/2-003sc-engineering-dynamics-fall-2011/

Course Name: Structured Programming

Course Code: VSEC01T and VSEC01P

Vertical/ Sub-Vertical: Vocational and Skill Enhancement Course

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Nil

Pre-requisite for: VSEC02T

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
VSEC01T	2	-	2	-
VSEC01P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical	25 (50%)	-	25 (50%)	50 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

Structured Programming is a foundational course designed to introduce the principles of programming and problem-solving using the C language. As one of the most widely used and efficient programming languages, C provides a strong base for understanding core concepts such as data types, control flow, functions, arrays, pointers, and file handling.

This course emphasizes a structured approach to programming—focusing on clarity, modularity, and maintainability. It equips students with the ability to write efficient, error-free, and logically organized code, which is essential for developing software in engineering and real-world applications.

It lays the groundwork for future studies in data structures, algorithms, operating systems, embedded systems, and other technical domains that rely on C or its derivatives.

Course Objectives:

- To familiarize students with the syntax, semantics, and foundation concepts of the C programming language.
- To develop structured programming and logical problem-solving abilities.
- To introduce modular programming using functions and various data types like arrays, strings and structures.
- To Equip students with skills to handle pointer manipulation, dynamic memory allocation and file operations.
- Prepare students to write efficient and reusable code for solving real world engineering problems.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	**Describe** basic components of C programming such as character sets, identifiers, keywords, data types, operators, and standard I/O functions.	Understanding
CO2	**Apply** appropriate control structures like conditional and looping statements to develop logic-based C programs.	Applying
CO3	**Develop** modular programs using user-defined functions, recursion, and appropriate variable storage classes.	Applying
CO4	**Manipulate** arrays and strings using various operations to perform data processing tasks.	Applying
CO5	**Illustrate** the use of structures and unions for handling complex data and memory operations.	Analysing
CO6	**Develop** programs to perform file operations for reading, writing, and processing data using various file handling techniques.	Analysing

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Fundamentals of C	***Learning Objective:*** *Introduce the concept of data types, type conversion, operators, in-built mathematical functions and the generic C program structure. (C01).*	4

Module No.	Module Name	Content	No. of Hours
		Contents: Character Set, Identifiers and Keywords, Data Types, Constants and Variables Operators, Math Library Functions, Expressions, Pre-processor Directives. ***Self-Learning Topics***: *Frequently used mathematical library functions* ***Learning Outcomes:*** *A learner will be able to:* 1. *Describe syntax, keywords, data types and variables. (P.I. – 1.3.1) (CO1)* 2. *Use appropriate operators in expressions to perform various calculations and operations. (P.I. 1.3.2) (CO1)* 3. *Use math library functions to perform mathematical computations within C programs. (P.I. 1.3.3) (CO1)* 4. *Explain the purpose of preprocessor directives. (P.I. 1.3.2) (CO1)*	
2	Input and Output	***Learning Objective:*** *Understand the format specifiers and their utility in input/output functions (CO1)* **Contents:** Unformatted and formatted I/O, scanf(), printf() functions, concept of field width, precision and flags and basic programs on computation. ***Self-Learning Topics****: Format specifiers, flags and their effect* ***Learning Outcomes:*** *A learner will be able to:* 1. *Use appropriate format specifiers for various data types in both input and output operations. (P.I. – 1.3.2) (CO1)*	2

Module No.	Module Name	Content	No. of Hours
		2. *Collaborate with peers to debug and improve computational programs, applying learned concepts effectively. (P.I. – 2.1.3, 9.2.1) (CO1)*	
3	Control Structures	***Learning Objective:*** *To design and implement control flow in C programs using conditional statements (if-else, nested if-else, switch-case), looping constructs (for, while, do-while), and control statements (break, continue). They will also be able to apply nested loops to solve complex programming problems efficiently. (CO2)* **Contents:** Conditional Branching – if else statement, nested if else statement, Switch case statement, Looping – for loop, while loop and do while loop, Nesting of loops, use of unconditional branching using break and continue statement ***Self-Learning Topics****: Mathematical concepts like natural numbers , sum of first n natural numbers, Armstrong, Magic, Strong Numbers, Fibonacci series.* ***Learning Outcomes:*** *A learner will be able to:* 1. *Analyse the flow of control in programs using selection statements to make decisions based on specific conditions. (P.I. – 2.1.2) (CO2)* 2. *Implement multi-choice logic using switch statements to manage multiple options conditions effectively. (P.I. 2.1.2) (CO2)* 3. *Illustrate the syntax and use cases for each type of loop, explaining when to use one over the others. (P.I. – 2.1.2) (CO2)* 4. *Analyse loop control mechanisms (break, continue) and their effect on loop execution. (P.I. - 2.1.2) (CO2)*	6

Module No.	Module Name	Content	No. of Hours
		5. *Integrate selection and looping statements in C programs to solve more complex problems. (P.I. – 2.2.3) (CO2).*	
4	Functions	***Learning Objective:*** *To create and use functions in C, including passing arguments and managing return values, understand the scope of variables (local and global), utilize different storage classes (auto, extern, static, register), and implement recursive functions to solve problems involving repeated computation. (CO3)* **Content:** Introduction to functions Declaration and definition of functions, calling a function and passing argument to a function, concept of global and local variables, Storage classes – auto, extern, static and register, recursive Functions ***Self-Learning Topics****: Decomposition of problems in to sub tasks.* ***Learning Outcomes:*** *A learner will be able to:* 1. *Write function declarations and definitions to modularize C programs effectively. (P.I. – 1.3.3, 2.2.3) (CO3)* 2. *Demonstrate how to divide the problem into subproblems and propose a function to address a subproblem (P.I. –2.1.4) (CO3)* 3. *Identify and apply appropriate storage classes (auto, extern, static, register) to control variable lifetime and linkage. (P.I. - 2.1.2) (CO3)* 4. *Compare recursive and iterative approaches to problem-solving and justify the selection of one over the other based on context. (P.I. – 2.2.3) (CO3)*	6
5	Arrays, Strings and Structures	***Learning Objective:*** *To declare, initialize, and manipulate one-dimensional and multi-dimensional arrays, perform operations on strings using built-in and user-defined*	6

Module No.	Module Name	Content	No. of Hours
		functions, and design and implement structures—including nested structures and arrays of structures—to manage grouped data efficiently in C programs. *(CO4).* **Content:** Array-Concepts, Declaration, Definition, Accessing array element, One-dimensional and Multidimensional array. String- Basic of String, Array of String, Functions in string. Structure- Declaration, Initialization, Nested structure, Operation on structures, Array of Structure. ***Self-Learning Topics****: Functions for string and character processing, Concepts of Matrix multiplication, Matrix transform, Symmetric Matrix, Upper and Lower triangular matrix.* ***Learning Outcomes:*** *A learner will be able to:* 1. *Declare, initialize, and manipulate one-dimensional and multidimensional arrays to store and process data efficiently. (P.I. – 1.3.1, 2.1.2) (CO4)* 2. *Implement string operations using standard library functions from <string.h> and construct programs that manipulate arrays of strings. ((P.I. – 2.2.3) (CO4)* 3. *Define and use structures, including nested structures, to represent complex data types in C. (P.I. – 1.3.2) (CO5)* 4. *Create and manage arrays of structures to handle grouped data, and perform operations such as sorting, searching, and updating structure members. (P.I.- 2.2.3) (CO5)*	
6	Pointers and Files	***Learning Objective: T****o demonstrate the use of pointers in C for referencing, dereferencing, pointer arithmetic, and dynamic memory allocation, apply pointer concepts to*	6

Module No.	Module Name	Content	No. of Hours
		arrays, functions, and perform file operations, including creating, opening, reading, writing, and processing files using standard I/O functions. (CO6). **Contents:** Pointer introduction, pointer variable, reference and dereference, operators and void pointer, Pointer call by reference, pointer arithmetic, pointer to pointer, pointer and array, passing arrays to function, array of pointers and dynamic memory allocation, Types of files, file operations – opening, closing, creating, reading and processing file ***Self-Learning Topics**: File Operations.* ***Learning Outcomes:*** *A learner will be able to:* 1. *Explain the concept of pointers, including referencing, dereferencing, and the use of pointer operators. (P.I. – 1.3.2) (CO6)* 2. *Apply pointers for call-by-reference, and pointer arithmetic in solving programming problems. (P.I. – 2.2.3) (CO6)* 3. *Use pointers effectively with arrays, including passing arrays to functions and working with arrays of pointers. (P.I. – 1.3.4) (CO6)* 4. *Implement dynamic memory allocation using functions like malloc(), calloc(), realloc(), and free() to manage memory during runtime. (P.I. – 2.4.5) (CO6)* 5. *Perform file operations such as creating, opening, reading, writing, updating and closing files using C standard library functions. (P.I. – 2.3.3) (CO6)*	
Total			**30**

Suggested List of Practical:

Sr No.	Suggested Topic(s)
1.	Perform arithmetic operations using math library functions. ***Learning Outcome:*** LO1.2 Use operators and math library functions in expressions (P.I. – 1.3.3) (CO1)
2.	Use printf() and scanf() with format specifiers and field widths. ***Learning Outcome:*** LO2.1 Write program using correct format specifiers in input/output functions to perform basic computations (P.I. – 1.3.2) (CO1)
3.	Display various patterns using nested loops. ***Learning Outcome:*** LO3.4 Develop a logic to display various patterns by using nested loops (P.I. – 2.2.3) (CO2)
4.	Implement control structures to solve problems like Armstrong number, Fibonacci series, etc. ***Learning Outcome:*** LO3.3 Develop a logic and implement it for the problems which demands usage of Iterative Constructs (P.I. – 2.1.2) (CO2)
5.	Write recursive functions to compute factorial, GCD, etc. ***Learning Outcome:*** LO4.2 Analyse the problem statement to identify the scope of using recursion and accordingly implement it (P.I. – 2.2.3) (CO3)
6.	Perform sorting, searching on 1D array and matrix multiplication using 2D array. ***Learning Outcome:***

Sr No.	Suggested Topic(s)
	LO5.2 Perform operations like Matrix Multiplication, Addition, Transform, Magic Square generation etc. 3. (P.I. – 1.3.1) (CO4)
7.	Develop string functions: reverse, length, concat, and substring search. ***Learning Outcome:*** LO5.3 Propose user defined functions for: string length, string copy, string reverse, string concatenation, searching for substring 2. (P.I. – 2.2.3) (CO4)
8.	Create and manage student records using structures and arrays of structures. ***Learning Outcome:*** LO5.4 Declare a structure for representing the data about the entity, perform operations like, data population, updating, searching and displaying the records (P.I. – 2.2.3) (CO5)
9.	Use pointers to access and manipulate elements of 1D and 2D arrays. ***Learning Outcome:*** LO6.2 Write a program to process elements of 1 D array and 2 D array with the help of pointers (P.I. – 1.3.4) (CO4)
10.	Copy contents from one file to another using file handling. ***Learning Outcome:*** LO6.4 Develop an application to insert records into text file, delete and update them as per the need (P.I. – 2.3.3) (CO6)

Performance Indicators:

P.I.- 1.3.1: **Remembering**: List fundamental engineering principles and their applications.

P.I.- 1.3.2: **Understanding**: Explain the relevance of basic engineering principles to real-world problems.

P.I.- 1.3.3: **Applying**: Perform calculations and simulations to solve simple engineering tasks.

P.I.- 1.3.4: **Analysing**: Deconstruct engineering scenarios to identify fundamental principles at work.

P.I.- 2.1.2: **Understanding**: Explain the key features and scope of a complex engineering problem.

P.I.-2.1.3: **Applying**: Use standard problem-identification techniques to define an engineering challenge.

P.I.- 2.1.4: **Analysing**: Decompose a complex engineering problem into its constituent parts to identify critical aspects.

P.I.- 2.2.3: **Applying**: Develop a basic solution plan using a systematic approach to solve an identified problem.

P.I.- 2.3.3: **Applying**: Construct a basic model to represent a complex engineering system or process.

P.I.- 2.4.5: **Evaluating**: Critically assess the solution's accuracy and efficiency and propose of improvements if necessary.

P.I.- 9.2.1: **Understanding**: Describe the importance of effective communication and conflict resolution within a team.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	LO1.1, LO1.2, LO1.3, LO1.4, LO2.1 (5)
CO2	LO3.1, LO3.2, LO3.3, LO3.4, LO3.5 (5)
CO3	LO4.1, LO4.2, LO4.3 (3)
CO4	LO5.1, LO5.2, LO5.3, LO5.4, LO6.1, LO6.2 (6)
CO5	LO6.4, LO6.5 (2)
CO6	LO2.2, LO3.4, LO4.2, LO4.4, LO5.4, LO6.3, LO6.5 (7)

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	4/28	1/28	-	-	-	-	-	-	-	-	-	-
CO2	-	-	5/28	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3/28	-	-	-	-	-	-	-	-

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12
CO4	-	-	-	-	4/28	2/28	-	-	-	-	-	-
CO5	-	-	-	-	-	2/28	-	-	-	-	-	-
CO6		1/28	1/28	2/28	1/28	1/28	-	-	-	-	-	-

Mapping of Course Outcomes with Programme Specific Outcomes:

Course Outcome	PSO1	PSO2	PSO3
CO1	5/28	-	-
CO2	5/28	-	-
CO3	3/28	-	-
CO4	-	6/28	-
CO5	-	2/28	-
CO6	4/28	2/28	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	Assessment Criteria: The Learner can:	Evaluated under ISA/MSE/ESE/LAB
Describe syntax, keywords, data types and variables. (P.I. – 1.3.1) (CO1)	• Define the syntax rules of the C programming language. • List and explain commonly used C keywords. • Describe the basic data types in C (int, float, char, double, etc.) and their usage. • Demonstrate the declaration and initialization of variables with correct syntax.	ISA, LAB
Use appropriate operators in expressions to perform various calculations and operations. (P.I. 1.3.2) (CO1)	• Identify different types of operators in C (arithmetic, relational, logical, assignment, increment/decrement, etc.).	ISA, MSE, LAB

Learning Outcomes: **The Learner will:**	**Assessment Criteria:** **The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
	• Write expressions using appropriate operators based on the problem statement. • Evaluate complex expressions involving multiple operators with correct precedence and associativity. • Debug and correct operator-related errors in given C code snippets.	
Use math library functions to perform mathematical computations within C programs. (P.I. 1.3.3) (CO1)	• Identify commonly used functions from the <math.h> library (e.g., sqrt(), pow(), abs(), ceil(), floor()). • Apply appropriate math functions to solve computation-based problems in C. • Write C programs that include math functions to perform real-world calculations. • Interpret the output of math function-based expressions and validate their correctness.	ISA, MSE, LAB
1.4 Explain the purpose of preprocessor directives. (P.I. 1.3.2) (CO1)	• Define what preprocessor directives are in the C language. • Describe common directives such as #include, #define, and #ifdef. • Explain how preprocessor directives affect the compilation process. • Illustrate the use of preprocessor directives with relevant code examples.	ISA
2.1 Use appropriate format specifiers for various data types in both input and output operations. (P.I. – 1.3.2 (CO1)	• dentify the correct format specifiers for data types like int, float, char, and double in C. • Write programs using scanf() and printf() with proper format specifiers.	ISA, MSE, LAB

Learning Outcomes: **The Learner will:**	**Assessment Criteria:** **The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
	• Apply field width, precision, and flags to format the output appropriately. • Debug and correct input/output statements with incorrect specifiers.	
2.2 Collaborate with peers to debug and improve computational programs, applying learned concepts effectively. (P.I. – 2.1.3, 9.2.1) (CO1, CO6)	• Work effectively in a team to identify logical and syntax errors in C programs. • Apply debugging techniques (like dry run, printf-debugging, or using IDE tools) to locate and fix errors. • Suggest and implement improvements in peer-written code to enhance efficiency or readability. • Demonstrate teamwork and communication skills during collaborative problem-solving sessions.	LAB
3.1 Analyse the flow of control in programs using selection statements to make decisions based on specific conditions. (P.I. – 2.1.2) (CO1, CO2)	• Identify and use appropriate selection statements (if, if-else, nested if-else, switch) based on the problem requirements. • Analyse conditions and logical expressions to determine program flow. • Trace and predict the execution path of programs using selection constructs. • Debug control flow errors in decision-making code blocks.	LAB, MSE
3.2 Implement multi-choice logic using switch statements to manage multiple options conditions effectively. (P.I. 2.1.2) (CO1, CO2)	• Write programs using switch statements to handle multiple decision paths. • Appropriately use case, break, and default clauses to structure multi-choice logic. • Select switch over if-else where it enhances code clarity and performance. • Test and debug switch constructs to ensure correct branching and output.	ISA, LAB, MSE

Learning Outcomes: **The Learner will:**	**Assessment Criteria:** **The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
3.3 Illustrate the syntax and use cases for each type of loop, explaining when to use one over the others. (P.I. – 2.1.2) (CO1, CO2)	• Describe the syntax of for, while, and do-while loops with examples. • Explain the differences in behavior and typical use cases of each loop type. • Choose the most appropriate loop construct based on the problem requirements. • Implement programs using different loop types and justify the selection.	ISA, MSE, ESE
3.4 Analyse loop control mechanisms (break, continue) and their effect on loop execution. (P.I. - 2.1.2) (CO2, CO6)	• Describe the purpose and syntax of break and continue statements in loops. • Implement programs demonstrating the use of break and continue in various loop constructs. • Trace the execution of loops with control statements to observe their impact on flow. • Analyse scenarios to determine when and why to use break or continue for optimal logic.	ISA, ESE, LAB
3.5 Integrate selection and looping statements in C programs to solve more complex problems. (P.I. – 2.2.3) (CO2, CO6).	• Combine conditional (if, switch) and iterative (for, while, do-while) constructs to implement problem-solving logic. • Design solutions for real-world or mathematical problems that require nested or sequential control flow. • Implement modular code using combined control structures for clarity and reusability. • Test and debug integrated logic to ensure correctness and efficiency.	LAB

Learning Outcomes: **The Learner will:**	**Assessment Criteria:** **The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
4.1 Write function declarations and definitions to modularize C programs effectively. (P.I. – 1.3.3, 2.2.3) (CO1, CO3)	• Declare and define functions correctly with appropriate return types and parameters. • Break down problems into smaller tasks and implement each using separate functions. • Use function prototypes to enhance code structure and readability. • Develop modular programs by reusing functions and maintaining logical separation of concerns.	LAB
4.2 Demonstrate how to divide the problem into subproblems and propose a function to address a subproblem (P.I. –2.1.4) (CO3, CO6)	• Analyse a given problem and identify logical sub-tasks that can be solved independently. • Design function signatures and logic specific to each subproblem. • Implement multiple functions to handle individual components of the main problem. • Justify the modular breakdown and demonstrate how it improves readability, reusability, and testing.	ISA, LAB, ESE
4.3 Identify and apply appropriate storage classes (auto, extern, static, register) to control variable lifetime and linkage. (P.I. - 2.1.2) CO3)	• Define the purpose and behavior of each storage class in C. • Demonstrate the use of auto, static, extern, and register in suitable programming scenarios. • Explain the effect of storage classes on variable scope, lifetime, and visibility across files or functions. • Write C programs that utilize different storage classes and validate their behavior through outputs.	MSE, LAB, ESE

Learning Outcomes: **The Learner will:**	**Assessment Criteria:** **The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
4.4 Compare recursive and iterative approaches to problem-solving and justify the selection of one over the other based on context. (P.I. – 2.2.3) (CO1, CO3, CO6)	• Explain the concepts of recursion and iteration with examples. • Implement equivalent programs using both recursive and iterative techniques (e.g., factorial, Fibonacci). • Compare performance, readability, and memory usage of recursive vs. iterative solutions. • Justify the choice of approach based on problem complexity, constraints, and clarity.	ISA, LAB, ESE
5.1 Declare, initialize, and manipulate one-dimensional and multidimensional arrays to store and process data efficiently. (P.I. – 1.3.1, 2.1.2) (CO2, CO4)	• Declare and initialize one-dimensional and multidimensional arrays using correct syntax. • Access and modify array elements through indexing in real-world problem contexts. • Perform operations such as insertion, deletion, traversal, and updates on arrays. • Write programs using arrays for computational tasks like summation, average, matrix operations, etc.	ISA, LAB, MSE, ESE
5.2 Implement string operations using standard library functions from <string.h> and construct programs that manipulate arrays of strings. ((P.I. – 2.2.3) (CO2, CO4)	• Identify and use standard string functions such as strlen(), strcpy(), strcat(), strcmp(), and strrev(). • Write programs to perform string manipulation tasks using these library functions. • Declare and work with arrays of strings (2D character arrays) effectively. • Solve real-world problems involving string processing, like sorting names or validating input.	ISA, LAB

Learning Outcomes: **The Learner will:**	**Assessment Criteria:** **The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
5.3 Define and use structures, including nested structures, to represent complex data types in C. (P.I. – 1.3.2) (CO2, CO4)	• Declare and define user-defined structures with appropriate data members. • Create and access structure variables using dot operator and pointers. • Implement nested structures to represent hierarchical or grouped data logically. • Write programs that utilize structures for storing and processing related data entities.	ISA, LAB
5.4 Create and manage arrays of structures to handle grouped data, and perform operations such as sorting, searching, and updating structure members. (P.I.-2.2.3) (CO2, CO3, CO4, CO6)	• Declare arrays of structures to manage collections of related records (e.g., student, employee). • Write functions to perform operations like insertion, deletion, search, and update on structure members. • Implement sorting algorithms (e.g., bubble sort, selection sort) on structure data based on specific fields. • Test and debug code for correctness, maintainability, and scalability when handling grouped data.	LAB, ESE
6.1 Explain the concept of pointers, including referencing, dereferencing, and the use of pointer operators. (P.I. – 1.3.2) (CO1, CO4)	• Define what pointers are and explain their significance in C programming. • Demonstrate referencing (&) and dereferencing (*) operations through simple examples. • Use pointer variables to store and manipulate memory addresses. • Explain and apply the correct usage of pointer operators in different programming contexts.	LAB, ESE

Learning Outcomes: **The Learner will:**	**Assessment Criteria:** **The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
6.2 Apply pointers for call-by-reference, and pointer arithmetic in solving programming problems. (P.I. – 2.2.3) (CO1, CO4)	• Implement functions using pointers to achieve call-by-reference and modify actual parameters. • Demonstrate pointer arithmetic (e.g., incrementing/decrementing pointers, accessing array elements) with appropriate examples. • Solve problems that require manipulation of data using pointer expressions. • Debug and validate programs involving pointer-based logic for correctness and efficiency.	ISA, LAB
6.3 Use pointers effectively with arrays, including passing arrays to functions and working with arrays of pointers. (P.I. – 1.3.4) (CO4, CO6)	• Demonstrate how to pass one-dimensional and two-dimensional arrays to functions using pointers. • Use pointer notation to access and manipulate array elements. • Implement and utilize arrays of pointers (e.g., array of strings) in C programs. • Solve problems involving dynamic data structures and memory access using pointer-array combinations.	ISA, LAB
6.4 Implement dynamic memory allocation using functions like malloc(), calloc(), realloc(), and free() to manage memory during runtime. (P.I. – 2.4.5) (CO5)	• Explain the need for dynamic memory allocation in C programming. • Use malloc(), calloc(), and realloc() to allocate memory for variables, arrays, and structures. • Apply free() to release dynamically allocated memory and prevent memory leaks. • Develop programs that demonstrate efficient memory usage and reallocation based on runtime requirements.	ISA, LAB

Learning Outcomes: **The Learner will:**	**Assessment Criteria:** **The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
6.5 Perform file operations such as creating, opening, reading, writing, updating and closing files using C standard library functions. (P.I. – 2.3.3) (CO5, CO6)	• Explain different file modes (r, w, a, r+, etc.) used in C file handling. • Use file handling functions such as fopen(), fprintf(), fscanf(), fgets(), fputs(), and fclose(). • Write programs that perform tasks like reading from and writing to text files. • Implement file operations for creating, updating, and managing data in real-world applications (e.g., student records, logs).	LAB

Tools/ Technologies/ Programming Languages learnt:

Programming Languages: C

Integrated Development Environments (IDEs): Visual Studio Code

Textbooks:

E. Balagurusamy, "Programming in ANSI C", 8th Edition, McGraw Hill Education, 2019.

Yashavant Kanetkar, "Let Us C", 17th Edition, BPB Publications, 2023.

Byron Gottfried, "Programming with C", 3rd Edition, McGraw Hill Education, 2017.

Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Prentice Hall, 1988.

Ashok N. Kamthane, "Programming in C", 3rd Edition, Pearson Education, 2015.

P.B. Mahapatra, "Thinking in C", 1st Edition, PHI Learning, 2010.

Reference Books:

Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Prentice Hall, 1988.

E. Balagurusamy, "Programming in ANSI C", 8th Edition, McGraw Hill Education, 2019.

Related/ Equivalent MOOC and Associated Certification:

1. Introduction to C Programming

Platform: NPTEL (National Programme on Technology Enhanced Learning)

Instructor: Prof. Anupam Basu, IIT Kharagpur

Link: https://nptel.ac.in/courses/106105085

- Equivalent Certification Course

2. Programming in C

Platform: SWAYAM-NPTEL

Instructor: Prof. Shriram K. Vasudevan, IIT Madras

Link: https://nptel.ac.in/courses/106105171

- Beginner-friendly, with weekly assignments and proctored exam

3. C Programming: Getting Started

Platform: edX (offered by Dartmouth College & IMT)

Link: https://www.edx.org/course/c-programming-getting-started

- Part of "C Programming with Linux" Professional Certificate

4. Introduction to Programming in C

Platform: Coursera (Duke University)

Link: https://www.coursera.org/learn/c-programming

- Hands-on certification course with beginner to intermediate content

Course Name: Effective Communication

Course Code: AEC01T and AEC01P

Vertical/ Sub-Vertical: Humanities Social Science and Management

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: Nil

Pre-requisite for: Nil

Recommended Semester: I

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
AEC01T	2	-	2	-
AEC01P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (AEC01T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (AEC01P)	25 (50%)	-	25 (50%)	50 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

This course introduces learners to the basics of Effective Communication which will equip them with the requisite soft skillset required for higher studies and placements. With focus on LSRW skills, the course considers the important foundational aspects of communication skills and English proficiency required for the workplace. It acquaints the students with modern communication tools and the basics of public speaking before an audience.

Course Objectives:

- To enable learners to gain understanding of the cyclic process, methods, channels, and barriers of communication.
- To facilitate learners in developing the skills of active listening, impactful public speaking, reading strategies, and effective writing.

- To create awareness of strengthening English proficiency for competitive exam preparation and the art of comprehension and summarization.
- To introduce strategies for creating effective presentations using modern ICT enabled tools.
- To enhance learners' summarization and comprehension skills using graphic organizers to identify key ideas, structure information, and improve retention and clarity of understanding across diverse texts.
- To equip learners with skills in digital content creation using ICT tools, infographics, and social and popular media to communicate ideas effectively and engage diverse audiences.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Use verbal/non-verbal cues at social and workplace situations by learning the basics of communication skills.	Affective Responding
CO2	Employ listening strategies to become effective listeners and powerful speakers for speaking at social, academic and business situations.	Psychomotor Perception
CO3	Improved verbal aptitude to be equipped for competitive examinations and placements.	Cognitive Application
CO4	Make effective presentations and present before an audience with confidence.	Affective Organizing
CO5	Use reading strategies for faster comprehension, summarization and evaluation of texts.	Cognitive Comprehension
CO6	Develop awareness of contemporary digital tools of communication.	Cognitive Application

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Fundamentals of Communication	***Learning Objective:*** *To enhance students' proficiency in verbal and non-verbal communication relevant to academic and professional settings. (CO1)* **Contents:** Concept, Elements and Cycle of Communication, Methods of Communication (Verbal and Nonverbal), Objectives and Channels of Communication (Formal and Informal), Barriers to Communication: Physical, Mechanical, Psychological, Semantic, Socio-cultural, Cross-cultural ***Learning Outcomes:***	10

Module No.	Module Name	Content	No. of Hours
		1.1 Learners will be able to identify and explain the key concepts, elements, and stages of the communication cycle, and apply them to analyse and improve real-life communication scenarios. (CO1) (P.I. 10.1.2, 10.2.1, 12.1.1, 12.1.2) *1.2 Learners will be able to differentiate between verbal and non-verbal methods and channels of communication, align them with specific communication objectives, and choose the most effective approach for diverse contexts. (CO1) (P.I.10.1.1, 10.2.2, 12.1.1, 12.1.2)* *1.3 Learners will be able to identify and analyse physical, mechanical, psychological, semantic, socio-cultural, and cross-cultural barriers to communication, and propose strategies to overcome them effectively. (CO1) (P.I.10.1.1, 12.1.2)*	
2	Listening & speaking	***Learning Objective:*** *To cultivate active listening, and appropriate response strategies in both academic and professional interactions. (CO2)* **Contents:** Techniques to improve Listening, Listening-exercises, Speech writing and delivery, Different types of Speeches & Tips on Public Speaking ***Learning Outcomes:*** *2.1 Learners will be able to apply effective listening techniques to enhance understanding, retention, and response in various communication contexts. (CO2) (P.I. 10.2.1, 10.2.2, 12.1.1, 12.1.2, 12.2.2)* *2.2 Learners will be able to craft clear, organized speeches and deliver them confidently using effective verbal and non-verbal communication techniques. (CO2) (P.I. 10.3.2, 10.2.1, 8.1.1, 8.4.2, 12.1.1, 12.1.2)* *2.3 Learners will be able to distinguish different types of speeches and apply key public speaking tips to deliver engaging and effective presentations. (CO2) (P.I. 10.1.3, 10.2.2, 10.3.2, 9.2.1, 9.2.2, 9.2.3, 12.1.1,12.1.2, 12.2.2)*	6
3	English Usage	***Learning Objective:*** *To equip students with strategies to perform well in verbal aptitude sections of standardized tests and engineering placement assessments. (CO3)*	4

Module No.	Module Name	Content	No. of Hours
		Contents: Vocabulary Building (Etymology, Synonyms, Antonyms, One Word Substitutes) useful for TOEFL, GRE, Grammar Proficiency Tests (Articles, Prepositions, Tenses, Punctuation), Identifying Common Errors in Writing, Grammar Checkers and Sentence Correction Tools ***Learning Outcomes:*** *3.1 Learners will be able to enhance their vocabulary through etymology, synonyms, antonyms, and one-word substitutes, while strengthening grammar proficiency in articles, prepositions, tenses, and punctuation to excel in TOEFL, GRE, and other proficiency tests. (CO3) (P.I.10.1.1, 10.1.2, 10.1.3, 12.1.1, 12.1.2, 12.3.1, 12.3.2)* *3.2 Learners will be able to identify common writing errors and effectively use grammar checkers and sentence correction tools to improve the accuracy and clarity of their written work. (CO3) (P.I. 10.1.2, 12.1.1, 12.1.2, 12.2.2)* *3.3 Learners will be able to apply grammar knowledge and utilize digital correction tools to produce clear, professional written communication essential for career success. (CO3) (P.I.10.1.2, 12.1.1, 12.1.2, 12.2.2)*	
4	Presentation Skills	***Learning Objective:*** *To build confidence and effectiveness in delivering oral presentations, including the use of visual aids and proper body language. (CO1, CO4)* **Contents:** Introduction to Presentation Skills, Creating Presentations-Content, Delivering Presentations before an audience, Using Presentation Software-Modern Presentation Tools ***Learning Outcomes:*** *4.1 Learners will be able to design well-structured presentations by effectively organizing content and applying fundamental presentation skills. (CO4) (P.I. 10.1.3, 10.3.1, 10.3.2, 5.1.1, 5.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1)* *4.2 Learners will be able to confidently deliver presentations to an audience using effective verbal and non-verbal communication techniques to engage*	4

Module No.	Module Name	Content	No. of Hours
		and inform listeners. (CO4) (P.I.9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.3, 10.2.2, 10.3.2) *4.3 Learners will be able to proficiently use modern presentation software and tools to create visually engaging and impactful presentations. (CO4) (P.I.10.1.3, 10.2.2, 10.3.1, 10.3.2, 5.1.1, 5.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1)*	
5	Comprehension And Summarization	***Learning Objective:*** *To improve the ability to quickly read, interpret, and respond to complex texts such as manuals, technical articles, and instructions. (CO5)* **Contents:** Comprehension & Reading Strategies, Graphic Organizers (Mind Maps, Flow Charts, Tree Diagrams etc.), Summarization of technical passages within specified word limit ***Learning Outcomes:*** *5.1 Learners will be able to apply effective comprehension and reading strategies to analyse, interpret, and critically evaluate various types of texts. (CO5) (P.I.10.1.1, 12.1.1, 12.1.2)* *5.2 Learners will be able to use graphic organizers like mind maps, flow charts, and tree diagrams to visually organize information and enhance understanding and retention. (CO5) (P.I.10.3.1, 12.1.1)* *5.3 Learners will be able to accurately summarize technical passages within a specified word limit, capturing key points clearly and concisely. (CO5) (P.I.10.1.1, 10.1.2, 12.1.1, 12.3.1)*	2
6	Communication Strategies for Virtual Age	***Learning Objective****: To raise awareness of secure digital communication practices, develop online content, and master the use of ICT tools in accordance with professional and ethical standards. (CO6)* **Contents:** Digital Content Creation, Infographics, ICT Tools, Social and Popular Media Self-learning topics: List of self-learning topics on communication strategies for the virtual age are: Virtual communication etiquette by watching relevant videos,	4

Module No.	Module Name	Content	No. of Hours
		writing clear digital messages by using various social media platforms ***Learning Outcomes:*** *6.1 Learners will be able to create engaging digital content and infographics using various ICT tools to effectively communicate information. (CO6) (P.I.10.3.2, 10.3.1, 12.1.1, 12.1.2, 12.2.2, 5.1.1,5.2.1, 5.2.2, 5.3.1, 5.3.2)* *6.2 Learners will be able to critically analyse and effectively use social and popular media platforms to engage audiences and communicate messages responsibly. (CO6) (P.I. 10.1.2, 10.1.3, 5.2.2, 5.3.2, 8.1.1, 8.4.2, 12.1.1, 12.1.2, 12.2.2)*	
Total			**30**

Suggested List of Practical:

Sr No.	Suggested Topic(s)
1.	Practice and Delivery of Public Speech. Document a speech, free of plagiarism. ***Learning Outcomes:*** *A learner will be able to:* *2.2 Learners will be able to craft clear, organized speeches and deliver them confidently using effective verbal and non-verbal communication techniques. (CO2) (P.I. 10.3.2, 10.2.1, 10.2.1, 8.1.1, 8.4.2, 12.1.1, 12.1.2)* *2.3 Learners will be able to distinguish different types of speeches and apply key public speaking tips to deliver engaging and effective presentations. (CO2) (P.I. 10.1.3, 10.2.2, 10.3.2, 9.2.1, 9.2.2, 9.2.3, 12.1.1,12.1.2, 12.2.2)* *3.2 Learners will be able to identify common writing errors and effectively use grammar checkers and sentence correction tools to improve the accuracy and clarity of their written work. (CO3) (P.I. 10.1.2, 12.1.1, 12.1.2, 12.2.2)* *3.3 Learners will be able to apply grammar knowledge and utilize digital correction tools to produce clear, professional written communication essential for career success. (CO3) (P.I.10.1.2, 12.1.1, 12.1.2, 12.2.2)*
2.	MOOC TCSion Course ***Learning Outcomes:*** *A learner will be able to:*

Sr No.	Suggested Topic(s)
	1.1 Learners will be able to identify and explain the key concepts, elements, and stages of the communication cycle, and apply them to analyse and improve real-life communication scenarios. (CO1) (P.I. 10.1.2, 10.2.1, 12.1.1, 12.1.2) *1.2 Learners will be able to differentiate between verbal and non-verbal methods and channels of communication, align them with specific communication objectives, and choose the most effective approach for diverse contexts. (CO1) (P.I.10.1.1, 10.2.2, 12.1.1, 12.1.2)* *1.3 Learners will be able to identify and analyse physical, mechanical, psychological, semantic, socio-cultural, and cross-cultural barriers to communication, and propose strategies to overcome them effectively. (CO1) (P.I.10.1.1, 12.1.2)* *2.1 Learners will be able to apply effective listening techniques to enhance understanding, retention, and response in various communication contexts. (CO2) (P.I. 10.2.1, 10.2.2, 12.1.1, 12.1.2, 12.2.2)* *2.2 Learners will be able to craft clear, organized speeches and deliver them confidently using effective verbal and non-verbal communication techniques. (CO2) (P.I. 10.3.2, 10.2.1, 10.2.1, 8.1.1, 8.4.2, 12.1.1, 12.1.2)* *3.3 Learners will be able to apply grammar knowledge and utilize digital correction tools to produce clear, professional written communication essential for career success. (CO3) (P.I.10.1.2, 12.1.1, 12.1.2, 12.2.2)* *4.2 Learners will be able to confidently deliver presentations to an audience using effective verbal and non-verbal communication techniques to engage and inform listeners. (CO4) (P.I.9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.3, 10.2.2, 10.3.2)* *5.4 Learners will be able to apply effective comprehension and reading strategies to analyse, interpret, and critically evaluate various types of texts. (CO5) (P.I.10.1.1, 12.1.1, 12.1.2)*
3.	Poster Making and Presentation ***Learning Outcomes:*** *A learner will be able to:* *2.3 Learners will be able to distinguish different types of speeches and apply key public speaking tips to deliver engaging and effective presentations. (CO2) (P.I. 10.1.3, 10.2.2, 10.3.2, 9.2.1, 9.2.2, 9.2.3, 12.1.1,12.1.2, 12.2.2)* *4.1 Learners will be able to design well-structured presentations by effectively organizing content and applying fundamental presentation skills. (CO4) (P.I. 10.1.3, 10.3.1, 10.3.2, 5.1.1, 5.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1)*

Sr No.	Suggested Topic(s)
	4.2 Learners will be able to confidently deliver presentations to an audience using effective verbal and non-verbal communication techniques to engage and inform listeners. (CO4) (P.I.9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.3, 10.2.2, 10.3.2) *4.3 Learners will be able to proficiently use modern presentation software and tools to create visually engaging and impactful presentations. (CO4) (P.I.10.1.3, 10.2.2, 10.3.1, 10.3.2, 5.1.1, 5.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1)*
4.	Listening Exercises ***Learning Outcomes:*** *A learner will be able to:* *2.1 Learners will be able to apply effective listening techniques to enhance understanding, retention, and response in various communication contexts. (CO2) (P.I. 10.2.1, 10.2.2, 12.1.1, 12.1.2, 12.2.2)* *2.2 Learners will be able to craft clear, organized speeches and deliver them confidently using effective verbal and non-verbal communication techniques. (CO2) (P.I. 10.3.2, 10.2.1, 10.2.1, 8.1.1, 8.4.2, 12.1.1, 12.1.2)* *2.3 Learners will be able to distinguish different types of speeches and apply key public speaking tips to deliver engaging and effective presentations. (CO2) (P.I. 10.1.3, 10.2.2, 10.3.2, 9.2.1, 9.2.2, 9.2.3, 12.1.1,12.1.2, 12.2.2)*
5.	Comprehension (Reading research paper) and Summarization ***Learning Outcomes:*** *A learner will be able to:* *5.1 Learners will be able to apply effective comprehension and reading strategies to analyse, interpret, and critically evaluate various types of texts. (CO5) (P.I.10.1.1, 12.1.1, 12.1.2)* *5.2 Learners will be able to use graphic organizers like mind maps, flow charts, and tree diagrams to visually organize information and enhance understanding and retention. (CO5) (P.I.10.3.1, 12.1.1)* *5.3 Learners will be able to accurately summarize technical passages within a specified word limit, capturing key points clearly and concisely. (CO5) (P.I.10.1.1, 10.1.2, 12.1.1, 12.3.1)*
6.	Reel/ Video/ Tabloid Making or Blog Writing or Travelogues ***Learning Outcomes:*** *A learner will be able to:* *6.1 Learners will be able to create engaging digital content and infographics using various ICT tools to effectively communicate information. (CO6) (P.I.10.3.2, 10.3.1, 12.1.1, 12.1.2, 12.2.2, 5.1.1,5.2.1, 5.2.2, 5.3.1, 5.3.2)*

Sr No.	Suggested Topic(s)
	6.2 Learners will be able to critically analyse and effectively use social and popular media platforms to engage audiences and communicate messages responsibly. (*CO6) (P.I. 10.1.2, 10.1.3, 5.2.2, 5.3.2, 8.1.1, 8.4.2, 12.1.1, 12.1.2, 12.2.2)*
7.	Extempore Speech Delivery ***Learning Outcomes:*** *A learner will be able to:* *2.2 Learners will be able to craft clear, organized speeches and deliver them confidently using effective verbal and non-verbal communication techniques. (CO2) (P.I. 10.3.2, 10.2.1, 10.2.1, 8.1.1, 8.4.2, 12.1.1, 12.1.2)* *2.3 Learners will be able to distinguish different types of speeches and apply key public speaking tips to deliver engaging and effective presentations. (CO2) (P.I. 10.1.3, 10.2.2, 10.3.2, 9.2.1, 9.2.2, 9.2.3, 12.1.1,12.1.2, 12.2.2)*
8.	Group Presentation on "Innovative Technologies related to the domains/ ICT tools" along with 2-3 Page Report ***Learning Outcomes:*** *6.1 Learners will be able to create engaging digital content and infographics using various ICT tools to effectively communicate information. (CO6) (P.I.10.3.2, 10.3.1, 12.1.1, 12.1.2, 12.2.2, 5.1.1,5.2.1, 5.2.2, 5.3.1, 5.3.2)* *6.2 Learners will be able to critically analyse and effectively use social and popular media platforms to engage audiences and communicate messages responsibly.* (*CO6) (P.I. 10.1.2, 10.1.3, 5.2.2, 5.3.2, 8.1.1, 8.4.2, 12.1.1, 12.1.2, 12.2.2)*

Performance Indicators –

P.I. 5.1.1: Understanding: Identify modern engineering tools, techniques and resources for engineering activities
P.I. 5.2.2: Applying: Create/adapt/modify/extend tools and techniques to solve engineering problems
P.I. 5.2.1: Understanding: Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.
P.I. 5.3.1: Analysing: Discuss limitations and validate tools, techniques and resources
P.I. 5.3.2: Analysing: Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use
P.I. 8.1.1: Understanding: Identify situations of unethical professional conduct and propose ethical alternatives
P.I. 8.4.2: Applying: Examine and apply moral & ethical principles to known case studies
P.I. 9.1.1: Remembering: Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
P.I. 9.1.2: Applying: Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective teamwork, to accomplish a goal
P.I.9.2.4: Understanding: Maintain composure in difficult situations
P.I. 9.3.1: Applying: Present results as a team, with smooth integration of contributions from all individual efforts

P.I. 9.2.1: Applying: Demonstrate effective communication, problem-solving, conflict resolution and leadership skills
P.I. 9.2.2: Applying: Treat other team members respectfully
P.I. 9.2.3: Applying: Listen to other members
P.I. 10.1.1: Understanding: Read, understand and interpret technical and non-technical information
P.I. 10.1.2: Applying: Produce clear, well-constructed, and well-supported written engineering documents
P.I. 10.1.3: Applying: Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
P.I. 10.2.1: Understanding: Listen to and comprehend information, instructions, and viewpoints of others
P.I. 10.2.2: Applying: Deliver effective oral presentations to technical and non-technical audiences
P.I. 10.3.1: Applying: Create engineering-standard figures, reports and drawings to complement writing and presentations
P.I. 10.3.2: Applying: Use a variety of media effectively to convey a message in a document or a presentation
P.I. 12.1.1: Understanding: Describe the rationale for the requirement for continuing professional development
P.I. 12.1.2: Understanding: Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
P.I. 12.2.2: Understanding: Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
P.I. 12.3.1: **Understanding: Source and comprehend** technical literature and other credible sources of information
P.I. 12.3.2: Analysing: Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 1.2, 1.3, 4.2, 3.3
CO2	2.1, 2.2, 2.3, 3.1, 3.3
CO3	3.1, 3.2, 3.3, 2.1, 2.2
CO4	4.1, 4.2, 4.3, 3.3, 6.1
CO5	5.1, 5.2, 5.3
CO6	6.1, 6.2, 4.3, 3.3

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1									5/26		5/26
CO2							2/26	3/26	7/26		8/26

CO	PO1	PO2	PO3	PO4	PO5	PO7	PO8	PO9	P010	PO11	PO12
CO3									5/26		10/26
CO4					4/26			21/26	10/26		
CO5									4/26		5/26
CO6					7/26		2/26		4/26		6/26

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1: Students develop proficiency in verbal and non-verbal communication relevant to academic and professional settings.	1.1 Learners will practice public speaking through Speech delivery to enhance both verbal and non-verbal communication	ISA LAB
	1.2 Learners will document the speech, free of plagiarism, using various plagiarism checkers.	ISA TH
	1.3 Learners will perform role plays to identify and analyse physical, mechanical, psychological, semantic, socio-cultural, and cross-cultural barriers to communication, and propose strategies to overcome them effectively. (Activity)	ISA LAB
LO2: Improves Listening and Speaking in both academic and professional interactions.	2.1 Learners will be able to apply effective listening techniques through various listening exercises	ISA LAB
	2.2 Learners will complete MOOC on TCSion for effective verbal and non-verbal communication techniques.	MSE
	2.3 Learners will deliver extempore public speeches by applying key public speaking tips.	ISA LAB
LO3: Equips students with strategies to perform well in verbal aptitude sections of standardized tests and engineering placement assessments.	3.1 Learners will attempt various grammar tests, in the form of comprehension exercises, thereby, strengthening grammar proficiency in articles, prepositions, tenses, and punctuation to excel in TOEFL, GRE, and other proficiency tests.	ISA TH
	3.2 Learners will read research papers and summarise them to	ESE LAB

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	improve the accuracy and clarity of their written work.	
	3.3 Learners will write Blogs/ Travelogues, etc. to apply grammar knowledge and utilize digital correction tools to produce clear, professional written communication essential for career success.	ESE LAB
LO4: Builds confidence and effectiveness in delivering oral presentations, including the use of visual aids and proper body language.	4.1 Learners will confidently deliver group presentations to an audience using effective verbal and non-verbal communication techniques to engage and inform listeners.	ISA LAB
	4.2 Learners will be able to proficiently use modern presentation software and tools to create visually engaging and impactful presentations. Various ICT tools may also be used for enhanced content delivery.	MSE
LO5: Improves the ability to quickly read, interpret, and respond to complex texts such as manuals, technical articles, and instructions.	5.1 Learners will make reports of the Presentations to improve their writing prowess.	ISA TH
	5.2 Learners will use graphic organizers like mind maps, flow charts, and tree diagrams to visually organize information from research papers.	ISA LAB
LO6: Students become aware of secure digital communication practices, develop online content, and master the use of ICT tools in accordance with professional and ethical standards.	6.1 Learners will make Posters using different ICT tools and give presentations.	ISA LAB

Textbooks:

Sr. No	Text Book Titles	Author/s	Publisher	Edition	Module Nos.
1	Communication Skills with CD	Sanjay Kumar & Pushp Lata	OUP		All
2	Business communication with writing improvement exercises	P.D. Hemphill; D.W. McCormick; R.D. Hemphill	NJ Prentice Hall		3

Sr. No	Text Book Titles	Author/s	Publisher	Edition	Module Nos.
3	Effective Business Communication	A.Kaul	Prentice Hall of India		1
4	Business Communication- Building Critical Skills	Kitty O. Locker	ManjulPublications	18th	4
5	Effective Business Communication	Herta Murphy	Mc Graw Hill	7th	4

Reference Books:

Sr. No	Reference Book Titles	Author/s	Publisher	Edition	Module Nos.
1	Mastering Communication	Nicky Stanton	Palgrave Master Series	3rd	1
2	BCOM	Lehman, Dufrene, Sinha	Cengage Learning	2nd	1,4
3	Soft Skills	K. Alex	S. Chand and Company	3rd	1,4
4	Business Communication Strategies	Monippally	Tata McGraw Hill	12th	1
6	Non Verbal Communication: The Unspoken Dialogue	J.K Burgoon, D.B Buller and W.G Woodall	McGraw Hill	3rd	1
7	Body Language	Alan Pease	Tata McGraw Hill	1st	1
8	Business Communication – Concepts, Cases and Applications	Chaturvedi and Chaturdevi	Pearson	2nd	1
9	How to Speak Fluently (Handbook)	Jones	Indian Publishing House	1st	1
10	50 ways to improve your Business English	Ken Taylor	Orient Blackswan	1st	3
11	Objective English	Thorpe and Thorpe	Pearson	2nd	2
12	Technical Writing & Professional Communication for non-native speakers of English	Thomas N. Huckin & Leslie A. Olsen	McGraw – Hill	2nd	5
14	English Vocabulary in Use	Micahel McCarthy and Felicity O'Dell	Cambridge University Press	7th	2
15	Communication in Organizations	Dalmar Fisher	Jaico Publishing House	2nd	1,6
16	Communication Skills	Meenakshi Raman & Sangeeta Sharma	Oxford University Press	1st	1
17	Business Correspondence & Report-writing	R.C. Sharma & Krishna Mohan	Tata McGraw Hill	2nd	2
18	Effective Technical Communication	Ashraf Rizvi	Tata McGraw-Hill	1st	5

Related / Equivalent MOOC and Associated Certification:

Sr. No.	MOOC Course Link	Course conducted by – Person / University / Institute / Industry	Course Duration	Certificate (Y / N)
1	https://learning.tcsionhub.in/courses/tcs-ion/introduction-to-soft-skills/ (Introduction to Soft Skills)	TCS ion	1 Week	Y
2	https://www.tcsion.com/courses/nsdc/effective_communication/ (Effective Communication) by NSDC	TCS ion	1 Week	Y

Detailed Syllabus of First Year Semester - II

Course Name: Engineering Physics

Course Code: BSC10T and BSC10P

Vertical/ Sub-Vertical:

K-S-A Mapping: Knowledge

Pre-requisite required: Nil

Pre-requisite for: PCET18T

Recommended Semester: 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
BSC10T	2	--	2	-
BSC10P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (BSC10T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (BSC10P)	25 (50%)	-	25 (50%)	50 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

Most of the engineering branches are being offspring of basic sciences where physics is playing a pivotal role in concept and understanding the foundation of core engineering branches. Physics prepares learners to apply physics to tackle 21st century engineering challenges, and to apply engineering to address 21st century questions in physics.
The course will develop the learner awareness in semiconductor devices and quantum Physics The learner will develop an informed appreciation of the paradigm shift already in evidence in technologies behind modern services and products. He will possess basic physics knowledge to pursue simulation and modelling of the semiconductor systems

Course Objectives:

• Identify and understand the fundamental physical principals underlying engineering devices and processes— a prerequisite to become successful engineers.
• To provide inclusive knowledge of fundamental physical principles encouraging engineering students to venture into the research field.
• To develop scientific temperament for scientific observations, recording, and inference drawing essential for technology studies.
• To give exposure to the topics of fundamental physics in semiconductor and Laser.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Recall fundamental definitions, laws, structures, and basic principles related to crystallography, semiconductors, engineering materials, lasers, and quantum physics.	Remember
CO2	Explain key physical concepts such as Miller indices, energy bands, carrier transport, device operation, material properties, laser mechanisms, and quantum behavior.	Understand
CO3	Apply physical laws, mathematical models, and principles to solve problems related to semiconductor behavior, device operation, material response, laser action, and quantum systems.	Apply
CO4	Analyze the interrelationship between structural, electrical, and optical properties across different devices, materials, and quantum systems to understand their behavior under various conditions.	Analyze
CO5	Evaluate the effectiveness and performance of semiconductor devices, lasers, and engineering materials for practical and futuristic applications based on physical principles.	Evaluate
CO6	Design conceptual experiments, models, or solutions that integrate crystallography, semiconductor physics, lasers, and quantum principles for engineering innovation or application.	Create

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Crystallography	***Learning Objective:*** *Recall the types of Bravais lattices, Miller indices, and identify common crystal defects in real materials.. (C01).* **Contents:** Bravais Lattice, Lattice Characteristics Miller - Indices, Planes and Directions, Interplanar spacing.	5

Module No.	Module Name	Content	No. of Hours
		Real crystals and crystal defects. ***Self-Learning Topics***: Explore unit cell calculations, coordination number, and packing efficiency in cubic systems. ***Learning Outcomes:*** *1.1: Recall the definitions of Bravais lattices and types of unit cells. (P.I. – 1.1.1 and 1.3.1) (CO1)1.2: Explain the concept of Miller indices and their use in crystallography. (P.I. – 1.2.1 and 1.3.2) (CO2)1.3: Categorize types of crystal defects and discuss their impact on materials. (P.I. – 1.2.2 and 2.1.4) (CO1, CO2)*	
2	Semiconductor Physics	***Learning Objective:*** *Explain the classification of semiconductors, band theory, and the role of Fermi energy in determining carrier concentration(CO2)* **Contents:** Band theory of solids, Classification of semiconductors. Fermi-Dirac statistics, carrier concentration in semiconductors. Concept of Fermi energy level, its position and variation with temperature and impurity concentration.. ***Self-Learning Topics****: Study intrinsic vs extrinsic semiconductor energy diagrams and temperature dependence of carrier concentration.* ***Learning Outcomes:*** *A learner will be able to:* *2.1 2.1: Describe the band theory of solids and energy band diagrams. (P.I. – 1.2.2 and 1.3.1) (CO2)* *2.2 2.2: Explain Fermi-Dirac distribution and calculate carrier concentration. (P.I. – 1.4.2 and 2.1.2) (CO2)* *2.3 2.3: Classify semiconductors using band structure. (P.I. – 1.2.2 and 2.1.4) (CO2)*	5
3	Semiconductor Conductivity	***Learning Objective:*** *Apply principles of drift, diffusion, and the Hall effect to analyze charge transport and conductivity in semiconductors.(CO3)* **Contents:** Intrinsic carrier density, mobility, and conductivity. Carrier diffusion, drift, and resistance. Electrical conduction in extrinsic semiconductor. Diffusion length and mean lifetime. Hall Effect. ***Learning Outcomes:*** *A learner will be able to:* *3.1 3.1: Calculate current density from drift and diffusion mechanisms. (P.I. – 2.3.1 and 2.4.1) (CO3)3.2: Explain and*	5

Module No.	Module Name	Content	No. of Hours
		apply the Hall effect to determine carrier concentration and type. (P.I. – 1.3.1 and 1.2.2) (CO3)3.3: Analyze the influence of mobility and lifetime on conductivity. (P.I. – 2.1.4 and 2.2.3) (CO3)	
4	Semiconductor Devices	***Learning Objective:*** *Analyze the operation of p-n junctions and associated devices using band bending and Fermi level concepts.(CO4)* **Content:** Physics of p-n junctions. Fermi level - in equilibrium, in forward and in reverse bias. Band bending in forward and reverse bias junction Introduction to two terminal devices – Rectifier diode, LED, Zener diode, PIN diode, Solar Cell, Schottky diode etc. ***Learning Outcomes:*** *A learner will be able to:* *4.1: Explain Fermi level shift and band bending under bias conditions. (P.I. – 2.1.2 and 2.2.1) (CO4)4.2: Describe the working of diodes like LED, Zener, and PIN diode. (P.I. – 1.4.2 and 2.1.2) (CO4)4.3: Analyze the current-voltage characteristics of different p-n junction devices. (P.I. – 3.1.1 and 3.2.1) (CO4)*	5
5	Engineering Materials and Applications	***Learning Objective:*** *Evaluate the properties and applications of modern engineering materials such as liquid crystals, multiferroics, and spintronics.(CO5)* **Content:** Liquid crystals: Nematic, Smectic and cholesteric phases, Liquid crystal display. Multiferroics: Type I & Type II multiferroics and applications. Magnetoresistive Oxides: Magnetoresistance, GMR and CMR materials. Introduction to spintronics. ***Learning Outcomes:*** *A learner will be able to:* *5.1: Describe various types of liquid crystals and their applications. (P.I. – 1.2.2 and 3.1.1) (CO5)5.2: Explain properties and use cases of GMR/CMR materials and multiferroics. (P.I. – 3.3.1 and 5.1.1) (CO5)5.3: Evaluate spintronic materials for futuristic engineering devices. (P.I. – 3.2.2 and 5.2.1) (CO5)*	4
6	Lasers	***Learning Objective:*** *Illustrate laser working principles and compare the structure and applications of various laser systems. (CO6)*	4

Module No.	Module Name	Content	No. of Hours
		Contents: Radiation Matter Interactions, Einstein's coefficients. Basics of Laser- Population inversion, Pumping, Optical Resonator, Metastable state etc. Laser Beam Characteristics. Laser Systems - Ruby laser, He-Ne Laser, Semiconductor Laser, Nd-YAG Laser. Engineering applications of Laser. ***Learning Outcomes:*** *A learner will be able to:* *6.1: Explain the concept of stimulated emission and population inversion. (P.I. – 1.2.2 and 2.1.2) (CO6)6.2: Describe the working of different laser systems. (P.I. – 3.1.1 and 4.3.2) (CO6)6.3: Identify engineering applications of lasers. (P.I. – 3.2.1 and 3.3.2) (CO6)*	
7	Introduction to Quantum Physics	***Learning Objective:*** *Explain the fundamental concepts of quantum mechanics including matter waves and Schrödinger's equation. (CO6)* **Contents:** De Broglie hypothesis of matter waves; properties of matter waves. Physical interpretation of wave function Introduction to Schrodinger's equations ***Learning Outcomes:*** *A learner will be able to:* *7.1: State the de Broglie hypothesis and derive the expression for matter waves. (P.I. – 1.2.1 and 2.1.2) (CO2)7.2: Explain the significance of wave function and probability density. (P.I. – 2.1.2 and 2.3.1) (CO2)7.3: Apply Schrödinger's equation to basic quantum systems. (P.I. – 2.4.1 and 2.2.3) (CO2)*	
Total			**30**

Suggested List of Practicals:

Sr. No.	Suggested Topic(s)
1.	Determination of diameter of wire/hair or thickness of paper using Wedge shape film method. ***Learning Outcome:*** *A learner will be able to:* *Apply interference concept to determine small thickness of a wedge film.CO2* *P.I-1.2.1, 2.4.1*
2.	Determination of refractive index of water using Newton's Ring.

Sr. No.	Suggested Topic(s)
	Learning Outcome: *A learner will be able to:* *Analyze Newton's rings to calculate refractive index of a liquid. CO2* *P.I.-4.1.2, 4.6.4*
3.	Study of Hall Effect. ***Learning Outcome:*** *A learner will be able to:* *Apply Hall effect principles to determine carrier type and mobility. CO1* *P.I-1.2.1, 2.4.2*
4.	Determination of energy band gap of semiconductor. ***Learning Outcome:*** *A learner will be able to:* *Calculate the band gap of a semiconductor using temperature vs current graph.CO1* *P.I-2.4.1, 2.4.4*
5.	Study of I/V characteristics of LED. ***Learning Outcome:*** *A learner will be able to:* *Analyze the electrical behavior of an LED to identify threshold voltage.CO1, CO3* *P.I.-1.3.1, 2.4.2*
6.	Determination of 'h' using Photocell. ***Learning Outcome:*** *A learner will be able to:* *Determine Planck's constant using photoelectric effect and graphical analysis.CO5* *P.I-2.4.1, 2.4.2*
7.	Study of I/ V characteristics of semiconductor diode ***Learning Outcome:*** *A learner will be able to:* *Analyze the behavior of a semiconductor diode under forward/reverse bias. CO1* *P.I-1.3.1, 2.4.2*
8.	Determination of wavelength using Diffraction grating. (Hg/Na source) ***Learning Outcome:*** *A learner will be able to:* *Calculate the wavelength of light using diffraction grating and known light sources. CO2* *P.I-1.2.1, 4.1.2*
9.	Determination of number of lines on the grating surface using LASER Source. ***Learning Outcome:*** *A learner will be able to:* *Calculate number of lines on a grating using LASER diffraction.CO3* *P.I-5.2.2*
10.	Determination of Numerical Aperture of an optical fibre. ***Learning Outcome:*** *A learner will be able to:* *Measure numerical aperture and acceptance angle of a fibre.CO4* *P.I- 1.2.1, 2.4.1*
11.	Determination of wavelength using Diffraction grating. (Laser source)

Sr. No.	Suggested Topic(s)
	Learning Outcome: *A learner will be able to:* *Determine wavelength of LASER using diffraction method. CO3* *P.I-5.2.2*
12.	Study of divergence of laser beam. ***Learning Outcome:*** *A learner will be able to:* *Analyze divergence angle of a LASER beam through experimental setup.CO3* *P.I-5.2.2*
13.	Determination of refractive index of water using Laser source. ***Learning Outcome:*** *A learner will be able to:* *Evaluate refractive index of water using angle of incidence/refraction with LASER.CO2* *P.I-4.6.2, 4.6.4*

Performance Indicators:

P.I. – 1.1.1: **Remembering** – Recall key mathematical formulas and concepts relevant to engineering problems.
P.I. – 1.2.1: **Applying** – Apply laws of natural science to an engineering problem.
P.I. – 1.2.2: **Understanding** – Describe how basic science concepts apply to material behavior and engineering systems.
P.I. – 1.3.1: **Remembering** – List fundamental engineering principles (e.g., Ohm's law, Bernoulli's equation) and their applications.
P.I. – 1.3.2: **Understanding** – Explain the relevance of basic engineering principles to real-world problems.
P.I. – 1.4.2: **Understanding** – Explain the functions of specialized engineering systems in the computer engineering domain.
P.I. – 2.1.2: **Understanding** – Explain the key features and scope of a complex engineering problem.
P.I. – 2.1.4: **Analyzing** – Decompose a complex engineering problem into its constituent parts to identify critical aspects.
P.I. – 2.2.1: **Analyzing** – Identify functionalities and computing resources for the system.
P.I. – 2.2.3: **Analyzing** – Identify existing solutions or methods to solve the problem.
P.I. – 2.3.1: **Applying** – Apply engineering principles to formulate modules of a system.
P.I. – 2.4.1: **Applying** – Apply engineering mathematics to implement the solution.
P.I. – 3.1.1: **Defining / Applying** – Define a precise problem statement with objectives and scope.
P.I. – 3.2.1: **Creating / Evaluating** – Explore design alternatives and analyze solutions.
P.I. – 3.2.2: **Creating / Evaluating** – Produce a variety of potential design solutions.
P.I. – 3.3.1: **Evaluating** – Perform systematic evaluation of design concepts.
P.I. – 3.3.2: **Evaluating / Creating** – Consult experts to select the candidate engineering design.
P.I. – 4.3.2: **Analyzing** – Analyze and interpret data for trends and correlations.
P.I. – 5.1.1: **Applying** – Use modern tools, techniques, and resources to solve engineering problems.
P.I. – 5.2.1: **Applying / Evaluating** – Select appropriate software tools for solving computational tasks.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 1.3
CO2	1.2, 2.1, 2.2, 2.3, 7.1, 7.2, 7.3
CO3	3.1, 3.2, 3.3
CO4	4.1, 4.2, 4.3
CO5	5.1, 5.2, 5.3

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	4/48	-	-	-	-	-	-	-	-	-	-
CO2	5/48	-	-	-	-	-	-	-	-	-	-
CO3	6/48	-	-	-	-	-	-	-	-	-	-
CO4	5/48	-	-	-	-	-	-	-	-	-	-
CO5	6/48	-	-	-	-	-	-	-	-	-	-
CO6	5/48	-	-	-	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1: Implement Basic Data Structures	1.1 Define and explain the purpose of basic data structures such as arrays, stacks, queues, and linked lists.	ISA, LAB,MSE, ESE
	1.2 Demonstrate the creation and initialization of basic data structures in a programming language (e.g., C++, Java, or Python).	ISA, LAB
	1.3 Perform insertion, deletion, and traversal operations on each data structure.	ISA, LAB
	1.4 Evaluate the time and space complexity for basic operations on each data structure.	ISA, MSE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	1.5 Debug and troubleshoot issues in code implementations of basic data structures.	LAB
LO2: Apply Stack and Queue Operations in Real-world Scenarios.	2.1 Implement stack operations to solve mathematical expression problems, such as Infix to Postfix conversion.	ISA, LABMSE, ESEE
	2.2 Apply queue structures in real-world scenarios such as task scheduling and buffering.	ISA, LAB
	2.3 Demonstrate the use of circular and priority queues with practical examples.	ISA, LAB
	2.4 Analyze and compare the efficiency of stack and queue implementations in different scenarios.	ISA, MSE
	2.5 Test and validate stack and queue implementations to ensure they handle edge cases correctly.	LAB
LO3: Design and Manipulate Linked Lists for Dynamic Data Management.	3.1 Design and implement various types of linked lists, including singly, doubly, and circular linked lists.	ISA, LAB, MSE
	3.2 Perform operations such as insertion, deletion, and traversal on linked lists.	ISA, LAB, MSE
	3.3 Compare linked lists with arrays in terms of memory usage and performance for different operations.	ISA, MSE, ESE
	3.4 Apply linked lists in practical applications, such as ordered lists and task management systems.	ISA, MSE, LAB
	3.5 Debug linked list implementations to ensure efficient handling of data and proper memory management.	LAB
LO4: Construct and Analyze Tree Data Structures.	4.1 Construct different types of trees, including binary trees, binary search trees, and AVL trees.	ISA, LAB, MSE, ESE
	4.2 Perform traversal operations (preorder, inorder, postorder) on binary trees.	ISA, LAB, MSE, ESE
	4.3 Implement and analyze binary search tree operations like insertion, deletion, and search.	ISA, LAB

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	4.4 Apply trees to solve real-world problems, such as expression trees and Huffman encoding.	ISA, LAB
	4.5 Evaluate the performance of balanced vs. unbalanced trees in terms of time complexity.	LAB
LO5: Implement Graph Algorithms and Hashing Techniques.	5.1 Define and implement graph representations (adjacency list, adjacency matrix) in a programming language.	ISA, LAB, MSE, ESE
	5.2 Apply graph traversal algorithms, such as Depth First Search (DFS) and Breadth First Search (BFS), to solve network-related problems.	ISA, LAB, MSE, ESE
	5.3 Implement Minimum Spanning Tree algorithms (Kruskal's and Prim's) for specific use cases.	ISA, LAB
	5.4 Design and test hash functions and apply collision resolution techniques like chaining and open addressing.	ISA, LAB
	5.5 Analyze the efficiency of different hashing techniques for data storage and retrieval.	LAB

Tools/ Technologies/ Programming Languages learnt:

- Wedge film setup
- Newton's Rings apparatus
- Diffraction grating (Hg/Na/Laser)
- Optical fiber kit
- Photocell setup
- Semiconductor devices (Diode, LED, Zener, PIN, Schottky, Solar cell)
- Laser systems (Ruby, He-Ne, Semiconductor, Nd-YAG)
- Liquid crystals and LCDs
- Multiferroics and magnetoresistive materials (GMR, CMR)
- Spintronics
- Band theory and Fermi-Dirac tools
- Hall effect setup
- Quantum models and Schrödinger equation
- Python, MATLAB, COMSOL (implied for simulation)

Textbooks:

1. John Wiley ,S.M. Sze Physics of Semiconductor Devices,
2. Prentice Hall India, B. Streetman, and S. Banerjee, Solid State Electronics,
3. Narosa 2008 R.P. Feynman, "The Feynman Lectures on Physics (Vol. 1-3)",
4. Pearson Education 2013-I.S. Tyagi, "Principles of Quantum Mechanics",

5. D.J. Griffiths," Introduction to Quantum Mechanics"
6. R Shankar, second edition Principles of Quantum Mechanics

Reference Books:

1. Lasers- Fundamentals and Applications, Ajoy Ghatak K. Thyagarajan, S-Chand, 2016
2. Solid State Physics, Neil Ashcroft (Author), N. Mermin (Author), Dan Wei (Author), Cengage Learning Asia, 2016
3. Concepts of Modern Physics, Arther Beiser, Tata McGraw Hill, 2024
4. Principles of Quantum Mechanics, R. Shankar, Springer, 2011
5. Physics of Semiconductor Devices, S M Sze, Wiley, 2024

Related/ Equivalent MOOC and Associated Certification:

1. **Fundamentals of Engineering Physics**
   Platform: SWAYAM
   Link: https://onlinecourses.swayam2.ac.in/nou24_ph01/preview
2. **Experimental Physics I**
   Platform: NPTEL
   Link: https://onlinecourses.nptel.ac.in/noc20_ph16/preview
3. **Computational Physics**
   Platform: NPTEL
   Link: https://onlinecourses.nptel.ac.in/noc19_ph16/preview
4. **Semiconductor Physics**
   Platform: Coursera (University of Colorado Boulder)
   Link: https://www.coursera.org/learn/semiconductor-physics
5. **Semiconductor Device Modeling and Simulation**
   Platform: NPTEL
   Link: https://onlinecourses.nptel.ac.in/noc24_ee27/preview

Course Name: Engineering Mathematics-II (EXCS/EXTC/ BIOM)

Course Code: BSC14

Vertical/ Sub-Vertical: BSES_BSC

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: BSC12 (Engineering Mathematics-I)

Pre-requisite for: BSC06 (Engineering Mathematics-III), and higher-level mathematical courses.

Recommended Semester: II

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
BSC04	3	-	3	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	20 (~20%)	30 (~30%)	50 (~50%)	100 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

This course introduces fundamental concepts of matrices, differential equations, and multiple integrals, focusing on analytical and computational techniques for solving engineering problems. It emphasizes the application of mathematical methods to real-world situations and the development of problem-solving skills.

Course Objectives:

- Understand and compute eigenvalues and eigenvectors and apply their properties in matrix analysis.
- Apply the Cayley-Hamilton theorem for matrix computations, including diagonalization and evaluation of matrix functions.
- Solve first-order and higher-order differential equations using appropriate analytical methods.
- Evaluate double and triple integrals using suitable coordinate systems and apply them to compute area and volume in practical problems.

Course Outcomes:

Learner will be able to:

Course Outcomes	Course Outcome Statement	Bloom's Level
CO1	Recall fundamental concepts of matrices, differential equations, and multiple integrals.	Remember
CO2	Explain mathematical principles such as eigenvalue properties, matrix transformations, solution methods of differential equations, and	Understand

	coordinate transformations in integration.	
CO3	Apply appropriate techniques to solve problems involving matrices, differential equations, and evaluation of multiple integrals.	Apply
CO4	Analyze mathematical problems to select suitable methods and interpret results in the context of engineering applications.	Analyze

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours	CO's Mapped
1	Advanced Matrices	**Contents:** Characteristic equation, Eigen values and Eigen vectors, Properties of Eigen values and Eigen vectors. **Learning Objective:** To introduce the concept of eigenvalues and eigenvectors and develop the ability to compute and interpret them in different contexts. (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 1.1 Recall the definition of characteristic equation, eigenvalues, and eigenvectors (CO1) 1.2 Explain the properties of eigenvalues and eigen vectors in matrix computations (CO2) 1.3 Compute eigen values and eigen vectors of matrix (CO3) 1.4 Analyze matrices by interpreting the properties of eigenvalues and eigenvectors in different contexts. (CO4) **Self-Learning Topics**: Applications of Eigenvalues and Eigenvectors; Symmetric and Skew-Symmetric Matrices.	7	
2	Matrix Transformations & Applications	**Contents:** Cayley-Hamilton theorem (without proof), examples based on verification of Cayley-Hamilton theorem. Similarity of matrices, Diagonalisation of matrices. Functions of square matrix. Singular Value Decomposition. **Learning Objective:** To enable learners to apply the Cayley-Hamilton theorem in matrix computations, including functions of matrices, diagonalization, and similarity transformations. (CO1 to CO4)	7	

		Learning Outcomes: A learner will be able to: 2.1 Recall the Cayley Hamilton theorem and related matrix concepts. (CO1) 2.2 Explain the concepts of similarity of matrices, diagonalization, matrix functions, and the fundamentals of Singular Value Decomposition. (CO2) 2.3 Apply the Cayley–Hamilton theorem to verify matrix equations, compute functions of matrices, perform diagonalization, and determine Singular Value Decomposition of matrices. (CO3) 2.4 Analyze matrices by interpreting similarity, diagonalization, matrix functions, and Singular Value Decomposition in various computational and application-based contexts. (CO4) **Self-Learning Topics**: Derogatory and Non-Derogatory Matrices; Applications of Singular Value Decomposition.		
3	Differential Equations of first order and first degree	**Contents:** Exact Differential Equations, Equations reducible to exact form by integrating factors, Linear Differential Equations, Equations reducible to Linear Differential Equations, Bernoulli's Equation. **Learning Objective:** To understand methods for solving first-order differential equations, including exact, linear, and Bernoulli forms, and to apply appropriate techniques such as integrating factors to obtain solutions. (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 3.1 Recall definitions of exact differential equations, linear differential equations, and Bernoulli's equation. (CO1) 3.2 Explain the concept of integrating factors and conditions for exactness and linearity. (CO2) 3.3 Apply suitable methods to solve exact equations, equations reducible to exact form, linear and Bernoulli differential equations. (CO3)	8	

		3.4 Analyze differential equations by identifying appropriate solution methods and transforming them into solvable forms. (CO4) **Self-Learning Topics**: Orthogonal Trajectories; Applications of First-Order Differential Equations.		
4	Higher Order Differential Equations	**Contents:** Linear Differential Equation with constant coefficient- Complementary Function and Particular Integral of Differential Equations of the type f(D)y=X, where X is e^{ax}, sin(ax+b), cos(ax+b), x^m (m is positive integer), $e^{ax}V$, xV *or* X, Method of Variation of Parameters. **Learning Objective:** To develop the ability to solve higher-order linear differential equations with constant coefficients using methods such as complementary function, particular integral, and variation of parameters (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 4.1 Recall the concepts of auxiliary equation, complementary function, and particular integral. (CO1) 4.2 Understand the formation of solutions for differential equations of the type f(D)y = X for standard functions. (CO2) 4.3 Apply appropriate methods to compute complementary function and particular integral for given differential equations. (CO3) 4.4 Analyze and select suitable techniques, including variation of parameters, for solving complex differential equations. (CO4) **Self-Learning Topics**: Applications of Homogeneous and Higher-Order Differential Equations in Engineering.	8	
5	Multiple Integration-I	**Contents:** Evaluation of double integrals, evaluation of double integrals by changing the order of integration, double integrals in cartesian and polar forms, evaluation of area using double integration over specified regions. **Learning Objective:**	8	

		To develop the ability to evaluate double integrals in Cartesian and polar coordinates and apply them to compute integrals over specified regions. (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 5.1 Recall the definition and basic properties of double integrals. (CO1) 5.2 Understand the transformation between Cartesian and polar coordinates for double integration. (CO2) 5.3 Apply methods to evaluate double integrals over given regions in Cartesian and polar forms. (CO3) 5.4 Analyze regions of integration and select appropriate coordinate systems for efficient evaluation. (CO4) **Self-Learning Topics:** Double Integrals in Engineering applications; Change of Variables in Double Integrals applications.		
6	Multiple Integration-II	**Contents:** Evaluation of triple integration, evaluation of triple integral by changing to polar coordinates, evaluation of triple integration by changing to cylindrical and spherical coordinates and applying to real-world regions. **Learning Objective:** To develop the ability to evaluate multiple integrals using appropriate coordinate transformations and apply them to compute areas and volumes of real-world regions. (CO1 to CO4) **Learning Outcomes:** A learner will be able to: 6.1 Recall formulas and coordinate systems for triple integrals. (CO1) 6.2 Understand the need for coordinate transformations such as polar, cylindrical, and spherical systems. (CO2) 6.3 Apply integration techniques to evaluate triple integrals in different coordinate systems. (CO3) 6.4 Analyze regions and select suitable coordinate systems to efficiently compute volume of practical domains. (CO4)	7	

		Self-Learning Topics: Triple Integrals applications in engineering computation; Coordinate transformations in Multiple Integrals using Jacobian.		
Total			45	

Performance Indicators:

P.I.–1.1.1: Applying, Understanding: Apply knowledge of discrete structures, linear algebra, statistics, and numerical techniques.
P.I.–1.1.2: Applying, Understanding: Apply concepts of probability, statistics, and queuing theory in modeling.
P.I.–1.2.1: Applying: Apply laws of natural science to an engineering problem.
P.I.–1.3.1: Applying: Apply engineering fundamentals to solve engineering problems.
P.I.–1.4.1: Applying: Apply theory and principles of computer science and engineering to solve engineering problems.
P.I.–2.1.1: Analyzing: Evaluate problem statements and identify objectives.
P.I.–2.1.2: Analyzing: Identify processes, modules, and algorithms of a system and parameters to solve the problem.
P.I.–2.2.1: Analyzing, Applying: Reframe the computer-based system into interconnected subsystems.
P.I.–2.2.2: Analyzing: Identify functionalities and computing resources for the system.
P.I.–2.2.3: Analyzing: Identify existing solutions or methods to solve the problem, including justified approximations.
P.I.–2.3.1: Applying: Apply engineering principles to formulate modules of a system.
P.I.–2.4.1: Applying: Apply engineering mathematics to implement the solution.
P.I.–3.1.1: Defining, Applying: Define a precise problem statement with objectives and scope.
P.I.–3.1.2: Defining: Identify and document system requirements from stakeholders.
P.I.–3.1.3: Evaluating: Review state-of-the-art literature to synthesize system requirements.
P.I.–3.1.4: Evaluating: Choose appropriate quality attributes as defined by ISO/IEC/IEEE standards.
P.I.–3.1.5: Analyzing, Evaluating: Synthesize requirements from larger social and professional concerns.
P.I.–3.2.1: Creating, Evaluating: Explore design alternatives and analyze solutions.
P.I.–3.2.2: Creating, Evaluating: Produce a variety of potential design solutions to meet functional requirements.
P.I.–3.3.1: Evaluating: Perform systematic evaluation of design concepts based on criteria.
P.I.–3.3.2: Evaluating, Creating: Consult with domain experts to select the candidate engineering design for further development.
P.I.–3.4.1: Applying, Evaluating: Refine architecture design into a detailed design within the existing constraints.
P.I.–3.4.2: Applying, Creating: Implement and integrate modules into the design.
P.I.–3.4.3: Evaluating, Applying: Verify functionalities and validate the design.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 2.1, 3.1, 4.1, and 5.1
CO2	1.2, 2.2, 3.2, 4.2, 5.2 and 6.2
CO3	1.3, 2.3, 3.3, 4.3, 5.3, and 6.3

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	5/17	-	-	-	-	-	-	-	-	-	-
CO2	4/17	2/17	-	-	-	-	-	-	-	-	-
CO3	-	6/17	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1 Recall Exact differential Equations (P.I.- 1.1.1) (CO1)	• Identify the general form of an exact differential equation. • Determine whether a given first-order equation is exact. • Recall and state conditions for exactness and the integration method.	MSE ISA ESE
LO 1.2 Explain Reducible to Exact differential Equations and Linear Differential Equation (P.I.- 1.1.1) (CO2)	• Distinguish between exact and non-exact equations with integrating factors. • Explain the method to convert an equation into exact form using integrating factors. • Discuss linear first-order differential equations and their solving approach.	MSE ISA ESE
LO 1.3 Explain Reducible to Linear differential Equations and Bernoulli's Differential Equation (P.I.- 2.4.1) (CO3)	• Interpret the form of equations reducible to linear type. • Rewrite and solve Bernoulli's equations by reducing to linear form. • Analyze the transformation steps applied to solve non-linear DEs.	MSE ESE ISA

LO 2.1: Recall definition of Linear Differential Equation with constant coefficient (P.I.- 1.1.1) (CO1)	• Recognize standard forms of linear differential equations with constant coefficients. • State the structure of complementary functions for homogeneous equations.	MSE ISA ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	• Recall methods for solving f(D)y = X type equations.	
LO 2.2: Explain complementary function, particular integrals of differential equation of various types (P.I.- 1.1.1) (CO2)	• Explain how to find the complementary function based on the auxiliary equation. • Describe the process of selecting appropriate methods for particular integrals. • Classify and solve differential equations based on the form of RHS functions.	MSE ISA ESE
LO 2.3: Apply Method of variation of parameters (P.I.- 2.4.1) (CO3)	• Implement variation of parameters method for second-order differential equations. • Select appropriate particular integrals using variation of parameters when the RHS is non-standard. • Solve engineering-related problems requiring non-constant coefficient ODEs.	MSE ISA ESE
LO 3.1: Recall properties of Beta and Gamma functions. (P.I.- 1.1.1) (CO1)	• Recall definitions and standard identities of Beta and Gamma functions. • Recognize integral representations and interrelationships between Beta and Gamma functions. • Identify the domain and convergence properties of these functions.	MSE ISA ISA ESE
LO 3.2: Explain DUIS Technique. (P.I.- 2.4.1) (CO2)	• Describe the DUIS technique and its applicability. • Interpret integrals involving parameters and explain constant limit behavior. • Justify the simplification process using DUIS in complex integrals.	MSE ISA ESE
LO 3.3: Apply Beta and Gamma to solve improper integrals. (P.I.- 2.4.1) (CO3)	• Transform a given integral into Beta or Gamma standard form. • Evaluate improper integrals using known Beta/Gamma properties. • Justify the method selected based on convergence and problem structure.	MSE ISA ESE

LO 4.1: Recall Double integration concepts. (P.I.- 1.1.1) (CO1)	• Identify the double integration setup over rectangular and general regions. • Recall formulas for evaluating integrals in Cartesian and polar forms. • Describe the geometrical interpretation of double integrals.	MSE ISA ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 4.2: Explain the conversion between cartesian and polar coordinates. (P.I.- 1.1.1) (CO2)	• Explain the substitution process for x and y in terms of r and θ. • Describe when conversion is preferred for simplifying region boundaries. • Convert limits and functions appropriately from Cartesian to polar form.	MSE ISA ISA, ESE
LO 4.3: Apply Double Integration to change the order of integration. (P.I.- 2.4.1) (CO3)	• Identify when changing the order of integration benefits evaluation. • Rearrange the limits of integration correctly and evaluate accordingly. • Apply the new order to simplify and solve double integrals over non-rectangular regions.	MSE ISA ISA ESE
LO 5.1: Understand about an Integral about when to change to polar form. (P.I.- 1.1.1) (CO2)	• Recognize integrals where polar form offers simplification (e.g., radial symmetry). • Interpret bounded regions that suit conversion to polar form. • Justify and apply transformation in practical engineering problems.	MSE ISA ESE
LO 5.2: Evaluate the double integral to compute area and triple integral using polar form (P.I.- 2.4.1) (CO3)	• Set up and solve double integrals to compute area using polar coordinates. • Extend integration to triple integrals in cylindrical or spherical coordinates. • Evaluate volume or mass using transformed integration techniques.	MSE ISA ESE
LO 6.1: Recall formulae of Euler's method and Runge-Kutta fourth order method. (P.I.- 1.1.1) (CO1)	• Recall the general algorithm and recursive formula for Euler's method. • State the stages involved in the Runge-Kutta 4th order method. • Identify initial conditions and step sizes needed for implementation.	MSE ISA ESE
LO 6.2: Explain Euler's method and Runge-Kutta fourth order method. (P.I.- 2.1.1) (CO2)	• Explain the difference in accuracy between Euler's and Runge-Kutta methods. • Justify the preference of Runge-Kutta for non-linear DEs. • Describe the local and global error behavior of each method.	MSE ISA ESE

LO 6.3: Apply Numerical solution of ordinary differential equation methods (P.I.- 2.4.1) (CO3)	• Use Euler's and RK-4 methods to approximate solutions to DEs. • Solve step-by-step with proper iterations and rounding. • Apply numerical methods to model real-life systems like circuits or decay processes.	MSE ISA ESE

Tools/ Technologies/ Programming Languages learnt:



- Python
- MATLAB
- MS Excel
- Desmos
- Scientific Calculator

Textbooks:

1. Ramana B.V.," Higher Engineering Mathematics",12th edition, Tata MCGraw Hill,2017

Reference Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th ed. New Delhi, India: Khanna Publishers, 2018.
2. E. Kreyszig, Advanced Engineering Mathematics, 10th ed. Hoboken, NJ, USA: John Wiley & Sons, 2011.
3. H. K. Dass, Advanced Engineering Mathematics, New Delhi, India: S. Chand Publishing, 2014.
4. J. Stewart, Calculus, 8th ed. Boston, MA, USA: Cengage Learning, 2015.
5. K. A. Stroud, Engineering Mathematics, 7th ed. London, UK: Palgrave Macmillan, 2013
6. D. C. Lay, Linear Algebra and Its Applications, 5th ed. Boston, MA, USA: Pearson, 2016.
7. G. Strang, Introduction to Linear Algebra, 5th ed. Wellesley, MA, USA: Wellesley-Cambridge Press, 2016.
8. H. Anton and C. Rorres, Elementary Linear Algebra, 11th ed. Hoboken, NJ, USA: Wiley, 2014.
9. D. G. Zill, A First Course in Differential Equations, 10th ed. Boston, MA, USA: Cengage Learning, 2013.
10. T. M. Apostol, Calculus, Vol. 2, 2nd ed. New York, NY, USA: John Wiley & Sons, 1969.

Online Reference Material:

1. NPTEL, Linear Algebra Course (Eigenvalues, Eigenvectors, Applications). [Online].
   Available: https://nptel.ac.in/courses/111106111
2. MIT OpenCourseWare, Mathematics Courses (Linear Algebra, Calculus, Differential Equations). [Online].
   Available: https://ocw.mit.edu

3. Khan Academy, Engineering Mathematics Video Lectures (Algebra, Calculus, Differential Equations). [Online].
Available: https://www.khanacademy.org
4. Paul Dawkins, Paul's Online Math Notes (Calculus and Differential Equations). Lamar University. [Online].
Available: https://tutorial.math.lamar.edu
5. Coursera, Online Courses on Engineering Mathematics and Linear Algebra. [Online].
Available: https://www.coursera.org

Course Name: Engineering Graphics

Course Code: ESC01T & ESC01P

Vertical/ Sub-Vertical: Engineering Science Courses

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Nil

Pre-requisite for: Nil

Recommended Semester: 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ESC01T	2	-	2	-
ESC01P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (ESC01T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (ESC01P)	25 (50%)	-	25 (50%)	50 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

To improve the visualization skills of the learners, with imparting the learner's ability to read a drawing. This course also imparts and inculcates learners to understand the theory of projection.

Course Objectives:

- To understand the concepts of the Engineering Graphics.
- To know how to use drawing instruments for drafting and dimensioning.
- To understand visualisation technic and skills of Engineering Graphics.
- To know the Construction of 3D object.

- To introduce the tools of Computer Aided drafting (CAD).

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Understand conventional method and usage of CAD software.	Understanding
CO2	Apply the basic principles of projections and visualization to communicate ideas graphically.	Applying
CO3	Construct the drawing of curves, points, straight lines, and planes using concept of projections.	Analysing
CO4	Interpret the three-dimensional pictorial objects and represent in two-dimensional views.	Evaluating
CO5	Construct three dimensional shapes from two dimensional views using the concept of projections.	Evaluating

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Engineering Graphics and CAD	***Learning Objective:*** Introduce the fundamentals of engineering graphics and CAD tools essential for technical drawing and visualization. (CO1) **Contents:** Introduction and importance of engineering graphics. Introduction of different types of the quadrants, method of projection, lines and dimensioning. Drawing instruments and their usage. Introduction Computer Aided Design and Drafting (CADD or CAD) software and operations, menu system and toolbars. ***Self-Learning Topics***: *Basic Geometry and Constructions of lines and shapes.* ***Learning Outcomes:*** *A learner will be able to:*	3

Module No.	Module Name	Content	No. of Hours
		1. *Identify the importance of engineering graphics in technical communication. (PI-1.1.2) (CO1)* 2. *Explain the types of quadrants and methods of projection used in engineering drawings. (PI-1.2.2) (CO1)* 3. *Demonstrate the use of drawing instruments and perform basic dimensioning and line work. (PI-1.3.1) (CO1)* 4. *Navigate CAD software interface, menu systems, and toolbars to create basic drawings. (PI-1.4.2) (CO1)*	
2	Engineering Curve	***Learning Objective:*** Develop the ability to construct engineering curves like cycloids, involutes, and helices using standard geometric methods. *(CO3)* **Contents:** Basic construction of cycloid, involutes, and helix of cylinder. ***Self-Learning Topics****: NIL* ***Learning Outcomes:*** *A learner will be able to:* 1. Construct the path of a cycloid using basic geometric techniques. (*PI-3.1.1*) *(CO3)* 2. Draw the involute of a circle and apply it in mechanical contexts such as gear tooth profiles. (*PI-3.1.2*) *(CO3)* 3. Generate the helix of a cylinder and interpret its application in threaded components. (*PI-3.1.3*)*(CO3)*	4
3	Projection of Points & lines	***Learning Objective:*** Apply projection techniques to represent lines inclined to both horizontal and vertical planes using the first angle projection method. *(CO2, CO3)*	4

Module No.	Module Name	Content	No. of Hours
		Contents: Projections of lines, inclined to both the reference planes HP and VP as per the first angle projection method. ***Learning Outcomes:*** *A learner will be able to:* 1. Interpret the concept of reference planes and first angle projection system. (*PI-2.1.2*) *(CO2)* 2. Construct projections of lines inclined to both HP and VP using graphical methods. (*PI-3.1.4*) *(CO3)* 3. Analyse the true length and true inclinations of lines from given projections. (*PI-3.1.5*) *(CO3)*	
4	Projection of Planes	***Learning Objective:*** Construct and interpret the projections of various geometric planes inclined to both HP and VP using the first angle projection method. *(CO2, CO3).* **Content:** Projection of rectangular, triangular, square, pentagonal, hexagonal, and circular planes, inclined to both the reference planes HP and VP as per the first angle projection method. ***Learning Outcomes:*** *A learner will be able to:* 4. Identify different types of planes (rectangular, triangular, polygonal, and circular) and their positions with respect to reference planes. (*PI-2.2.3*)*(CO2)* 5. Construct accurate projections of inclined planes using the first angle projection method. (*PI-3.1.6*)*(CO3)*	4

Module No.	Module Name	Content	No. of Hours
		6. Analyze the orientation and true shape of inclined planes through graphical representation. (*PI-3.1.7*)*(CO3)*	
5	Orthographic Projections	***Learning Objective:*** Develop skills to create orthographic and sectional views of machine parts using manual and CAD methods with appropriate dimensions and annotations. *(CO1, CO4).* **Content:** Drawing orthographic views from pictorial projections. Sectional orthographic Projections of a simple machine part as per the first angle projection method. - By drafting in the sketchbook as well as on CAD software. CAD Drawing: Applying dimensions to objects, applying annotations to drawings, setting up and use of layers, changing of the line properties, Printing setup and procedure. Different CAD Tools and usage- Draw tools, modify tools, properties, copy selection, dimensioning and editing (text height and arrow size). ***Learning Outcomes:*** *A learner will be able to:* 1. Interpret pictorial views and convert them into accurate orthographic projections using the first angle method. (*PI-4.1.1*)*(CO4)* 2. Generate sectional orthographic views of simple machine components using sketchbook and CAD software. (*PI-4.1.2*)*(CO4)* 3. Use CAD tools to apply dimensions, annotations, layers, and line properties effectively. (*PI-1.5.1*)*(CO1)*	8

Module No.	Module Name	Content	No. of Hours
		4. Demonstrate CAD operations such as drawing, modifying, copying, dimensioning, and printing a technical drawing. (*PI-1.6.1*)*(CO1)*	
6	Isometric Views	***Learning Objective:*** Construct isometric views of blocks with planar and cylindrical features using manual and CAD drafting techniques. *(CO1, CO5).* **Contents:** Drawing Isometric views from given views of simple blocks with plane, cylindrical surfaces, and circular holes. - By drafting in the sketchbook as well as on CAD software CAD Drawing: Switching to isometric drafting mode, switch /change to different ISO planes, ISO circles on different ISO planes, Different CAD Tools and usage- Draw tools, Modify tools, Properties of line. ***Learning Outcomes:*** *A learner will be able to:* 1. Convert orthographic views into isometric drawings of objects with planar, cylindrical surfaces, and circular holes. (*PI-5.1.1*)*(CO5)* 2. Create isometric drawings manually and by using CAD tools, including switching ISO planes and drawing ISO circles. (*PI-5.1.2*)*(CO5)* 3. Apply CAD features like draw tools, modify tools, and line properties to complete accurate isometric projections. (*PI-1.7.1*) *(CO1)*	7
Total			**30**

Suggested List of Practical:

Sr No.	Suggested Topic(s)
1.	Introduction and practice of AutoCAD software ***Learning Outcomes:*** *A learner will be able to:* 1. *Navigate CAD software interface, menu systems, and toolbars to create basic drawings. (P.I. – 1.4.2) (CO1)*
2.	Drawing of Water Tap ***Learning Outcomes:*** *A learner will be able to:* 1. *Use CAD tools to apply dimensions, annotations, layers, and line properties effectively. (P.I. – 1.5.1) (CO1).*
3.	Orthographic Projection ***Learning Outcomes:*** *A learner will be able to:* 1. *Interpret pictorial views and convert them into accurate orthographic projections using the first angle method. (P.I. – 4.1.1) (CO4).*
4.	Isometric Projection ***Learning Outcomes:*** *A learner will be able to:* 1. *Convert orthographic views into isometric drawings of objects with planar, cylindrical surfaces, and circular holes. (P.I. - 5.1.1) (CO5)*
5.	Floor Plan ***Learning Outcomes:*** *A learner will be able to:* 1. *Demonstrate CAD operations such as drawing, modifying, copying, dimensioning, and printing a technical drawing. (P.I. – 1.6.1) (CO1)*
6.	2D Views of Car/Vehicle

	Learning Outcomes: *A learner will be able to:* 1. *Interpret pictorial views and convert them into accurate orthographic projections using the first angle method. (P.I. - 4.1.1) (CO4)*

Performance Indicators:

P.I.- 1.1.2: **Remembering**: Identify the importance of engineering graphics in technical communication.

P.I.- 1.2.2: **Understanding**: Explain the types of quadrants and methods of projection used in engineering drawings.

P.I.- 1.3.1: **Applying**: Demonstrate the use of drawing instruments and perform basic dimensioning and line work.

P.I.- 1.4.2: **Applying**: Navigate CAD software interface, menu systems, and toolbars to create basic drawings.

P.I.- 1.5.1: **Applying**: Use CAD tools to apply dimensions, annotations, layers, and line properties effectively.

P.I.- 1.6.1: **Applying**: Demonstrate CAD operations such as drawing, modifying, copying, dimensioning, and printing a technical drawing.

P.I.- 1.7.1: **Applying**: Apply CAD features like draw tools, modify tools, and line properties to complete accurate isometric projections.

P.I.- 2.1.2: **Understanding**: Interpret the concept of reference planes and first angle projection system.

P.I.- 2.2.3: **Understanding**: Identify different types of planes (rectangular, triangular, polygonal, and circular) and their positions with respect to reference planes.

P.I.- 3.1.1: **Applying**: Construct the path of a cycloid using basic geometric techniques.

P.I.- 3.1.2: **Applying**: Draw the involute of a circle and apply it in mechanical contexts such as gear tooth profiles.

P.I.- 3.1.3: **Applying**: Generate the helix of a cylinder and interpret its application in threaded components.

P.I.- 3.1.4: **Applying**: Construct projections of lines inclined to both HP and VP using graphical methods.

P.I.- 3.1.5: **Analyzing**: Analyze the true length and true inclinations of lines from given projections.

P.I.- 3.1.6: **Applying**: Construct accurate projections of inclined planes using the first angle projection method.

P.I.- 3.1.7: **Analyzing**: Analyze the orientation and true shape of inclined planes through graphical representation.

P.I.- 4.1.1: **Applying**: Interpret pictorial views and convert them into accurate orthographic projections using the first angle method.

P.I.- 4.1.2: **Applying**: Generate sectional orthographic views of simple machine components using sketchbook and CAD software.

P.I.- 5.1.1: **Applying**: Convert orthographic views into isometric drawings of objects with planar, cylindrical surfaces, and circular holes.

P.I.- 5.1.2: **Applying**: Create isometric drawings manually and by using CAD tools, including switching ISO planes and drawing ISO circles.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 1.2, 1.3, 1.4, 5.3, 5.4, 6.3
CO2	3.1, 4.1
CO3	2.1, 2.2, 2.3, 3.2, 3.3, 4.2, 4.3
CO4	5.1, 5.2
CO5	6.1, 6.2

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	7/21	-	-	-	-	-	-	-	-	-	-
CO2	2/21	-	-	-	-	-	-	-	-	-	-
CO3	-	7/21	-	-	-	-	-	-	-	-	-
CO4	-	-	2/21	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3/21	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: Identify the importance of engineering graphics in technical	• Define engineering graphics and its purpose in communication.	ISA, MSE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
communication. (P.I.- 1.1.2) (CO1)	• Explain real-world applications of engineering drawings. • List the industries where engineering graphics is used.	
LO 1.4: Navigate CAD software interface, menu systems, and toolbars. (P.I.- 1.4.2) (CO1)	• Open and operate basic CAD interface elements. • Locate and use standard menu tools. • Demonstrate drawing a simple figure using toolbar.	ISA, LAB
LO 2.2: Draw the involute of a circle and apply it in mechanical contexts. (P.I.- 3.1.2) (CO3)	• Sketch an accurate involute of a circle. • Label tangent development method correctly. • Explain real-life application of involute in gears.	ISA, MSE
LO3.2: Construct projections of lines inclined to both HP and VP. (P.I.- 3.1.4) (CO3)	• Identify correct projection reference planes. • Draw projections of a line using correct angles. • Demonstrate true length and inclination.	MSE, ESE
LO 4.1: Identify types of planes and their positions w.r.t. reference planes. (P.I.- 2.2.3) (CO2)	• Classify plane surfaces by shape. • Distinguish between different plane positions. • Draw examples with proper quadrant placement.	ISA, MSE
LO 5.1: Convert pictorial views into orthographic projections. (P.I.- 4.1.1) (CO4)	• Visualize and draw 3 main views (top, front, side). • Maintain scale and proportion. • Label views correctly.	LAB, ESE
LO 6.1: Convert orthographic views into isometric drawings. (P.I.- 5.1.1) (CO5)	• Identify object orientation from 2D views. • Draw an isometric view with correct dimensions. • Use CAD software or sketching tools appropriately.	LAB, ISA, ESE

Tools / Technologies / Software Learnt:

- **CAD Software:** AutoCAD, DraftSight, LibreCAD
- **2D & 3D Drawing Tools:** AutoCAD Isometric Drafting, Orthographic Projection Tools
- **Annotation & Dimensioning Tools:** Dimensioning Toolbars, Text & Leader Tools, Hatch & Section tools
- **Layer and Property Management:** Layer Manager, Lineweight, Linetype Control, Object Properties
- **CAD File Operations:** Plotting & Printing Tools, DWG File Handling, Template Usage
- **Visualization Tools:** Isometric Grid, UCS (User Coordinate System), View Controls
- **Simulation & Practice Platforms (if applicable):** TinkerCAD, Fusion 360 (for extended practice)
- **Learning Platforms:** Autodesk Education Community, LinkedIn Learning – AutoCAD tutorials, NPTEL CAD Video Lectures

Textbooks:

1. N.D. Bhatt, *"Engineering Drawing"*, 53rd Edition, Charotar Publishing House, 2016.
2. P.S. Gill, *"Engineering Drawing"*, 17th Edition, S.K. Kataria & Sons, 2019.

Reference Books:

1. K. Venugopal, V. Prabhu Raja, *"Engineering Drawing + AutoCAD"*, 5th Edition, New Age International Publishers, 2020.
2. Dhananjay A. Jolhe, *"Engineering Drawing with an Introduction to AutoCAD"*, 3rd Edition, Tata McGraw-Hill Education, 2017.
3. M.B. Shah & B.C. Rana, *"Engineering Drawing"*, 2nd Edition, Pearson Education, 2009.

Related / Equivalent MOOC and Associated Certification:

1. **Engineering Drawing and Computer Graphics** – Equivalent Certification Course
   • **Platform:** NPTEL (National Programme on Technology Enhanced Learning)
   • **Link:** https://nptel.ac.in/courses/112103019
2. **Engineering Graphics Essentials with AutoCAD** – Skill-based Certification Course
   • **Platform:** Udemy
   • **Link:** https://www.udemy.com/course/autocad-engineering-graphics/
3. **Technical Drawing and Engineering Design** – Related Course
   • **Platform:** Coursera (offered by Moscow Institute of Physics and Technology)
   • **Link:** https://www.coursera.org/learn/technical-drawing

4. **AutoCAD for Design and Drafting** – Autodesk Certified Path
   - **Platform:** Autodesk Learning Hub
   - **Link:** https://academy.autodesk.com/course/115297/introduction-autocad

Course Name: Logic Circuits

Course Code: ESC07T & ESC07P

Vertical/ Sub-Vertical: Engineering Science Courses

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Nil

Pre-requisite for: PCET18T, PEEC38T

Recommended Semester: 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ESC07T	2	-	2	-
ESC07P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (ESC07T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (ESC07P)	25 (50%)	-	25 (50%)	50 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

This course introduces learners to the understanding of fundamental of Number systems, basic analog digital circuits like diode, BJT, Gates etc. and their applications. It also gives the insights of Boolean algebra. It will motivate the learners to design combinational logic circuits and demonstrates them during practical.

Course Objectives:

- To understand various Number Systems and their conversion.
- To understand and implement various combinational logic circuits.
- To understand and implement various sequential logic circuits.
- To understand various types of memory and their characteristics.
- To learn the concept of programmable logic devices and their use in implementation of logic circuit.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Understand the various Number systems, logic families, various Gates, Boolean algebra, combinational circuits, sequential circuits, types of memories and programmable logic devices	Remembering
CO2	Convert numbers among various number systems, simplify logical expressions, explain different types of memories and programmable logic devices	Understanding
CO3	Implement logical and mathematical expressions using logic Gates combinational circuits and sequential circuits	Applying
CO4	Analyse and design logical, mathematical functions using combinational circuits and sequential circuits	Analysing

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Number Systems and Codes	***Learning Objective:*** *To understand number systems, codes, and mathematical operations. (C01, CO2).* **Contents:** Review of Binary, Octal and Hexadecimal Number Systems, their inter-conversion, Binary code, Gray code and BCD code, Binary Arithmetic, Addition, Subtraction using 1's and 2'sComplement. ***Self-Learning Topics***: *practice examples.* ***Learning Outcomes:*** *A learner will be able to:* *1.4 Recall the definitions and characteristics of binary, octal, and hexadecimal number systems. (P.I.- 1.3.1 and 1.3.2) (CO1)* *1.5 Convert numbers between decimal, binary, octal, and hexadecimal number systems. (P.I. – 1.3.3 and 1.4.2) (CO2)* *1.6 dentify and represent numbers using Binary Code, Gray Code, and BCD code. (P.I. 1.3.2, 1.3.3) (CO2)* *1.7 Perform binary arithmetic operations such as addition and subtraction using 1's and 2's complement methods. (PI 1.4.2, 2.2.2, 2.2.3, 2.4.3,)(CO2)*	4
2	Logic Family and Logic Gates	***Learning Objective:*** *To understand the differences between analog and digital signals, characteristics of TTL and CMOS logic families, logic gates and apply Boolean algebra principles to realize digital logic circuits using basic and universal gates. (CO1, CO2, CO3)*	5

Module No.	Module Name	Content	No of Hours
		Contents: Difference between Analog and Digital signals, Logic levels, TTL and CMOS Logic families and their characteristics. Digital logic gates, Universal gates, Realization using NAND and NOR gates, Boolean Algebra, De Morgan's Theorem. ***Learning Outcomes:*** *A learner will be able to:* *2.4 Differentiate between analog and digital signals. (P.I. – 1.3.1 and 1.3.2) (CO1)* *2.5 Compare the features and performance characteristics of TTL and CMOS logic families. (P.I. – 1.3.2) (CO1)* *2.6 Identify and describe the function of basic and universal logic gates. (P.I. – 1.3.3, 1.3.4, 2.2.2, 2.2.4,) (CO2)* *2.7 Apply Boolean algebra rules and De Morgan's Theorems to simplify logical expressions. (P.I. – 1.3.4, 2.2.2, 2.2.4,) (CO2, CO3)*	
3	Combinational Logic Circuits	***Learning Objective:*** *To develop the ability to represent and minimize logical expressions using SOP, POS, Karnaugh Map, and Quine-McCluskey method, and to design and analyze fundamental combinational circuits such as adders, subtractors, comparators, multiplexers, demultiplexers, encoders, and decoders. (CO1, CO2, CO3, CO4)* **Contents:** SOP and POS representation, K-Map up to four variables and Quine-McClusky method for minimization of logic expressions. Arithmetic Circuits: Half adder, Full adder, Half Subtractor, Full Subtractor, Carry Look ahead adder and BCD adder, Magnitude Comparator, Multiplexer and De-Multiplexer: Multiplexer operations, cascading of Multiplexer, Boolean function implementation using MUX, DEMUX and basic gates, Encoder and Decoder. ***Learning Outcomes:*** *A learner will be able to:* *3.2 Represent logic functions in Sum of Products (SOP) and Product of Sums (POS) form and Minimize Boolean expressions using Karnaugh Map (up to 4 variables) and the Quine-McCluskey method. (P.I. – 1.3.1, 1.3.2) (CO1)* *3.3 Design and implement arithmetic circuits such as Half Adder, Full Adder, Subtractors, Carry Lookahead Adder, and BCD Adder. (P.I. 1.3.3, 1.4.2, 2.1.2) (CO2, CO3)*	8

Module No.	Module Name	Content	No of Hours
		3.4 Implement logic functions using multiplexers, demultiplexers, and basic gates and cascading of multiplexers and demultiplexers. (P.I. – 1.3.4, 1.3.6, 2.2.3, 2.2.4,) (CO3, CO4) *3.5 Design and evaluate encoders and decoders for digital communication and control applications. (P.I. – 1.3.6, 2.2.3, 2.2.4) (CO3, CO4)*	
4	Sequential Logic Circuits	***Learning Objective:*** *To understand the operation and characteristics of various flip-flops, shift registers, and counters, and to analyze and design sequential circuits for real-time applications using state diagrams and triggering methods. . (CO1,CO2,CO3,CO4).* **Content:** Flip flops: RS, JK, Master slave flip flops; T & D flip flops with various triggering methods, Conversion of flip flops, Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register Counters: Asynchronous and Synchronous counters with State transition diagram, Up/Down, MOD N, BCD Counter Applications of Sequential Circuits: Frequency division, Ring counter, Johnson counter. ***Learning Outcomes:*** *A learner will be able to:* *4.1 Describe the operation of basic flip-flops such as RS, JK, T, D, and master-slave configurations. (P.I. – 1.3.1, 1.3.2) (CO1)* *4.2 Compare and perform conversion between different types of flip-flop and explain and distinguish between types of triggering methods (edge-triggered, level-triggered).. (P.I. –1.3.3, 2.2.2) (CO2)* *4.3 Analyze and design registers (SISO, SIPO, PISO, PIPO) and universal shift registers and synchronous and synchronous counters using state transition diagrams. (P.I. -1.3.4, 1.3.6, 2.2.3, and 2.2.4) (CO2, CO3, CO4)* *4.4 Implement Up/Down counters, MOD-N counters, and BCD counters in sequential circuit design and Illustrate the applications of sequential circuits such as frequency division, ring counter, and Johnson counter. (P.I.- 1.3.6, 2.2.3, and 2.2.4) (CO2, CO3, CO4)*	9
5	Different Types of Memories	***Learning Objective:*** *Understand various types of memory and their characteristics. (CO1, CO2).* **Content:** Classification and Characteristics of memory, SRAM,	2

Module No.	Module Name	Content	No of Hours
		DRAM, ROM, PROM, EPROM and Flash memories. ***Learning Outcomes:*** *A learner will be able to:* *5.1 Classify memory types as volatile and non-volatile, and describe their general characteristics. (P.I. – 1.3.1 and 1.3.2) (CO1)* *5.2 Explain the structure, working, and application areas of SRAM and DRAM. (P.I. – 1.3.2. and 1.3.3) (CO1)* *5.3 Describe the purpose and features of ROM, PROM, EPROM, and Flash memory. (P.I. – 1.3.3, 1.3.4,) (CO1, CO2)* *5.4 Compare various memory types in terms of speed, volatility, cost, and reusability. (P.I. – 1.3.3, 1.3.4,) (CO1, CO2)*	
6	Programmable Logic Devices	***Learning Objective:*** *To introduce the concept of programmable logic devices and provide an understanding of how logic functions can be implemented using PLDs like Programmable Logic Array (PLA) and Programmable Array Logic (PAL). (CO1,CO2).* **Contents:** Introduction: Programmable Logic Devices (PLD), Programmable Logic Array (PLA), Programmable Array Logic (PAL). ***Learning Outcomes:*** *A learner will be able to:* *6.1 Define Programmable Logic Devices (PLDs) and explain their role in digital circuit design. (P.I. – 1.3.1, 1.3.2) (CO1)* *6.2 Describe the internal structure and functionality of a Programmable Logic Array (PLA).. (P.I. – 1.4.2. and 1.4.4) (CO1, CO2)* *6.3 explain the working of Programmable Array Logic (PAL) and compare it with PLA.. (P.I. – 1.3.3, 1.3.4, 1.4.3,) (CO2)* *6.4 Evaluate the performance of different hashing techniques in terms of efficiency and reliability. (P.I. – 1.4.3) (CO2)*	2
Total			**30**

Suggested List of Practicals:

Sr. No.	Suggested Topic(s)
1.	Verification of truth table for different logic gates. ***Learning Outcomes:*** *A learner will be able to:* *Explain the different logic gates and its implementation. (P.I. – 1.3.2,1.3.4) (CO1)*
2.	Implement EX-OR operation using Universal NAND and NOR Gates. ***Learning Outcomes:*** *A learner will be able to:*

Sr. No.	Suggested Topic(s)
	Implement EX-OR operations using universal gates. (P.I. – 13.3, 1.3.4, 2.4.3) (CO1).
3.	Design binary to grey and grey to binary code converter using logic gates. ***Learning Outcomes:*** *A learner will be able to:* *Design binary to gray and gray to bibary concerter using logic gates. (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO2, CO3).*
4.	Reduction of Boolean Expression using Laws and implementation using Logic gates. ***Learning Outcomes:*** *A learner will be able to:* *Simplify and implement logical expressions using Boolean algebra and logical gates. (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO2, CO3).*
5.	Design and implement Half adder and Full adder using Logic Gates. ***Learning Outcomes:*** *A learner will be able to:* *Design and Implement Half adder and Full adder using Logic Gates. (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO2, CO3).*
6.	Design and implement Half subtractor and full subtractor using Logic Gates. ***Learning Outcomes:*** *A learner will be able to:* *Design and Implement Half adder and Full subtractor using Logic Gates. (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO2, CO3).*
7.	Design and implement 2:1 Multiplexer and Demultiplexer using Logic Gates/Multiplexer ICs. *Learning Outcomes:* *A learner will be able to:* *Design and implement 2:1 Multiplexer and Demultiplexer using Logic Gates/Multiplexer ICs. (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO2, CO3).*
8.	Verification of Truth table for Flip Flops ***Learning Outcomes:*** *A learner will be able to:* *Implement and verify truth tables of flip-flops. (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO1, CO2).*
9.	Design and simulate Mod-N counter circuit using Logic Gates and Logisim Simulator. ***Learning Outcomes:*** *A learner will be able to:* *Design and simulate Mod-N counter circuit using Logic Gates and Logisim Simulator. (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO2, CO3).*
10.	Design and implementation of PLA and PLD and verify using Logisim Simulator ***Learning Outcomes:*** *A learner will be able to:* *Design and implementation of PLA and PLD and verify using Logisim Simulator. (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO4).*

Performance Indicators:

P.I.- 1.3.1: **Remembering**: List fundamental engineering principles (e.g., Ohm's law, Bernoulli's equation) and their applications.
P.I.- 1.3.2: **Understanding**: Explain the relevance of basic engineering principles to real-world problems.
P.I.- 1.3.3: **Applying**: Perform calculations and simulations to solve simple engineering tasks.

P.I.– 1.3.4: **Analyzing**: Deconstruct engineering scenarios to identify fundamental principles at work.

P.I.- 1.3.5: **Creating**: Design a system or solution integrating basic engineering fundamentals to meet specific requirements.

P.I.- 1.4.2: **Understanding**: Explain the functions of specialized engineering systems in the computer engineering domain.

P.I.- 1.4.3: **Applying**: Implement domain-specific tools and technologies (e.g., HDL for hardware design, Python for AI).

P.I.- 1.4.4: **Analyzing**: Compare and contrast different specialized engineering approaches for solving a given problem.

P.I.- 2.1.2: **Understanding**: Explain the key features and scope of a complex engineering problem.
P.I.- 2.2.2: **Understanding**: Describe the steps involved in formulating a solution plan for an engineering problem.

P.I.- 2.2.3: **Applying**: Develop a basic solution plan using a systematic approach to solve an identified problem.
P.I.- 2.2.4: **Analyzing**: Evaluate various solution methodologies to determine the most effective approach for a given problem.

P.I.- 2.4.3: **Applying**: Implement the solution process using appropriate tools, software, or experimental setups.

P.I.- 3.4.2: **Understanding**: Explain how engineering principles and tools are applied during the design development process.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1,1.3, 1.4, 2.1,2.2, 3.1, 4.1, 5.1, 5.2, 6.1, and 6.1
CO2	1.2, 1.3, 1.4, 2.3, 2.4, 3.2, 4.2, 4.3, 4.4, 5.3, 5.4, 6.2,6.3 and 6.4
CO3	3.2, 3.3, 3.4, 4.3, 4.4
CO4	3.3, 3.4, 4.3, 4.4

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	12/49	2/49	-	-	-	-	-	-	-	-	-
CO2	12/49	6/49	1/49	-	-	-	-	-	-	-	-
CO3	8/49	5/49	1/49	-	-	-	-	-	-	-	-
CO4	4/49	--	1/49	-	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: *Recall the definitions and characteristics of binary, octal, and hexadecimal number systems. (P.I.- 1.3.1 and 1.3.2) (CO1)*	• Define binary, Decimal, Octal, Hexadecimal number system. • Applications of number systems.	ISA MSE ESE
LO 1.2: *Convert numbers between decimal, binary, octal, and hexadecimal number systems. (P.I. – 1.3.3 and 1.4.2) (CO2)*	• Convert number among different number systems.	MSE ISA ESE
LO 1.3: *Identify and represent numbers using Binary Code, Gray Code, and BCD code. (P.I. 1.3.2, 1.3.3) (CO2)*	• Convert binary to Gray code and Gray code to binary code. conversion. • The student can identify the usage of each code in real-life applications or systems.	LAB ISA
LO 1.4: *Perform binary arithmetic operations such as addition and subtraction using 1's and 2's complement methods. (PI 1.4.2, 2.2.2, 2.2.3, 2.4.3,)(CO2)*	• The student can do binary numbers addition and subtraction. • The student can do binary numbers addition and subtraction using 1's and 2's complement methods. • The student can identify the usage of binary arithmetic real-life applications or systems.	ISA MSE ISA
LO 2.1: *Differentiate between analog and digital signals. (P.I. – 1.3.1 and 1.3.2) (CO1)*	• The students can Differentiate between analog and digital signals. • The student can identify the usage/processing and applications in real-life applications or systems.	MSE ISA LAB
LO 2.2: *Compare the features and performance characteristics of TTL and CMOS logic families. (P.I. – 1.3.2) (CO1)*	• The students can Compare the features and performance characteristics of TTL and CMOS logic families. • The student can identify the use and applications of TTL and CMOS logic families. in real-life applications or systems.	ISA LAB
LO 2.3: *Identify and describe the function of basic and universal logic gates. (P.I. – 1.3.3, 1.3.4, 2.2.2, 2.2.4,) (CO2)*	• The student is able to Identify and verify truth table of the basic and universal logic gates • The student can be able to represent basic gates using universal gates. • Students will be impalement logical expressions using logic and universal gates.	LAB LAB ISA MSE MSE ESE
LO 2.4: *Apply Boolean algebra rules and De Morgan's Theorems to simplify logical expressions. (P.I. – 1.3.4, 2.2.2, 2.2.4,) (CO2, CO3)*	• student will be able simplify logical expressions using Boolean algebra and Demorgans theorem. • Student can identify the use and applications of Boolean algebra and Demorgans theorem in real-life applications or systems.	ISA MSE ESE ISA

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 3.1: *Represent logic functions in Sum of Products (SOP) and Product of Sums (POS) form and Minimize Boolean expressions using Karnaugh Map (up to 4 variables) and the Quine-McCluskey method. (P.I. – 1.3.1, 1.3.2) (CO1)*	• Student will be able represent and simplify logical functions using SOP and POS forms. • Student will be able represent and simplify logical functions using SOP and POS forms. using K-Map.	MSE ISA ISA MSE
LO 3.2: *Design and implement arithmetic circuits such as Half Adder, Full Adder, Subtractors, Carry Lookahead Adder, and BCD Adder. (P.I. 1.3.3, 1.4.2, 2.1.2) (CO2, CO3)*	• Student will be able to Design and implement arithmetic circuits such as Half Adder, Full Adder, Subtractors. • Student will be able to Design and implement Carry Lookahead Adder, and BCD Adder.	MSE ISA LAB ISA ESE
LO 3.3 *Implement logic functions using multiplexers, demultiplexers, and basic gates and cascading of multiplexers and demultiplexers. (P.I. – 1.3.4, 1.3.6, 2.2.3, 2.2.4,) (CO3, CO4)*	• Student will be able to Implement logic functions using multiplexers, demultiplexers, and basic gates and cascading of multiplexers and demultiplexers. • Student can identify the use and applications of multiplexers, demultiplexers in real life applications/systems.	LAB ISA MSE ESE ISA
LO 3.4: *Design and evaluate encoders and decoders for digital communication and control applications. (P.I. – 1.3.6, 2.2.3, 2.2.4) (CO3, CO4)*	• Student will be able to Design and evaluate encoders and decoders for digital communication and control applications. • Student can identify the use and applications of encoders and decoders in real life applications/systems.	ISA ESE ISA
LO 4.1: *Describe the operation of basic flip-flops such as RS, JK, T, D, and master-slave configurations. (P.I. – 1.3.1, 1.3.2) (CO1)*	• Student will be able to Describe the operation of basic flip-flops such as RS, JK, T, D, and master-slave configurations.	ISA MSE LAB
LO 4.2: *Compare and perform conversion between different types of flip-flop and explain and distinguish between types of triggering methods (edge-triggered, level-triggered). (P.I. –1.3.3, 2.2.2) (CO2)*	• Student will be able to Compare and perform conversion between different types of flip-flop and explain and distinguish between types of triggering methods (edge-triggered, level-triggered). • Student can identify the use and applications of different types of flip-flop and their triggering types in real life applications/systems.	ISA MSE LAB ISA
LO 4.3: *Analyze and design registers (SISO, SIPO, PISO, PIPO) and universal shift registers and synchronous and synchronous counters using state transition diagrams. (P.I. -1.3.4, 1.3.6, 2.2.3, and 2.2.4) (CO2, CO3, CO4)*	• Student will be able to analyse and design registers (SISO, SIPO, PISO, PIPO) and universal shift registers. • Student will be able to Analyse and design synchronous and synchronous counters using state transition diagrams.	ISA MSE ESE ISA ESE LAB

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 4.4: *Implement Up/Down counters, MOD-N counters, and BCD counters in sequential circuit design and Illustrate the applications of sequential circuits such as frequency division, ring counter, and Johnson counter. (P.I.- 1.3.6, 2.2.3, and 2.2.4) (CO2, CO3, CO4)*	• Student will be able to Implement Up/Down counters, MOD-N counters, and BCD counters in sequential circuit design. • Student will be able to Implement and design the sequential circuits such as frequency division, ring counter, and Johnson counter.	ISA ESE LAB ISA ESE LAB ESE
LO 5.1: *Classify memory types as volatile and non-volatile, and describe their general characteristics. (P.I. – 1.3.1 and 1.3.2) (CO1)*	• Student will be able to Classify memory types as volatile and non-volatile, and describe their general characteristics. • Student can identify the use and applications of memory in real life applications/systems.	ISA ESE ISA
LO 5.2: *Explain the structure, working, and application areas of SRAM and DRAM. (P.I. – 1.3.2. and 1.3.3) (CO1)*	• Student will be able to Explain the structure, working, and application areas of SRAM and DRAM.	ISA ESE
LO 5.3: *Describe the purpose and features of ROM, PROM, EPROM, and Flash memory. (P.I. – 1.3.3, 1.3.4,) (CO1, CO2)*	• Student will be able to Describe the purpose and features of ROM, PROM, EPROM, and Flash memory.	ISA ESE
LO 5.4: *Compare various memory types in terms of speed, volatility, cost, and reusability. (P.I. – 1.3.3, 1.3.4,) (CO1, CO2)*	• Student will be able to Compare various memory types in terms of speed, volatility, cost, and reusability.	ISA ESE
LO 6.1: *Define Programmable Logic Devices (PLDs) and explain their role in digital circuit design. (P.I. – 1.3.1, 1.3.2) (CO1)*	• Student will be able to Define Programmable Logic Devices (PLDs) and explain their role in digital circuit design. • Student can identify the use and applications of Programmable Logic Devices (PLDs) and role in digital circuit design in real life applications/systems.	ISA ESE
LO 6.2: *Describe the internal structure and functionality of a Programmable Logic Array (PLA). (P.I. – 1.4.2. and 1.4.4) (CO1, CO2)*	• Student will be able to Describe the internal structure and functionality of a Programmable Logic Array (PLA).	ISA ESE
LO 6.3: *explain the working of Programmable Array Logic (PAL) and compare it with PLA. (P.I. – 1.3.3, 1.3.4, 1.4.3) (CO2)*	• Student will be able to explain the working of Programmable Array Logic (PAL) and compare it with PLA.	ISA ESE

Tools/ Technologies/ Programming Languages learnt:

- Digital Electronics hardware as Basic and Universal gates.
- Multiplexer ICs.
- Counter ICs
- Simulation Software Logisim.

Textbooks:

1. R. P. Jain ," Modern Digital Electronics", 2nd Edition, TMcGraw, 2020.
2. Donald A. Neamen, "Electronic Circuit Analysis and Design", TATA McGraw Hill, 2nd Edition.

Reference Books:

1. M. Morris Mano, "Digital Logic and computer Design", PHI.

2. Robert L. Boylestad, Louis Nashelsky, "Electronic devices and circuit Theory", PHI 2.

3. Donald P Leach, Albert Paul Malvino, "Digital Principals & Applications", TMH

Related/ Equivalent MOOC and Associated Certification:

- Digital System Design, NPTEL Course by Prof. Goutam

  Link: https://archive.nptel.ac.in/courses/108/105/108105132/

Course Name: Object Oriented Programming

Course Code: VSEC02T & VSEC02P

Vertical/ Sub-Vertical: Vocational and Skill Enhancement Course

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: VSEC01T & VSEC01P

Pre-requisite for: VSEC05, PEET28T

Recommended Semester: 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
VSEC02T	2	-	2	-
VSEC02P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical	25 (50%)	-	25 (50%)	50 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

The course aims to advance learner's knowledge in problem solving and programming principles for real world applications through object-oriented programming using Java language. The course emphasizes data abstraction and object-oriented programming design through the implementation of classes, objects and related concept like Inheritance, Polymorphism, Exception Handling, Multithreading and Applets.

Course Objectives:

1. To introduce students to the foundational concepts of Java programming, including its features, platform independence for developing basic programs.

2. To enable learners to implement object-oriented programming principles such as classes, objects, constructors, method overloading, and object passing, fostering modular and reusable Java code.
3. To apply advanced OOP concepts like inheritance, interfaces, polymorphism, and wrapper classes (String, StringBuffer, Vector) to develop extensible and maintainable Java applications.
4. To develop the ability to handle runtime errors gracefully by applying exception handling mechanisms for building robust applications.
5. To introduce students to concurrent programming and application modularization for building interactive and scalable Java programs.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Explain the features of Java and its platform-independent nature using bytecode, JVM, and JRE.	Understand
CO2	Develop basic Java programs using data types, operators, control structures, static members, and arrays (1D and 2D).	Apply
CO3	Construct modular programs using object-oriented programming concepts such as classes, constructors, object passing, and method overloading.	Apply
CO4	Implement inheritance, interfaces, polymorphism, and use of wrapper classes to enhance code reusability and flexibility.	Analyse
CO5	Apply exception handling techniques such as try-catch, throw, throws, and user-defined exceptions for developing error-resilient applications	Evaluate
CO6	Design multithreaded Java applications and modular programs using packages and interactive applets.	Create

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Java	***Learning Objective:*** *To enable students to understand and apply the foundational concepts of Java programming such as platform independence, data types, control structures, static members, and arrays to develop simple and structured programs.(CO1, CO2)*	4

Module No.	Module Name	Content	No. of Hours
		Contents: Features of Java, Platform Independence – Byte Code, JVM, JRE. Data Types, Operators, Control Structures, Static Data, Static Function, 1D Array and 2D Array ***Self-Learning Topics***: *Array Data Structure* **Learning Outcomes:** LO1.1: Describe the features of Java and explain how bytecode, JVM, and JRE contribute to its platform independence.(PI1.4.1 & PI 2.1.2)(CO1) **LO1.2**: Use data types, operators, and control structures to write basic Java programs. (PI1.3.3 & PI1.4.3) (CO2) **LO1.3**: Implement static variables and static functions to demonstrate shared functionality in Java. (PI2.4.3)(CO2) **LO1.4**: Construct Java programs using one-dimensional and two-dimensional arrays to manipulate tabular data. (PI2.2.3 & PI1.3.3) (CO2)	
2	Object Oriented Programming	***Learning Objective:*** *To enable students to construct modular and reusable programs by applying core object-oriented programming concepts such as class design, constructors, method overloading, object passing, and array of objects in Java.(CO3)* **Contents:** Classes and Objects, Instance Variables, Constructors, Object Passing Methods, Method Overloading, Array of Objects ***Learning Outcomes:*** *A learner will be able to:* ***LO2.1****: Define and use classes, objects, and instance variables to model real-world entities in Java programs. (PI1.4.1 & PI1.3.2)(CO3)*	4

Module No.	Module Name	Content	No. of Hours
		***LO2.2**: Implement constructors (default and parameterized) to initialize Java objects (PI1.3.3 & PI2.4.3) (CO3)* ***LO2.3**: Demonstrate method overloading and object passing techniques to achieve functional flexibility. (PI1.4.3 & PI2.2.3)(CO3)* ***LO2.4**: Create and manipulate arrays of objects to organize and manage grouped object data. (PI1.3.6 & PI1.4.6)(CO3)*	
3	Inheritance	***Learning Objective:** To equip students with the ability to develop flexible and reusable Java programs by applying advanced object-oriented concepts such as inheritance, interfaces, method overriding, and wrapper classes.(CO4)* **Contents:** Concept and Types, Constructors in Inheritance, Method Overriding and Dynamic Method Dispatch, abstract and final keyword, Interfaces – Concept and Significance, Wrapper Classes – String, StringBuffer, Vector ***Learning Outcomes:*** *A learner will be able to:* ***LO3.1**: Explain the concept and types of inheritance and the use of constructors in inheritance(PI2.1.2 & PI1.3.2)(CO4)* ***LO3.2**: Apply method overriding and dynamic method dispatch to implement runtime polymorphism.(PI1.4.3 & PI2.4.3)(CO4)* ***LO3.3**: Use abstract classes, final keywords, and interfaces to build structured and extendable programs.(PI1.4.4 & PI2.2.4)(CO4)*	4
4	Exception Handling	***Learning Objective:** To enable students to develop robust Java applications by applying exception handling mechanisms such as try-catch blocks, throws/throw keywords, and custom exception classes to manage runtime errors effectively.(CO5)* **Content:** To enable students to develop robust Java applications by applying exception handling mechanisms such as try-catch	7

Module No.	Module Name	Content	No. of Hours
		blocks, throws/throw keywords, and custom exception classes to manage runtime errors effectively. ***Learning Outcomes:*** *A learner will be able to:* ***LO4.1****: Explain the need for exception handling and distinguish between checked and unchecked exceptions (PI2.1. & PI2.4.2) (CO5)* ***LO4.2****: Analyze the flow of control in nested or multiple catch blocks to ensure error handling effectiveness. (PI2.4.4) (CO5)* ***LO4.3****: Create and use user-defined exceptions to handle domain-specific errors in Java applications.(PI2.4.5 & PI1.4.6) (CO5)*	
5	Multithreaded Programming	***Learning Objective:*** *To enable students to design and manage concurrent programs by applying thread creation techniques, thread lifecycle methods, synchronization mechanisms, and exception handling in Java.(CO6)* **Content:** Creating Thread – Different Methods, Using Thread Methods, Thread Exceptions, Priorities, Life Cycle of Thread Synchronization ***Learning Outcomes:*** *A learner will be able to:* ***LO5.1****: Explain the thread lifecycle and different ways of creating and managing threads in Java. (PI2.1.2 & PI3.2.2)(CO6)* ***LO5.2****: Implement multithreading using Thread class and Runnable interface with appropriate thread methods and priorities.(PI1.4.3 & PI2.4.3)(CO6)* ***LO5.3****: Handle thread-related exceptions and apply synchronization to avoid race conditions in concurrent programs.(PI2.4.4 & PI3.1.4)(CO6)*	5

Module No.	Module Name	Content	No. of Hours
		***LO5.4**: Design efficient multithreaded applications incorporating synchronization, priorities, and exception handling.(PI1.4.6 & PI2.2.6)(CO6)*	
6	Packages and Applets	***Learning Objective** To enable students to design modular and interactive Java applications by organizing code using packages and developing applets using life cycle methods and graphical capabilities.(CO6)* **Contents:** Inbuilt Package, Importing Packages, User Defined Packages, Naming Packages, Advantages of Packages, Applet Basics, Applet Life Cycle, Applet Drawing Methods. ***Learning Outcomes:*** *A learner will be able to:* ***LO6.1**: Explain the concept, purpose, and benefits of using inbuilt and user-defined packages in Java. terms of efficiency and reliability. (PI2.1.2 & PI3.2.3) (CO6)* ***LO6.2**: Implement modular Java applications using package creation, importing, and naming conventions.(PI2.4.3 & PI1.4.3)(CO6)* ***LO6.3**: Develop interactive Java applets using applet life cycle methods and override paint() to draw on the screen.(PI1.4.6 & PI2.2.6)(CO6)* ***LO6.4**: Analyze the structure of modular Java programs using packages and applets to ensure maintainability and scalability.(PI2.4.4 & PI3.1.4)(CO6)*	5
Total			**30**

Performance Indicators:

PI 1.1.1 Remembering: Recall key mathematical formulas and concepts relevant to engineering problems.

PI 1.3.1 Remembering: List fundamental engineering principles (e.g., Ohm's law, Bernoulli's equation) and their applications.

PI 1.3.2 Understanding: Explain the relevance of basic engineering principles to real-world problems.

PI 1.3.3 Applying: Perform calculations and simulations to solve simple engineering tasks.

PI 1.3.6 Creating: Design a system or solution integrating basic engineering fundamentals to meet specific requirements

PI 1.4.1 Remembering: Identify key concepts and tools in specialized areas such as computer architecture, AI, programming

PI 1.4.3 Applying: Implement domain-specific tools and technologies

PI 1.4.4 Analyzing: Compare and contrast different specialized engineering approaches for solving a given problem

PI 1.4.6 Creating: Propose innovative solutions using advanced computer engineering knowledge and tools.

PI 2.1.1 Remembering: Recall relevant engineering principles, theories, and concepts to identify a problem.

PI 2.1.2 Understanding: Explain the key features and scope of a complex engineering problem.

PI 2.1.3 Applying: Use standard problem-identification techniques (e.g., root cause analysis) to define an engineering challenge

PI 2.1.4 Analyzing: Decompose a complex engineering problem into its constituent parts to identify critical aspects

PI 2.1.5 Evaluating: Assess the relevance and significance of various problem aspects using evidence-based reasoning

PI 2.2.1 Remembering: List standard methodologies and tools applicable to solving engineering problems.

PI 2.2.2 Understanding: Describe the steps involved in formulating a solution plan for an engineering problem

PI 2.2.3 Applying: Develop a basic solution plan using a systematic approach to solve an identified problem.

PI 2.2.4 Analyzing: Evaluate various solution methodologies to determine the most effective approach for a given problem

PI 2.2.6 Creating: Design a comprehensive and innovative solution plan, integrating multidisciplinary methods if necessary

PI 2.4.1 Remembering: Recall procedures and tools required for executing an engineering solution process.

PI 2.4.2 Understanding: Explain the solution process and its relevance to the identified engineering problem.

PI 2.4.3 Applying: Implement the solution process using appropriate tools, software, or experimental setups.

PI 2.4.4 Analyzing: Examine the results of the solution process to determine trends, patterns, and inconsistencies

PI 2.4.5 Evaluating: Critically assess the solution's accuracy and efficiency, and propose improvements if necessary

PI3.1.3 Applying: Translate real-world challenges into structured engineering problem statements.

PI 3.1.4 Analyzing: Break down the problem into sub-problems and evaluate its complexity in engineering terms

PI 3.2.1 Remembering: List potential design approaches and tools relevant to solving the problem.

PI 3.2.2 Understanding: Describe the principles and methodologies used to generate alternative design solutions

PI 3.2.3 Applying: Propose multiple design concepts addressing the problem's constraints and requirements.

PI 4.1.4 Analyzing: Break down the problem into components and critically assess the relationships between them

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1 (01)
CO2	1.2, 1.3, 1.4 (03)
CO3	2.1, 2.2, 2.3, 2.4 (04)
CO4	3.1, 3.2, 3.3 (03)
CO5	4.1, 4.2, 4.3 (03)
CO6	5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3, 6.4 (08)

Mapping of Course Outcomes with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO7	PO8	PO9	P010	PO11	PO12
CO1	1/22	-	-	-	-	-	-	-	-	-	-
CO2	-	3/22	-	-	-	-	-	-	-	-	-
CO3	-	4/22	-	-	-	-	-	-	-	-	-
CO4	-	-	3/22	-	-	-	-	-	-	-	-
CO5	-	-	-	3/22	-	-	-	-	-	-	-
CO6	-	-	8/22	-	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	Assessment Criteria: The Learner can:	Evaluated under ISA/MSE/ESE/LAB
Describe the features of Java and explain how bytecode, JVM, and JRE contribute to its platform independence. (PI1.4.1 & PI 2.1.2)(CO1)	• **Identify key features of Java** (e.g., Object-oriented, Simple, Secure, Robust, Architecture Neutral, etc.) • Describe the compilation and execution process in Java • Define and differentiate between Bytecode, JVM, and JRE • Explain how Java achieves platform independence	ISA, LAB
Use data types, operators, and control structures to write basic Java programs. (PI1.3.3 & PI1.4.3) (CO2)	• Identify different types of operators in Java (arithmetic, relational, logical, assignment, increment/decrement, etc.). • Write expressions using appropriate operators based on the problem statement. • Evaluate complex expressions involving multiple operators with correct precedence and associativity. • Debug and correct operator-related errors in given C code snippets.	ISA, MSE, LAB

Learning Outcomes: The Learner will:	**Assessment Criteria: The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
Implement static variables and static functions to demonstrate shared functionality in Java. (PI2.4.3)(CO2)	• Declare and initialize static variables • Define and use static functions • Demonstrate the sharing of static variables across multiple objects • Differentiate static and non-static context	ISA, MSE, ESE, LAB
Construct Java programs using one-dimensional and two-dimensional arrays to manipulate tabular data. (PI2.2.3 & PI1.3.3) (CO2)	• Declare and initialize one-dimensional and two-dimensional arrays • Access and manipulate array elements • Display array contents in a tabular format • Implement input/output operations for arrays	ISA, MSE, ESE, LAB
Define and use classes, objects, and instance variables to model real-world entities in Java programs. (PI1.4.1 & PI1.3.2)(CO3)	• Define a Java class representing a real-world entity • Use instance variables to store and access individual object data • Demonstrate encapsulation by using methods to operate on object data • Implement a Java program that interacts with multiple objects	ESE, LAB
Implement constructors (default and parameterized) to initialize Java objects (PI1.3.3 & PI2.4.3) (CO3)	• Define a default constructor • Define a parameterized constructor • Create and initialize objects using both types of constructors	ISA, MSE, LAB
Demonstrate method overloading and object passing techniques to achieve functional flexibility. (PI1.4.3 & PI2.2.3) (CO3)	• Implement method overloading • Demonstrate correct selection of overloaded methods • Define a method that accepts an object as a parameter	ISA, MSE, ESE, LAB

Learning Outcomes: The Learner will:	**Assessment Criteria: The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
	• Demonstrate functional flexibility using overloading and object passing	
Create and manipulate arrays of objects to organize and manage grouped object data. (PI1.3.6 & PI1.4.6) (CO3)	• Declare and initialize an array of object references • Use loops to populate object arrays with user or predefined data • Traverse the object array to access or update attributes	ISA, ESE, LAB
Explain the concept and types of inheritance and the use of constructors in inheritance (PI2.1.2 & PI1.3.2) (CO4)	• Define and explain the concept of inheritance • Identify and describe different types of inheritance supported by Java • Demonstrate inheritance using a Java program • Explain constructor calling mechanism in inheritance	ISA, MSE, ESE, LAB
Apply method overriding and dynamic method dispatch to implement runtime polymorphism. (PI1.4.3 & PI2.4.3) (CO4)	• Override a method in a subclass • Execute overridden method at runtime using dynamic dispatch • Demonstrate polymorphic behavior through multiple subclass types	ISA, ESE, LAB
Use abstract classes, final keywords, and interfaces to build structured and extendable programs. (PI1.4.4 & PI2.2.4) (CO4)	• Define and use an abstract class and method • Define and implement interfaces • Use the final keyword appropriately • Demonstrate polymorphism using abstract class or interface	ISA, MSE, ESE, LAB
Explain the need for exception handling and distinguish between checked and unchecked exceptions	• Explain the need for exception handling in Java	ISA, MSE, ESE, LAB

Learning Outcomes: The Learner will:	**Assessment Criteria: The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
(PI2.1. & PI2.4.2) (CO5)	• Define what exceptions are and where they occur • Classify exceptions as checked and unchecked • Describe the role of try-catch-finally and throws/throw • Provide relevant examples for both checked and unchecked exceptions	
Analyze the flow of control in nested or multiple catch blocks to ensure error handling effectiveness. (PI2.4.4) (CO5)	• Implement nested try-catch blocks and track control flow • Compare multiple catch vs. nested try-catch	ESE, LAB
Create and use user-defined exceptions to handle domain-specific errors in Java applications. (PI2.4.5 & PI1.4.6) (CO5)	• Define a custom exception class • Throw user-defined exceptions in appropriate conditions • Catch and handle user-defined exceptions	ESE, LAB
Explain the thread lifecycle and different ways of creating and managing threads in Java. (PI2.1.2 & PI3.2.2)(CO6)	• Describe the complete thread lifecycle • Explain thread creation using the Thread class • Explain thread creation using the Runnable interface • Describe thread management methods • Differentiate between Thread and Runnable approaches	ESE, LAB
Implement multithreading using Thread class and Runnable interface with appropriate thread methods and priorities. (PI1.4.3 & PI2.4.3)(CO6)	• Apply appropriate thread methods • Set and utilize thread priorities effectively	ESE, LAB

Learning Outcomes: The Learner will:	**Assessment Criteria: The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
Handle thread-related exceptions and apply synchronization to avoid race conditions in concurrent programs. (PI2.4.4 & PI3.1.4)(CO6)	• Apply synchronization using synchronized methods or blocks	LAB
Design efficient multithreaded applications incorporating synchronization, priorities, and exception handling. (PI1.4.6 & PI2.2.6)(CO6)	• Create a multithreaded application using Thread/Runnable • Use thread priorities to influence execution order	LAB
Explain the concept, purpose, and benefits of using inbuilt and user-defined packages in Java. terms of efficiency and reliability. (PI2.1.2 & PI3.2.3) (CO6)	• Define packages and differentiate between inbuilt and user-defined packages • Explain the purpose of using packages in Java • Describe efficiency and reliability benefits of using packages	ISA, LAB
Implement modular Java applications using package creation, importing, and naming conventions. (PI2.4.3 & PI1.4.3)(CO6)	• Import and use inbuilt and custom packages correctly • Demonstrate modular application design using packages	LAB
Develop interactive Java applets using applet life cycle methods and override paint() to draw on the screen. (PI1.4.6 & PI2.2.6)(CO6)	• mplement applet life cycle methods (init(), start(), stop(), destroy()) correctly • Compile and run the applet successfully in a browser or applet viewer	ISA, ESE, LAB
Analyze the structure of modular Java programs using packages and applets to ensure maintainability and scalability.	• Evaluate how applet components are integrated within the program	LAB

Learning Outcomes: The Learner will:	Assessment Criteria: The Learner can:	Evaluated under ISA/MSE/ESE/LAB
(PI2.4.4 & PI3.1.4)(CO6)		

Tools/ Technologies/ Programming Languages learnt:

- Programming Languages: Java.
- Integrated Development Environments (IDEs): Eclipse.
- Code Practice Platforms: LeetCode, HackerRank, CodeSignal.
- Data Structure Visualization Tools: Algorithm Visualizer.
- Version Control Systems: Git and GitHub.
- Online Learning Platforms with Interactive Coding Environments: Codeblock, Eclipse.

Textbooks:

1. Herbert Schildt, "JAVA: The Complete Reference", Oracle Press
2. Sachin Malhotra and Saurabh Chaudhary, "Programming in JAVA", Oxford University Press

Reference Books:

1. Ivor Horton, "Beginning JAVA", Wiley, India
2. Dietal and Dietal, "Java: How to program", Prentice Hall
3. Stevan Jolzner, "JAVA Programming- Black Book", Dreamtech Press
4. ScriptDemics, "Learn to Master Java Programming", Staredu Solutions.

Related/ Equivalent MOOC and Associated Certification:

1. Programming in Java (NPTEL) –

- SWAYM-NPTEL
- Link: https://nptel.ac.in/courses/106105191

Course Name: Professional Skills

Course Code: VEC01T & VEC01P

Vertical/ Sub-Vertical: Value Education Course

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: Nil

Pre-requisite for: AEC04

Recommended Semester: 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
VEC01T	2	-	2	-
VEC01P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (VEC01T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (VEC01P)	25 (50%)	-	25 (50%)	50 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

The course, Professional Skills, will groom students in the areas of developing professional etiquettes, building digital profiles, imbibing workplace ethics, and organizational behaviour. This course will also be an essential guide in building business communication and soft skills concepts.

Course Objectives:

- Recognize and apply the do's and don'ts of participation in group discussions, resume writing and interviews. (K)
- To develop professional etiquettes and build an effective digital profile for positive communication and workplace presence. (A)
- Learn and demonstrate the dynamics of various types of interpersonal skills through team presentations and role play sessions. (S)

- Comprehend various ethical and unethical practices and ethical decision-making and concepts like intellectual property rights, and plagiarism checks. (K)
- Learn about various personality traits, learning styles, productivity tools and understand SWOT. (A)
- To foster critical thinking, creativity, collaboration, and communication skills essential for success in the 21st-century workplace and society. (K)

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Observe and participate in Group Discussions and Mock Interviews on the lines of campus placement training.	Cognitive Application
CO2	Build a digital profile by demonstrating awareness of a professional persona	Cognitive Application
CO3	Identify various interpersonal skills through participation in presentations and role play.	Affective Responding
CO4	Differentiate between ethical and non-ethical behaviour through analysis of case studies.	Affective Valuing
CO5	Identify their personality traits and learning styles through activities like SWOT analysis	Affective Responding
CO6	Demonstrate awareness of 4 C's relevant to 21st Century Skills.	Affective Responding

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Employment Skills:	***Learning Objective:*** Students will be able to demonstrate essential employment skills by effectively participating in group discussions, preparing professional resumes, and performing confidently in job interviews. *(C01).* **Contents:** Job Application & Resume Writing Group Discussion Interview Skills ***Self-Learning Topics***: Nil ***Learning Outcomes:*** *A learner will be able to:* 1.1 *Demonstrate effective participation and articulation of viewpoints in group discussions. (P.I.- 9.1.1, 9.1.2, 9.2.2, 9.2.3, 9.3.1, 10.2.1 (CO1)*	10

Module No.	Module Name	Content	No. of Hours
		1.2 *Prepare for and perform confidently in various interview formats. (P.I. –9.2.3, 9.2.4, 10.2.1, 10.2.2 (CO1)* 1.3 *Create a professional and tailored resume, and portfolios highlighting skills and achievements. (P.I. 10.1.2, 10.1.3 (CO1)*	
2	Professional Etiquettes	***Learning Objective:*** Students will be able to demonstrate appropriate professional etiquette in academic and workplace environments by practicing respectful communication, maintaining decorum in formal interactions, and following accepted norms of behavior during meetings, emails, and networking events. (*CO2)* **Contents:** Techniques Corporate Grooming and Workplace Etiquette Telephone Etiquette Netiquettes, Telephone Etiquette Digital Footprints, Social Media, Personal Profile Privacy Digital Profile Building (ePortfolio, LinkedIn) ***Self-Learning Topics****: Nil* ***Learning Outcomes:*** *A learner will be able to:* *2.8 Apply appropriate grooming and etiquette to project a professional image at the workplace. (P.I. –9.2.3, 9.2.4) (CO2)* *2.9 Practice responsible and respectful behavior in telephone and all forms of digital communications. (P.I. –9.2.2, 9.2.3, 10.1.1) (CO2)* *2.10 Manage digital footprints and ensure privacy across social media platforms and maintain a professional digital profile using ePortfolio and LinkedIn. (P.I. – 9.2.1, 10.1.1, 10.3.2) (CO2)*	4
3	Interpersonal Skills:	***Learning Objective:*** Students will be able to **develop effective interpersonal communication skills** by engaging in active listening, expressing ideas clearly, providing constructive feedback, and collaborating productively in diverse teams and professional environments. *(CO3)* **Contents:** Assertiveness, Negotiation Leadership, Team Building Problem Solving, Decision Making Cultural and Emotional Intelligence ***Self-Learning Topics:*** *Nil* ***Learning Outcomes:*** *A learner will be able to:*	6

Module No.	Module Name	Content	No. of Hours
		3.6 Demonstrate assertive communication, effective negotiation skills, and leadership qualities to influence and guide individuals and teams toward common goals. (P.I. –9.1.1, 9.2.1, 10.2.1) (CO3) *3.7 Collaborate effectively within teams to solve problems and make informed decisions in dynamic professional environments. (P.I. –9.1.1, 9.2.1, 9.3.1, and 12.1.2) (CO3)* *3.8 Apply cultural awareness and emotional intelligence to foster inclusive, empathetic, and productive interpersonal interactions. (P.I. –9.1.1, 9.1.2, 9.2.1) (CO3)*	
4	Ethics	***Learning Objective:*** Students will be able to analyze and apply ethical principles in engineering practices by recognizing moral dilemmas, evaluating consequences, and making decisions that reflect integrity, responsibility, and social accountability. *(CO4)*. **Content:** Introduction to Ethics Plagiarism and Online Plagiarism Checker Patents Trademark and Copyrights and GI – Geographical Indicators Professional Ethics Corporate Social Responsibility (CSR) –Information Confidentiality ***Self-Learning Topics:*** *Nil* ***Learning Outcomes:*** *A learner will be able to:* *4.5 Recognize and apply ethical principles in professional decision-making. (P.I. – 8.1.1 and 8.2.2) (CO4)* *4.6 Identify plagiarism, understand IPR and utilize tools to ensure academic and professional integrity. (P.I. – 8.1.1 and 8.2.1) (CO4)* *4.7 Demonstrate understanding of CSR principles and the importance of maintaining information confidentiality. (P.I. - 8.2.2) (CO4)*	4
5	Personality Enrichment:	***Learning Objective:*** *Students will be able to enhance their personal and professional identity by developing self-awareness, confidence, emotional intelligence, and a positive mindset that supports personal growth, stress management, and career readiness. (CO5)* **Content:** SWOT Analysis and JOHARI window	2

Module No.	Module Name	Content	No. of Hours
		Developing Positive Attitude Personality Types and Learning Styles Vision and Goal Setting Stress Management and Time Management ***Self-Learning Topics:*** *Nil* ***Learning Outcomes:*** *A learner will be able to:* *5.5 Apply SWOT analysis, JOHARI Window to enhance self-awareness and personal development and also set personal and professional goals aligned with a clear vision. (P.I. 9.1.1, 10.2.1) (CO5)* *5.6 Identify different personality types and adapt learning strategies accordingly. (P.I.-9.1.1) (CO5)* *5.7 Employ strategies to effectively manage stress and optimize time. (P.I. – 9.2.4, 10.2.1) (CO5)*	
6	21st Century Skills	***Learning Objective:*** *Enable students to apply creative and critical thinking, analyze and solve problems collaboratively, and communicate ideas effectively in diverse professional and social contexts.(CO5).* **Contents:** Creative Thinking Critical Thinking Collaboration and Communication ***Self-Learning Topics: All*** ***Learning Outcomes:*** *A learner will be able to:* *6.5 Generate original ideas and innovative solutions to problems. (P.I. – 10.1.2, 10.2.2 and 12.2.1, 12.2.2) (CO6)* *6.6 Analyze information logically to make informed decisions and solve complex problems. (P.I.-12.1.2) (CO6)* *6.7 Collaborate effectively and communicate ideas clearly in diverse team environments. (P.I. –9.3.1, 10.1.1, 10.2.1) (CO6)*	4
Total			**30**

Suggested List of Practicals:

Sr. No.	Suggested Topic(s)
1.	Group Discussion ***Learning Outcomes:*** *A learner will be able to:* *1.1 Demonstrate effective participation and articulation of viewpoints in group discussions. (P.I.- 9.1.1, 9.1.2, 9.2.2, 9.2.3, 9.3.1, 10.2.1 (CO1)*
2.	Mock Interviews (Participate in Peer Interviews and learn the skills required to ace the Interviews) ***Learning Outcomes:*** *A learner will be able to:* 1.2 *Prepare for and perform confidently in various interview formats. (P.I. –9.2.3, 9.2.4, 10.2.1, 10.2.2 (CO1)*
3.	Case Study on Ethics ***Learning Outcomes:*** *A learner will be able to:* *4.8 Recognize and apply ethical principles in professional decision-making. (P.I. – 8.1.1 and 8.2.2) (CO4)*
4.	E-Portfolio ***Learning Outcomes:*** *A learner will be able to:* 1.3 *Create a professional and tailored resume, and portfolios highlighting skills and achievements. (P.I. 10.1.2, 10.1.3 (CO1)*
5.	Video Resume ***Learning Outcomes:*** *A learner will be able to:* 1.3 *Create a professional and tailored resume, and portfolios highlighting skills and achievements. (P.I. 10.1.2, 10.1.3 (CO1)*
6.	Mini Project ***Learning Outcomes:*** *A learner will be able to:* *6.1 Generate original ideas and innovative solutions to problems. (P.I. – 10.1.2, 10.2.2 and 12.2.1, 12.2.2) (CO6)*
7.	Interpersonal Skills Presentation ***Learning Outcomes:*** *A learner will be able to:* *A learner will be able to:* *3.1 Demonstrate assertive communication, effective negotiation skills, and leadership qualities to influence and guide individuals and teams toward common goals. (P.I. –9.1.1, 9.2.1, 10.2.1) (CO3)*

Performance Indicators:

P.I. 8.1.1 - **Analyzing** :Analyze ethical issues in engineering practice and societal expectations.

P.I. 8.2.1- **Evaluating :** Evaluate the responsibility of engineers towards public safety and welfare.

P. I. 8.2.2 **Applying**: Examine and apply moral & ethical principles to known case studies.

P.I. 9.1.1 **Understanding**: Recognize a variety of working and learning preferences; appreciate the value of diversity on a team.

P.I. 9.2.1 **Remembering**: Demonstrate effective communication, problem-solving, conflict resolution and leadership skills

P.I. 9.2.2 **Understanding**: Treat other team members respectfully

P.I. 9.2.3 **Understanding**: Listen to other members

P.I. 9.2.4 **Understanding**: Maintain composure in difficult situations

P.I. 9.3.1 **Applying**: Present results as a team, with smooth integration of contributions from all individual efforts

P.I. 10.1.1 **Understanding**: Read, understand and interpret technical and non-technical information

P.I. 10.1.2- **Applying**: Produce clear, well-constructed, and well-supported written engineering documents.

P.I. 10.2.1- **Applying**: Listen to and comprehend information, instructions, and viewpoints of others

P.I. 10.2.2- **Understanding** Deliver effective oral presentations to technical and non-technical audiences

P.I. 12.1.2- **Analyzing;** Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap

P.I. 12.2.1- **Remembering** Actively pursue self-learning, professional development, and staying updated with emerging technologies.

P.I. 12.2.2- **Remembering** Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field

P.I.- 1.1.1: **Remembering**: Students will gain knowledge to develop the traits of a suitable candidate with respect to resume writing, participating in group discussions, and facing interviews
P.I.- 1.2.2: **Understanding**: Students will understand the techniques to analyse problem statements and formulate solutions of problems using surveys and project work
P.I.- 1.3.1: **Remembering**: Students can demonstrate the key skills required to face GDs, interviews, and resume writing as an individual or a team member
P.I.- 1.3.2: **Understanding**: Students can exhibit professional presentation skills both individually or in a team
P.I.- 1.4.2: **Understanding**: Students can prepare themselves as an individual or as a part of a team for various corporate ethics and etiquettes
P.I.- 2.1.2: **Understanding**: Student will inculcate professional ethics to build stronger relationships in professional practices
P.I.- 2.1.3: **Applying**: Students will apply the skills of communicating effectively to deliver the right employment skills
P.I.- 2.1.4: **Analyzing**: Students will critically analyse the insights about communicating effectively during campus placements and competitive examinations

P.I.- 2.2.3: **Applying**: Students will develop effective communication strategies to build their inter-personal skills.
P.I.- 3.2.1: **Remembering**: Students will inculcate knowledge by communicating about contemporary issues and demonstrate the ethical code of conduct.
P.I.- 3.2.2: **Understanding**: Students will learn to communicate effectively to deliver the right employment skills
P.I.- 3.2.3: **Applying**: Students can apply their skills to prepare themselves as an individual or as a part of a team for various corporate ethics and etiquettes
P.I.- 3.3.1: **Remembering**: Students will gain fundamental knowledge of various inter-personal skills like team building, motivation, assertiveness, conflict resolution etc., to progress professionally
P.I.- 3.3.2: **Understanding**: Students will explain and demonstrate the formal presentations using modern ICT tools for a successful career that meets the global corporate world virtual requirements.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 1.2, 1.3
CO2	2.1, 2.2, 2.3, 2.4
CO3	3.1, 3.2, 3.3
CO4	4.1, 4.2
CO5	5.1, 5.2, 5.3
CO6	6.1, 6.2, 6.3

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1		-	-	-	-	-	-	08/48	05/48	-	-
CO2				-	-	-	-	05/48	03/48	-	-
CO3				-	-	-	-	08/48	01/48	-	01/48
CO4				-	-	-	05/48	-	-	-	-
CO5				-	-	-	-	02/48	02/48	-	-
								01/48	04/48		03/48

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1: Students will be able to demonstrate essential employment skills by effectively participating in group discussions, preparing professional resumes, and performing confidently in job interviews.	1.1 Participate in Group Discussions and evaluate cases of group discussions	ISA LAB, MSE, ESE
	1.2 Group Discussion Do's and Don'ts, Selection Criteria	ISA TH
	1.2 Draft a professional beginner level resume	ESE LAB
	1.3 Participate in Mock interviews and write appropriate responses to HR and Technical Interview Questions	ISA LAB
	1.4 Prepare professional e-Portfolios	ESE LAB
	1.5 Prepare video resumes	ESE LAB
LO2: Students will be able to demonstrate appropriate professional etiquette in academic and workplace environments by practicing respectful communication, maintaining decorum in formal interactions, and following accepted norms of behavior during meetings, emails, and networking events.	2.1 Perform role play on different scenarios pertaining to professional etiquettes	ISA LAB
	2.2 Identify 4 Etiquettes which you feel matter a lot in the professional world. Write down tips to develop those etiquettes	ISA TH
LO3: Students will be able to develop effective interpersonal communication skills by engaging in active listening, expressing ideas clearly, providing constructive feedback, and collaborating productively in diverse teams and professional environments.	3.1 Design presentations on Interpersonal Skills and present in the class as a flipped activity	ISA
	3.2 Mini Project Report and Presentation	ESE (P)
LO4: Students will be able to analyze and apply ethical principles in engineering practices by recognizing moral dilemmas, evaluating consequences, and making decisions that reflect integrity, responsibility, and social accountability.	4.1 Analyze case studies based on Ethics	ISA LAB
	4.2 A. Select any one research paper from the AAP, read it and paraphrase the same. B. Submit a plagiarism check report of your paraphrase.	ISA TH
LO5: Students will be able to enhance their personal and professional identity by	5.1 Personality MBTI Test and Psychometric Test. Submit screenshot of results.	ISA LAB

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
developing self-awareness, confidence, emotional intelligence, and a positive mindset that supports personal growth, stress management, and career readiness.	5.3 Identify the major stressors in your life. Make a mind map on Stress Management.	ISA TH
	5.8 Prepare a comprehensive Time Management Matrix and design a productive schedule for yourself.	ISA TH
	5.9 What is SWOT analysis and what is its use? Prepare your SWOT Analysis	ISA TH
	5.10 What is Johari Window and how is it useful? Prepare your Johari Window.	ISA TH
	5.6 Complete MOOC course and get certified	ISA LAB
	5.7 Prepare a visual representation of your Vision Chart and Short-Term Goals and Long Term Goals.	ISA TH
LO6: Enable students to apply creative and critical thinking, analyze and solve problems collaboratively, and communicate ideas effectively in diverse professional and social contexts.	6.1 Design a Poster and write-up on any one of the following 21st century skills	ISA TH

Reference Books:

5. Personal Development for Life and Work, Wallace and Masters, Thomson Learning
6. Soft Skills, Dr. K.Alex, S. Chand and company
7. Organizational Behaviour, Robbins Stephens, Pearson Education
8. What Are Soft Skills? Dorch, Patricia, NewYork: Execu Dress Publisher, 2013
9. Soft Skills and Professional Communication, Francis Peter, Tata McGraw Hill
10. Business Communication- "Building Critical Skills," Kitty O Locker, McGraw Hill
11. "Business Communication - Concepts Cases and Applications," Chaturvedi and Chaturdevi, Pearson
12. How to Speak Fluently, Jones, Indian Publishing House

Related/ Equivalent MOOC and Associated Certification:

1. LinkedIn Mastery: Creating an awesome profile - https://www.udemy.com/course/linkedinmastery-creating-an-awesome-profile/
2. Soft Skills: The 11 Essential Career Soft Skills - https://www.udemy.com/course/soft-skills-the11-essential-career-soft-skills/
3. Understanding Personality Types at Work - https://www.udemy.com/course/understandingpersonality-types-at-work/
4. Speak English Professionally: In Person, Online & On the Phone -

https://www.coursera.org/learn/speak-english-professionally

5. How to Write a Resume (Project Centered Course) https://www.coursera.org/learn/how-to-write-aresume
6. Interviewing and Resume Writing in English Specialization https://www.coursera.org/specializations/english-interview-resume
7. Build Your Professional ePortfolio in English - https://www.coursera.org/learn/eportfolio-english

Detailed Syllabus IKS courses

Course Name: Indian Traditional Knowledge System

Course Code: IKS01

Vertical/ Sub-Vertical: Indian Knowledge System Courses

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Nil

Pre-requisite for: Nil

Recommended Semester: 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
IKS01	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (IKS01)	25 (~25%)	-	50 (~50%)	75 (100%)
-	-	-	-	-

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

This course explores its interdisciplinary nature—spanning philosophy, science, technology, art, and ecology—while highlighting its relevance to contemporary education and innovation. Through critical study of ancient texts and practices, students will engage with indigenous perspectives that foster holistic thinking and sustainable solutions.

Course Objectives:

- To understand the concepts of Indian Traditional Knowledge.
- To understand the importance of the roots of the knowledge system.
- To reflect on the thought process, reasoning, and inference.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Understand the rich history of the Indian Traditional Knowledge System	Understanding
CO2	Understand the different areas of contributions from India	Applying
CO3	Analyse the different principles of traditional knowledge in modern systems	Analysing

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Review of Scientific Literature in Sanskrit:	***Learning Objective:*** *To critically analyze and evaluate classical Sanskrit texts for their contributions to traditional scientific knowledge systems, such as Ayurveda, astronomy, mathematics, and linguistics, and to develop the ability to contextualize these contributions within both historical and contemporary frameworks. (CO1, CO2)* **Contents:** References of sciences /scientific knowledge through different textual sources. ***Self-Learning Topics***: *Nil* ***Learning Outcomes:*** *A learner will be able to:* 1. *Gain an overview of the vast repository of scientific knowledge preserved in Sanskrit texts (P.I. 10.1.1) CO1* 2. *Familiarize with specific works like Aryabhatiya (astronomy), Charaka Samhita (medicine), and Sulbasutras (geometry) (P.I.12.1.1) CO2* 3. *Learn how ancient principles from Sanskrit texts can be applied to modern sciences like astronomy,*	6

Module No.	Module Name	Content	No of Hours
		medicine, and environmental studies (P.I.12.1.2) CO2	
2	Chemistry and Mathematics:	***Learning Objective:*** *To explore and interpret key concepts, techniques, and contributions of ancient Indian scholars in the fields of chemistry (Rasashastra) and mathematics (Ganitashastra), and to understand their relevance and application in the evolution of scientific thought and practices (CO2, CO3).* **Contents:** Various treatises on Chemistry, Use of Chemistry in Medicines, Metallurgy, Use of Chemistry for occult practices, Mathematical concepts through Shulbasutras, Development of different types of mathematical branches and treatises based on that, Development of Astronomy etc. ***Learning Outcomes:*** *A learner will be able to:* *2.1 Learn about the use of alchemy in Ayurveda and traditional medicine, including processes like purification and transformation of metals (P.I. 12.2.1)CO2* *2.2 Learn about ancient Indian metallurgical techniques, including the extraction, alloying, and casting of metals as described in texts like Krishi-Parashara and Brihatsamhita (P.I. 12.2.2) CO2* *2.3 Understand the contributions of mathematicians like Aryabhata, Bhaskara, and Brahmagupta to global mathematical advancements (P.I. 12.2.1) CO2* *2.4 Learn about the Indian contributions to astronomy, including planetary motion, eclipses, and time calculation, as described in Surya Siddhanta and Aryabhatiya (P.I. 12.3.1) CO3*	6
3	Dietetics:	***Learning Objective:*** *To examine the principles of ancient Indian dietetics as outlined in classical texts such as*	7

Module No.	Module Name	Content	No of Hours
		Ayurveda, focusing on the relationship between food, health, and seasonal/regional variations, and to assess their applicability in promoting holistic well-being today. (CO1, CO2, CO3). **Content:** Study of different texts based on culinary art Nalapakadarpana, Bhojanakuthuhalam, Supashastra, Modes of preservation of food, Dietary guidelines through branches of Ayurveda, Food and Diseases, etc. ***Learning Outcomes:*** *A learner will be able to:* *3.1 Learn traditional methods of food preservation such as fermentation, pickling, drying, and smoking (P.I2.2.1) CO1* *3.2 Study the dietary principles and guidelines described in Ayurvedic texts, emphasizing balance (Tridosha), seasonal eating, and personalized nutrition (P.I. 12.3.1) CO1* *3.3 Explore the role of food as medicine in Ayurveda, focusing on how specific dietary practices can prevent and manage diseases (P.I. 12.1.2) CO2* *3.4 Study ancient practices of food presentation, garnishing, and plating as described in culinary texts (P.I. 12.2.1. 12.2.2) CO3* *3.5 Study ancient practices of food presentation, garnishing, and plating as described in culinary texts (P.I. 12.3.1) CO2*	
4	Agriculture, Astronomy, and Zoology	***Learning Objective:*** *To investigate the foundational knowledge and practices in agriculture, astronomy, and zoology as reflected in ancient Indian texts, and to appreciate their scientific insights, innovations, and environmental harmony in the context of traditional knowledge systems.(CO2, CO3).* **Content:** Study of Krishisuktas, Krishiparashara, Brihatsamhita, Types of crops, Manures, Types of land- Devamatruka,	6

Module No.	Module Name	Content	No of Hours
		Nadimatruka, Indian Astronomy, Use of animals in warfare, Animal husbandry, Animals for medicine. ***Learning Outcomes:*** *A learner will be able to:* 1. *Learn about the types of crops, their cultivation cycles, and their significance in ancient Indian agronomy (P.I0. 2.1) CO2* 2. *Understand the classification of land types like Devamatruka and Nadimatruka based on fertility, water retention, and suitability for specific crops (P.I2.1.2) CO2* 3. *Explore the role of Indian astronomy in agricultural practices, including the timing of sowing, harvesting, and irrigation (P.I2.2.1) CO3* 4. *Learn about the historical use of animals like horses, elephants, and others in warfare strategies and their impact(P.I.12.3.1) CO3* 5. *Study ancient practices of animal husbandry, focusing on their role in supporting agriculture and society(P.I. 12.3.2) CO3* 6. *Understand the medicinal uses of animals and animal-derived products as described in ancient texts (P.I.12.3.1) CO2*	
Total			**30**

Suggested List of Practicals:

Sr No.	Suggested Topic(s)
1.	Poster Presentation ***Learning Outcomes:*** *A learner will be able to:*

	1.1 Gain an overview of the vast repository of scientific knowledge preserved in Sanskrit texts (P.I. 10.1.1) (CO1)
2.	Blog Writing ***Learning Outcomes:*** *A learner will be able to:* *2.4 Learn about the Indian contributions to astronomy, including planetary motion, eclipses, and time calculation, as described in Surya Siddhanta and Aryabhatiya (P.I. 12.3.1) CO2*
3.	Book Review ***Learning Outcomes:*** *A learner will be able to:* *3.4 Study ancient practices of food presentation, garnishing, and plating as described in culinary texts* *. (P.I. – 12..2.1) (CO3).*
4.	Question and Answers ***Learning Outcomes:*** *A learner will be able to:* *3.1 Learn traditional methods of food preservation such as fermentation, pickling, drying, and smoking* *(P.I2.2.1) (CO2)*
5.	Essay Writing ***Learning Outcomes:*** *A learner will be able to:* 1. *Learn about the types of crops, their cultivation cycles, and their significance in ancient Indian agronomy (P.I. I0. 2.1) (CO3)*
6.	Infographics ***Learning Outcomes:*** *A learner will be able to:*

	5.3Explore the role of Indian astronomy in agricultural practices, including the timing of sowing, harvesting, and irrigation (P.I2.2.1, 12.3.2 (CO3)

Performance Indicators:

P.I.- 10.1.1 **Remembering:** Read, understand and interpret technical and non-technical information

P.I.- 10.2.1 **Understanding**: Listen to and comprehend information, instructions, and viewpoints of others

P.I.- 12.2.1 Remembering: Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current

P.I.- 12.3.1 **Understanding**: Source and comprehend technical literature and other credible sources of information

P.I.-12.3.2 **Analyzing**: Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

P.I.-12.2.2 **Understanding:** Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1. 3.1, 3.2
CO2	1.2, 1.3, 2.1, 2.2, 2.3, 3.3, 3.5, 5.1,5.2, 5.6
CO3	2.4, 3.4, 5.3, 5.4, 5.5
CO4	
CO5	

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1									1/13		4/13
CO2									1/13		5/13
CO3											2/13
CO4											
CO5											

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1 : *Students will be able to critically analyze and evaluate classical Sanskrit texts for their contributions to traditional scientific knowledge systems, such as Ayurveda, astronomy, mathematics, and linguistics, and to develop the ability to contextualize these contributions within both historical and contemporary frameworks. (CO1, CO2)*	• The student can analyze classical Sanskrit texts • The student is able to contextualize contributions to traditional scientific knowledge systems within historical and contemporary frameworks .	ISA ISA, MSE
LO2: *Students will be able to explore and interpret key concepts, techniques, and contributions of ancient Indian scholars in the fields of chemistry (Rasashastra) and mathematics (Ganitashastra), and to understand their relevance and application in the evolution of scientific thought and practices (CO2, CO3).*	• The student can describe interpret key concepts, techniques, and contributions of ancient Indian scholars in the fields of chemistry (Rasashastra) and mathematics (Ganitashastra), • The student provides relevant examples of contributions of ancient Indian scholars in the fields of chemistry (Rasashastra) and mathematics (Ganitashastra), • The student can explain their relevance and application in the evolution of scientific thought and practices	ese ISA ESE ISA
LO3: *Students will be able to examine the principles of ancient Indian dietetics as outlined in classical texts such as Ayurveda, focusing on the relationship between food, health, and seasonal/regional variations, and to assess their*	• The student is able to examine the principles of ancient Indian dietetics as outlined in classical texts such as Ayurveda • The student can justify their applicability in promoting holistic well-being today.	ESE ISA

applicability in promoting holistic well-being today. (CO1, CO2, CO3).		
LO4: *Students will be able to investigate the foundational knowledge and practices in agriculture, astronomy, and zoology as reflected in ancient Indian texts, and to appreciate their scientific insights, innovations, and environmental harmony in the context of traditional knowledge systems.(CO2)*	• The student can investigate the foundational knowledge and practices in agriculture, astronomy, and zoology • The student is able to appreciate their scientific insights, innovations, and environmental harmony in the context of traditional knowledge systems.	ISA ISA

Reference Books:

1. Nirmal Trikha, "Scientific Knowledge in Sanskrit Literature"
2. S. Balachandra Rao, "Indian Astronomy: An Introduction"
3. B. Seal, "Ancient Indian Sciences"
4. Melissa Stewert, "Science in Ancient India (Science of the Past)"
5. Sudheer Birodkar, "India's Contribution to World Culture"
6. R. C. Majumdar, "Ancient India"
7. Swami ChidatmanJee Maharaj, "Ancient Indian Sciences"
8. Stella Kramrisch, "The Art of India through the Ages"
9. K.Krishna Murthy, "Early Indian Secular Architecture"

Related/ Equivalent MOOC and Associated Certification:

1. Introduction to Indian Knowledge System – IGNOU (SWAYAM) Offered by: IGNOU | Language: English | Duration: 12 weeks, Starts: 15 Jul 2025 | Enroll by: 15 Sep 2025

Enroll here: https://onlinecourses.swayam2.ac.in/nou25_ge95/preview

. Indian Knowledge System (IKS): Concepts & Applications in Science – IIM Bangalore & Chanakya University (SWAYAM) Offered by: IIMB & Chanakya Univ. Duration: 10 weeks

Enroll here: https://onlinecourses.swayam2.ac.in/imb23_mg54/preview

3. Indian Knowledge System (IKS): Humanities & Social Sciences – IIM Bangalore & Chanakya University (SWAYAM) Offered by: IIMB & Chanakya Univ. Duration: 10 weeks

Enroll here: https://onlinecourses.swayam2.ac.in/imb23_mg55/preview

Indian Knowledge System – Dr Roli Pradhan (NITTTR, Bhopal) (SWAYAM) Offered by: NITTTR Bhopal Duration: 8 weeks

Enroll here: https://onlinecourses.swayam2.ac.in/ntr24_ed78/preview

Course Name: Indian Constitution

Course Code: IKS02

Vertical/ Sub-Vertical: Indian Knowledge System Courses

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Nil

Pre-requisite for: Nil

Recommended Semester: 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
GEPS01	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (GEPS01)	75	-	-	75 (100%)
-	-	-	-	-

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

This course introduces learners to the framework that defines India's political and legal systems. It emphasizes constitutional philosophy, fundamental rights and duties, governance mechanisms, and landmark judgments, fostering responsible citizenship and democratic values.

Course Objectives:

- To understand the concept and necessity of a constitution.
- To interpret the ideals enshrined in the Constitution.
- To comprehend the significance of Fundamental Rights and Duties.

- To gain knowledge of the Indian parliamentary and judicial systems.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Learner will be able to understand constitution principles	Remembering
CO2	Learner will be able to co-relate with political system	Understanding
CO3	Learner will be able to pursue the values of civic life	Analysing
CO4	Learner will be able to exercise their rights and duties	Understanding

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Indian Constitution	***Learning Objective:*** *Understand the historical context and philosophy behind the Constitution.* **Contents:** *Historical background, Constitutional philosophy.* ***Self-Learning Topics***: *Constituent Assembly Debates, Role of Dr. B.R. Ambedkar.* ***Learning Outcomes:*** *A learner will be able to:* 1. LO1.1: Recall historical origins and key objectives of the Indian Constitution (CO1) P.I. – 1.1.1, 2. LO1.2: Explain preamble values and their relevance (CO3) P.I. – 1.3.1	3
2	Citizenship & Fundamental Duties	***Learning Objective:*** *Understand who is an Indian citizen and the constitutional duties.* **Contents:** *Citizenship at commencement, Rights of overseas Indians, Duties of citizens.*	3

Module No.	Module Name	Content	No. of Hours
		Self Learning topics: *NRC, CAA provisions (non-political lens).* ***Learning Outcomes:*** *A learner will be able to:* 1. *Explain constitutional provisions regarding acquisition/loss of citizenship. (PI: 1.3.2, CO2)* 2. *Relate duties to everyday civic behaviour. (PI: 1.4.2, CO2)*	
3	Fundamental Rights	***Learning Objective:*** *Comprehend and evaluate the scope of rights and freedoms in the Constitution.* **Contents:** *Right to Equality, Freedom, Religion, Education, Remedies; UCC, Article 370, Reservations.* ***Self Learning:*** *PIL, RTI Act basics.* ***Learning Outcomes:*** *A learner will be able to:* 1. *Analyze the limitations and significance of each fundamental right. (PI: 2.1.4, CO3)* 2. *Evaluate constitutional debates like UCC and reservations. (PI: 3.2.1, CO3)*	4
4	Directive Principles of State Policy (DPSP)	***Learning Objective:*** *Analyze socio-economic principles for governance and their constitutional directives.* **Content:** Justice, legal aid, Panchayati Raj, education, environment, UCC. **Self Learning Topics:** Sustainable Development Goals (SDGs) vs. DPSP. ***Learning Outcomes:***	4

Module No.	Module Name	Content	No. of Hours
		A learner will be able to: 1. *Identify key social and economic DPSPs and their impact. (PI: 3.3.1, CO3)* 2. *Compare DPSPs with Fundamental Rights. (PI: 3.2.1, CO3)*	
5	The Parliament	***Learning Objective:*** *Understand the structure and functioning of legislative bodies.* **Content:** Lok Sabha, Rajya Sabha, powers, law-making, amendment process. ***Self-Learning Topics:*** *Budget session, Parliamentary privileges.* ***Learning Outcomes:*** *A learner will be able to:* 1. *Describe how laws are introduced and passed. (PI: 1.3.2, CO4)* 2. *Explain the amendment process and bicameral structure. (PI: 1.4.2, CO4)*	4
6	Judiciary	***Learning Objective:*** *Understand the structure and jurisdiction of Indian courts.* **Contents:** Supreme Court, High Courts, Subordinate courts, Quasi-judicial bodies **Self-Learning Topics:** Judicial review, Contempt of court. ***Learning Outcomes:*** *A learner will be able to:* 1. *Describe functions of Supreme and High Courts. (PI: 1.3.1, CO1)*	4

Module No.	Module Name	Content	No. of Hours
		2. *Explain the scope of judicial independence. (PI: 1.4.2, CO4)*	
7	Elections	***Learning Objective:*** *Understand the electoral process and related constitutional provisions.* **Content:** Election Commission, Legislative elections, Court restrictions. ***Self-Learning Topics:*** *Model Code of Conduct, NOTA.* ***Learning Outcomes:*** *A learner will be able to:* 1. *Explain the powers and functions of the Election Commission. (PI: 2.1.2, CO2)* 2. *Describe the legislative role in elections. (PI: 1.4.2, CO4)*	4
8	Landmark Cases	***Learning Objective:*** *Evaluate the constitutional impact of key judicial verdicts.* **Content:** Nanavati, Shah Bano, Kesavananda Bharati, Vishakha. ***Self-Learning Topics:*** *Maneka Gandhi, Golaknath, ADM Jabalpur.* ***Learning Outcomes:*** *A learner will be able to:* 1. *Analyze the legal and social implications of landmark cases. (PI: 3.2.3, CO3)* 2. *Justify the evolving nature of constitutional interpretation. (PI: 3.3.2, CO1)*	4
Total			**30**

Suggested List of Practicals: NA

Performance Indicators:

P.I.- 1.1.1: **Remembering**: Recall key mathematical formulas and concepts relevant to engineering problems.

P.I.- 1.2.2: **Understanding**: Describe how basic science concepts apply to material behavior and engineering systems.

P.I.- 1.3.1: **Remembering**: List fundamental engineering principles (e.g., Ohm's law, Bernoulli's equation) and their applications.

P.I.- 1.3.2: **Understanding**: Explain the relevance of basic engineering principles to real-world problems.

P.I.- 1.4.2: **Understanding**: Explain the functions of specialized engineering systems in the computer engineering domain.

P.I.- 2.1.2: **Understanding**: Explain the key features and scope of a complex engineering problem.

P.I.- 2.1.3: **Applying**: Use standard problem-identification techniques (e.g., root cause analysis) to define an engineering challenge.

P.I.- 2.1.4: **Analyzing**: Decompose a complex engineering problem into its constituent parts to identify critical aspects.

P.I.- 2.2.3: **Applying**: Develop a basic solution plan using a systematic approach to solve an identified problem.

P.I.- 3.2.1: **Remembering**: List potential design approaches and tools relevant to solving the problem.

P.I.- 3.2.2: **Understanding**: Describe the principles and methodologies used to generate alternative design solutions.

P.I.- 3.2.3: **Applying**: Propose multiple design concepts addressing the problem's constraints and requirements.

P.I.- 3.3.1: **Remembering**: Identify evaluation criteria (e.g., cost, safety, sustainability) for comparing design solutions.

P.I.- 3.3.2: **Understanding**: Explain the trade-offs involved in selecting a particular design solution.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 6.1,8.2

CO2	2.1,2.2,7.1
CO3	1.2, 3.1, 3.2, 4.1, 4.2, 8.1
CO4	5.1, 5.2, 6.2, 7.2

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	3/16	-	-	-	-	2/16	-	2/16	-	-	-	-
CO2	2/16	2/16	-	-	-	2/16	-	-	-	2/16	-	-
CO3	-			-	-	2/16	-	2/16	-	2/16	1/16	-
CO4	1/16	-	-	-	-	2/16	-	2/16	-	2/16	1/16	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1.1: Recall historical origins and key objectives of the Indian Constitution (CO1) P.I. – 1.1.1,	• Identify key events in India's constitutional development. • List the objectives stated in the Constitution's Preamble. • Match key dates with associated constitutional milestones. • Recognize contributions of major figures in constitution-making.	ISA
LO1.2: Explain preamble values and their relevance (CO3) P.I. – 1.3.1	• Define each value stated in the Preamble. • Explain how values like justice and equality are reflected in policies. • Relate Preamble values to recent Supreme Court judgments. • Analyze contemporary relevance of the term "Secular" or "Republic.".	ISA
LO2.1 *Explain constitutional provisions regarding*	• Outline methods of acquiring Indian citizenship.	ISA

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
acquisition/loss of citizenship. (PI: 1.3.2, CO2)	• Explain circumstances under which citizenship is lost. • Differentiate between constitutional and statutory provisions. • Apply rules to hypothetical citizenship scenarios.	
LO 2.2*Relate duties to everyday civic behaviour. (PI: 1.4.2, CO2)*	• List the fundamental duties in the Constitution. • Connect duties to real-life civic activities (e.g., voting, cleanliness). • Evaluate consequences of ignoring civic duties. • Suggest ways to promote civic sense among citizens.	ISA
LO3.1 *Analyze the limitations and significance of each fundamental right. (PI: 2.1.4, CO3)*	• Explain scope and limits of each right (e.g., Article 19). • Compare rights with international human rights. • Interpret case law related to right restrictions. • Evaluate situations where rights clash with national interest.	ISA
LO3.2 *Evaluate constitutional debates like UCC and reservations. (PI: 3.2.1, CO3)*	• Summarize key arguments for/against UCC. • Analyze the evolution of reservation policy. • Discuss legal challenges to reservation or UCC. • Debate on future trajectories using recent case law or reports.	ISA

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 4.1 *Identify key social and economic DPSPs and their impact. (PI: 3.3.1, CO3)*	• List important DPSPs (Articles 36–51). • Match articles with real-world policies (e.g., MGNREGA). • Identify differences between enforceable rights and guidelines. • Assess how DPSPs shape legislative priorities.	ISA
LO4.2 *Compare DPSPs with Fundamental Rights. (PI: 3.2.1, CO3)*	• Create a comparison table of DPSPs vs Fundamental Rights. • Discuss conflicts in implementation (e.g., Keshavananda Bharati case). • Explain prioritization in court verdicts. • Analyze implications of non-enforceability.	ISA
LO 5.1*Describe how laws are introduced and passed. (PI: 1.3.2, CO4)*	• List stages in the legislative process. • Identify roles of both Houses during lawmaking. • Trace the journey of a recent bill. • Compare legislative procedures in different countries.	ISA
LO5.2Explain the amendment process and bicameral structure. (PI: 1.4.2, CO4)	• Distinguish between types of amendments (simple, special). • Identify Articles involved in amendment process (e.g., Art. 368). • Diagram the structure of Lok Sabha and Rajya Sabha. • Analyze a major constitutional amendment (e.g., 42nd or 44th).	ISA ISA
LO 6.1*Describe functions of Supreme and High Courts. (PI: 1.3.1, CO1)*	• List jurisdiction types: original, appellate, advisory.	ISA

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	• Compare SC and HC functions. • Identify constitutional articles relevant to judiciary (e.g., Art. 124). • Give examples of landmark judgments.	
LO 6.2 *Explain the scope of judicial independence. (PI: 1.4.2, CO4)*	• Define "judicial independence." • Discuss appointment and removal of judges. • Examine NJAC and collegium debate. • Explain separation of powers using real cases.	ISA
LO7.1 *Explain the powers and functions of the Election Commission. (PI: 2.1.2, CO2)*	• List constitutional provisions (e.g., Art. 324). • Identify roles during pre, mid, and post-election. • Evaluate EC's role in ensuring free and fair elections. • Refer to cases where EC's role was questioned.	ISA
LO 7.2 *Describe the legislative role in elections. (PI: 1.4.2, CO4)*	• Explain laws governing elections (RPA 1951). • Identify Parliament's role in electoral reforms. • Discuss model code of conduct and its implementation. • Compare role of legislature vs Election Commission.	ISA
LO8.1 Analyze the legal and social implications of landmark cases. (PI: 3.2.3, CO3)	. Summarize major rulings (e.g., Kesavananda Bharati, S.R. Bommai). • Analyze how each case shaped constitutional interpretation.	ISA

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
	• Discuss long-term social effects. • Connect with public or media response.	ISA
LO 8.2*Justify the evolving nature of constitutional interpretation. (PI: 3.3.2, CO1)*	• Explain doctrines like basic structure, harmonious construction. • Discuss the role of judicial activism. • Analyze how SC has reinterpreted the Constitution over decades. • Use case law to support dynamic interpretation..	ISA

Reference Books:

- D.C. Gupta, *Indian Government and Politics*
- D.D. Basu, *Introduction to the Constitution of India*
- P. M. Bakshi, *The Constitution of India*
- M. V. Pylee, *Constitutional History of India*

Related/ Equivalent MOOC and Associated Certification:

- NPTEL: Constitutional Studies
- Udemy: Constitution of India

Course Name: Exploring Indian Arts

Course Code: IKS03

Vertical/ Sub-Vertical: Indian Knowledge System Courses

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: Nil

Pre-requisite for: Nil

Recommended Semester: 2

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

Preamble:

This course offers a vibrant journey into the rich and diverse artistic traditions of India. Through an exploration of classical and folk forms across music, dance, visual arts, and crafts, students will gain an appreciation of India's cultural heritage and the ways in which art reflects social, historical, and spiritual contexts. Emphasizing experiential learning, the course encourages creative engagement and critical understanding of India's artistic expressions.

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to appreciate and acknowledge creativity.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Understand how they can contribute towards each type of art.	Understand
CO2	Work towards developing holistic personality through critical and creative thinking.	Apply
CO3	Complement technical knowledge by developing diversified perspectives on various aspects of learning.	Understand

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Indian Art	***Learning Objective:*** *To understand the diversity, forms, and geographical scope of Indian art in both traditional and modern contexts. (CO1)* ***Contents:*** Indian art consists of a variety of art forms, including painting, sculpture, pottery, and textile arts such as woven silk. Geographically, it spans the entire Indian Subcontinent, including what is now India, Pakistan, Bangladesh, Sri Lanka, Nepal, and at times Eastern Afghanistan. A strong sense of design is characteristic of Indian Art and can be observed in its modern and traditional forms. Discussing different types and forms in Indian Art, like Drawing, Painting, Handicraft, performing art, and the performing arts. ***Learning Outcomes:*** *A learner will be able to:* 1. *Learners will be able to describe the cultural, religious, and socio-political contexts that shaped various art traditions in India. (CO1) (P.I.* 10.1.1, 10.1.2, 12.1.2, 12.3.1) 2. *Learners will be able to differentiate between classical, folk, tribal, and modern Indian art forms. (CO1) (P.I.* 10.1.1, 10.1.2, 12.1.2, 12.3.1)	2

Module No.	Module Name	Content	No. of Hours
		3. *Learners will be able to analyze visual and performing arts using appropriate terminology and critical frameworks. (CO1) (P.I.* 10.1.3, 10.3.1, 12.3.2, 12.1.2) 4. *Learners will be able to appreciate the diversity and symbolism in Indian sculpture, painting, architecture, music, dance, and crafts. (CO1) (P.I.* 10.2.1, 10.2.2 12.3.2) 5. *Learners will be able to trace the regional variations and continuity of artistic practices across India. (CO1) (P.I.* 10.1.1, 10.1.3, 12.2.1, 12.3.1)	
2	Indian Architecture	***Learning Objective:*** *To identify and analyze the distinctive features, historical development, and cultural significance of major architectural styles in India—from ancient to contemporary periods—while understanding their influence on society, religion, and regional identity.* (CO2) **Contents:** Photos and Videos of Indian structure will be shown. Students will share their views on the same. The session starts with students will get one topic, which they must discuss with their teammates and present in front of the class. Assignments will be on architectural sites. They will choose their own topic and will present in limited time span. ***Learning Outcomes:*** *A learner will be able to:* 1. *The Learners will be able to identify key architectural styles and monuments across different periods of Indian history (e.g., Buddhist, Hindu, Jain, Islamic, Colonial, and Modern). (CO 2) (P.I.* 10.1.1, 10.1.2, 12.3.1) 2. *The Learners will be able to describe the historical, religious, and cultural contexts that shaped the evolution of Indian architecture. (CO2) (P.I.* 10.1.1 10.1.2, 12.1.2, 12.3.1) 3. *The Learners will be able to differentiate between regional architectural features and materials used*	7

Module No.	Module Name	Content	No. of Hours
		across various parts of India. (CO2) (P.I. 10.1.1, 10.1.2 12.3.1) 4. *The Learners will be able to analyze the structural elements, aesthetics, and symbolism in prominent Indian architectural works. (CO2) (P.I.* 10.1.3, 10.3.1 12.3.2, 12.1.2) 5. *The Learners will be able to trace the development of temple, stupa, mosque, palace, and fort architecture in India. (CO2) (P.I.* 10.1.1, 10.1.3, 12.2.1, 12.3.1)	
3	**Indian music and Performing Arts**	***Learning Objective:*** *To enable students to understand and appreciate the fundamental concepts, historical evolution, and cultural significance of Indian music and performing arts, while developing the ability to critically engage with various classical, folk, and contemporary forms. (CO1)* **Contents:** What is Performing Arts? 4 major streams of dance music, theatre and film. Languages, Rulers and Kings as depicted in the paintings. Students will share their native experiences and will perform for their class. ***Learning Outcomes:*** *A learner will be able to:* 1. *The Learners will be able to identify the major forms of Indian music (classical, folk, devotional) and performing arts (dance, theatre, puppetry). (CO1) (P.I.* 10.1.1 10.1.2) 2. *The Learners will be able to understand the theoretical foundations of Indian classical music and dance, including ragas, talas, and natya shastra principles. (CO1) (P.I.* 10.1.1, 10.1.2, 12.1.2) 3. *The Learners will be able to differentiate between Hindustani and Carnatic music traditions and their regional and stylistic variations. (CO1) (P.I.* 10.1.1 10.1.2)	7

Module No.	Module Name	Content	No. of Hours
		4. *The Learners will be able to describe the key elements, techniques, and expressions used in major Indian classical dance forms (e.g., Bharatanatyam, Kathak, Odissi, Kathakali). (CO1) (P.I.* 10.1.3, 10.2.2, 12.3.2) 5. *The Learners will be able to trace the historical development and cultural significance of Indian performing arts across periods. (CO1) (P.I.* 10.1.1, 10.1.3, 12.2.1)	
4	**Painting Styles and Handicrafts**	***Learning Objective:*** *To develop an understanding of the Directive Principles as guiding values for governance, and to critically assess their role in shaping social and economic policies aimed at achieving a just and equitable society. (CO3)* **Contents:** Warli Painting is a Tribal Art mostly created by the tribal people from the North Sahyadri Range in Maharashtra, India. This range encompasses cities such as Dahanu, Talasari, Jawahar, Palghar, Mokhada, and Vikramgad of Palghar district. This tribal art originated in Maharashtra, where it is still practiced today. ***Learning Outcomes:*** *A learner will be able to:* 1. *The Learners will be able to identify major traditional and regional painting styles of India, such as Madhubani, Warli, Pattachitra, Kalamkari, Tanjore, and Miniature painting. (CO3) (P.I.* 10.1.1, 10.1.2, 12.3.1) 2. *The Learners will be able to recognize key Indian handicraft traditions, including textiles, pottery, woodwork, metalwork, and jewelry-making. (CO3) (P.I.* 10.1.1, 10.1.2, 12.3.1) 3. *The Learners will be able to Describe the historical and cultural context in which various painting styles and handicrafts developed. (CO3) (P.I.* 10.1.1, 10.1.2, 12.1.2, 12.3.1)	7

Module No.	Module Name	Content	No. of Hours
		4. *The Learners will be able to Differentiate between folk, tribal, and classical painting forms and their thematic and stylistic features. (CO3) (P.I.* 10.1.1, 10.1.2, 12.3.1) 5. *The Learners will be able to Analyze the materials, techniques, and symbolism used in traditional Indian art and craft practices. (CO3) (P.I.* 10.1.3, 10.3.1, 12.3.2, 12.1.2)	
5	**Madhubani Painting**	***Learning Objective**: To enable students to understand the origin, techniques, themes, and cultural significance of Madhubani painting, and to develop basic skills in creating artworks using its traditional motifs and styles. (CO2)* **Contents:** Madhubani Painting is a style of painting practiced in the Mithila region of India and Nepal. It is named after the Madhubani district of Bihar, India (the place of its origin). Artists create this painting by using a variety of mediums including their own fingers, twigs, brushes, nib-pens, and matchsticks. The paint is created using natural dyes and pigments. The paintings are characterized by their eye-catching geometrical patterns. There is a ritual content for particular occasions, such as birth or marriage, and festivals such as Holi, Surya Shasti, Kali Puja, Upanayana, and Durga Puja. ***Learning Outcomes:*** *A learner will be able to:* 1. *The Learners will be able to understand the historical and cultural origins of Madhubani painting and its connection to the Mithila region of Bihar. (CO2) (P.I.* 10.1.1, 10.1.2, 12.1.2, 12.3.1) 2. *The Learners will be able to identify key themes and symbols traditionally used in Madhubani art, such as mythology, nature, and rituals. (CO2) (P.I.* 10.1.1, 10.1.2 12.3.1) 3. *The Learners will be able to recognize different styles within Madhubani painting (e.g., Bharni, Kachni,*	5

Module No.	Module Name	Content	No. of Hours
		Tantrik, Godna, and Kohbar). (CO2) (P.I. 10.1.1, 10.1.2 12.3.1) 4. *The Learners will be able to describe the traditional tools and materials used, including natural dyes, handmade paper, and bamboo pens.(CO2) (P.I.* 10.1.1 10.1.2, 12.3.1) 5. *The Learners will be able to demonstrate basic techniques of line drawing, border making, and motif repetition typical of Madhubani. (CO2) (P.I.* 10.3.1 10.3.2, 12.3.2)	
Total			**30**

Suggested List of Practical:

Sr No.	Suggested Topic(s)
1.	Various Quizzes (as mentioned in the syllabus copy) ***Learning Outcomes:*** *A learner will be able to:* *1.5Learners will be able to trace the regional variations and continuity of artistic practices across India. (CO1) (P.I.* 10.1.1, 10.1.3, 12.2.1, 12.3.1) *2.5The Learners will be able to trace the development of temple, stupa, mosque, palace, and fort architecture in India. (CO2) (P.I.* 10.1.1, 10.1.3, 12.2.1, 12.3.1) *3.5The Learners will be able to trace the historical development and cultural significance of Indian performing arts across periods. (CO1) (P.I.* 10.1.1, 10.1.3, 12.2.1, 12.3.1) *4.5The Learners will be able to analyze the materials, techniques, and symbolism used in traditional Indian art and craft practices. (CO3) (P.I.* 10.1.3, 10.3.1, 12.3.2, 12.1.2) *5.5The Learners will be able to demonstrate basic techniques of line drawing, border making, and motif repetition typical of Madhubani. (CO2) (P.I.* 10.3.1, 10.3.2, 12.3.2)

Performance Indicators:

P.I. 10.1.1 Understanding: Read, understand and interpret technical and non-technical information

P.I. 10.1.2 Create: Produce clear, well-constructed, and well-supported written engineering

P.I. 10.1.3 Create/Analyze: Create flow in a document or presentation - a logical progression of ideas so that the main point is clear

P.I. 10.2.1 Understand: Listen to and comprehend information, instructions, and viewpoints of others

P.I. 10.2.2 Apply/Create: Deliver effective oral presentations to technical and non-technical audiences

P.I. 10.3.1 Create: Create engineering-standard figures, reports and drawings to complement writing and presentations

P.I. 10.3.2 Apply/Create: Use a variety of media effectively to convey a message in a document or a presentation

P.I. 12.1.1 Understand: Describe the rationale for the requirement for continuing professional development

P.I. 12.1.2 Analyse: Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap

P.I. 12.2.1 Remember: Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current

P.I. 12.2.2 Understand: Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field

P.I. 12.3.1 Understand: Source and comprehend technical literature and other credible sources of information

P.I. 12.3.2 Analyze: Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 1.2,1.3,1.4, 1.5, 3.1,3.2,3.3,3.4,3.5
CO2	2.1,2.2,2.3,2.4,2.5, 5.1,5.2,5.3,5.4,5.5
CO3	4.1,4.2,4.3,4.4,4.5

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	-	-	-	-	-	-	-	-	6/25	-	4/25
CO2	-	-	-	-	-	-	-	-	5/25	-	4/25

CO3	-	-	-	-	-	-	-	-	4/25	-	2/25

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: Learners will be able to describe the cultural, religious, and socio-political contexts that shaped various art traditions in India. (CO1) (P.I. 10.1.1, 10.1.2, 12.1.2, 12.3.1)	Learners will identify and explain key regional art forms across India, highlighting their unique features, cultural contexts, and historical roots through a painting/ a song/ a folkdance. Learners will attempt a quiz on an artwork inspired by a regional Indian art form, demonstrating understanding of its visual style and traditional techniques.	ESE ISA QUIZ
LO 1.2: Learners will be able to differentiate between classical, folk, tribal, and modern Indian art forms. (CO1) (P.I. 10.1.1, 10.1.2, 12.1.2, 12.3.1)		
LO 1.3: Learners will be able to analyze visual and performing arts using appropriate terminology and critical frameworks. (CO1) (P.I. 10.1.3, 10.3.1, 12.3.2, 12.1.2)		
LO 1.4: Learners will be able to appreciate the diversity and symbolism in Indian sculpture, painting, architecture, music, dance, and crafts. (CO1) (P.I. 10.2.1, 10.2.2, 12.3.2)		
LO 1.5: Learners will be able to trace the regional variations and continuity of artistic practices across India. (CO1) (P.I. 10.1.1, 10.1.3, 12.2.1, 12.3.1)		
LO 2.1: The Learners will be able to identify key architectural styles and monuments across different periods of Indian history (e.g., Buddhist, Hindu, Jain, Islamic, Colonial, and Modern).	Learners will describe the historical development, key features, and regional styles of temple, stupa, mosque, palace, and fort architecture in India. They will analyze how these	ESE

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
(CO 2) (P.I. 10.1.1, 10.1.2, 12.3.1)	structures reflect cultural, religious, and political influences over time through paintings. Learners will attempt a quiz on one architectural form (e.g., stupa, temple, mosque, fort, or palace), showcasing its key structural and decorative elements.	ISA QUIZ
LO 2.2: The Learners will be able to describe the historical, religious, and cultural contexts that shaped the evolution of Indian architecture. (CO2) (P.I. 10.1.1, 10.1.2, 12.1.2, 12.3.1)		
LO 2.3: The Learners will be able to differentiate between regional architectural features and materials used across various parts of India. (CO2) (P.I. 10.1.1, 10.1.2, 12.3.1)		
LO2.4: The Learners will be able to analyze the structural elements, aesthetics, and symbolism in prominent Indian architectural works. (CO2) (P.I. 10.1.3, 10.3.1, 12.3.2, 12.1.2)		
LO 2.5: The Learners will be able to trace the development of temple, stupa, mosque, palace, and fort architecture in India. (CO2) (P.I. 10.1.1, 10.1.3, 12.2.1, 12.3.1)		
LO 3.1: The Learners will be able to identify the major forms of Indian music (classical, folk, devotional) and performing arts (dance, theatre, puppetry). (CO1) (P.I. 10.1.1, 10.1.2)	Learners will explain the evolution of key Indian performing arts (such as classical dance, music, and theatre) across different historical periods through dance.	ESE
LO 3.2: The Learners will be able to understand the theoretical foundations of Indian classical music and dance, including ragas, talas, and natya shastra		

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
principles. (CO1) (P.I. 10.1.1, 10.1.2, 12.1.2)	Learners will attempt a quiz on an element of a traditional Indian performing art, reflecting its style and historical context.	ISA QUIZ
LO 3.3: The Learners will be able to differentiate between Hindustani and Carnatic music traditions and their regional and stylistic variations. (CO1) (P.I. 10.1.1, 10.1.2)		
LO 3.4: The Learners will be able to describe the key elements, techniques, and expressions used in major Indian classical dance forms (e.g., Bharatanatyam, Kathak, Odissi, Kathakali). (CO1) (P.I. 10.1.3, 10.2.2, 12.3.2)		
LO 3.5: The Learners will be able to trace the historical development and cultural significance of Indian performing arts across periods. (CO1) (P.I. 10.1.1, 10.1.3, 12.2.1)		
LO 4.1: The Learners will be able to identify major traditional and regional painting styles of India, such as Madhubani, Warli, Pattachitra, Kalamkari, Tanjore, and Miniature painting. (CO3) (P.I. 10.1.1, 10.1.2, 12.3.1)	Learners will identify and explain various materials and techniques used in traditional Indian art and craft, along with the symbolic meanings behind common motifs and designs through singing/ painting. Learners will attempt a quiz on a craft or artwork based on traditional materials and techniques, demonstrating their understanding of the symbolic elements involved.	ESE ISA QUIZ
LO 4.2: The Learners will be able to recognize key Indian handicraft traditions, including textiles, pottery, woodwork, metalwork, and jewelry-making. (CO3) (P.I. 10.1.1, 10.1.2, 12.3.1)		
LO 4.3: The Learners will be able to Describe the historical and cultural context in which various painting styles and handicrafts		

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
developed. (CO3) (P.I. 10.1.1, 10.1.2, 12.1.2, 12.3.1)		
LO 4.4: The Learners will be able to Differentiate between folk, tribal, and classical painting forms and their thematic and stylistic features. (CO3) (P.I. 10.1.1, 10.1.2, 12.3.1)		
LO 4.5: The Learners will be able to Analyze the materials, techniques, and symbolism used in traditional Indian art and craft practices. (CO3) (P.I. 10.1.3, 10.3.1, 12.3.2, 12.1.2		
LO 5.1: The Learners will be able to understand the historical and cultural origins of Madhubani painting and its connection to the Mithila region of Bihar. (CO2) (P.I. 10.1.1, 10.1.2, 12.1.2, 12.3.1)	Learners will describe the fundamental techniques used in Madhubani art, including line drawing, border design, and motif repetition through Madhubani paintings.	ESE
LO 5.2: The Learners will be able to identify key themes and symbols traditionally used in Madhubani art, such as mythology, nature, and rituals. (CO2) (P.I. 10.1.1, 10.1.2, 12.3.1)	Learners will attempt a quiz on Madhubani-style artwork that includes skillful use of line drawing, border making, and repeated motifs.	ISA QUIZ
LO 5.3: The Learners will be able to recognize different styles within Madhubani painting (e.g., Bharni, Kachni, Tantrik, Godna, and Kohbar). (CO2) (P.I. 10.1.1, 10.1.2, 12.3.1)		
LO 5.4: The Learners will be able to describe the traditional tools and materials used, including natural dyes, handmade paper,		

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
and bamboo pens. (CO2) (P.I. 10.1.1, 10.1.2, 12.3.1)		
LO 5.5: The Learners will be able to demonstrate basic techniques of line drawing, border making, and motif repetition typical of Madhubani. (CO2) (P.I. 10.3.1, 10.3.2, 12.3.2)		

Reference Books:

1. Coomaraswamy, A. K. (1956). *The dance of Śiva: Fourteen Indian essays*. Dover Publications.
2. Michell, G. (1990). *The Penguin guide to the monuments of India: Volume 1: Buddhist, Jain, Hindu*. Penguin Books.
3. Ebeling, K. (1973). *The art of India: Traditions of Indian sculpture, painting and architecture*. Crown Publishers.
4. Chandra, P. (1983). *Indian art*. Thames & Hudson.
5. Varadpande, M. L. (1987). *History of Indian theatre: Volume 1*. Abhinav Publications.
6. Mitter, P. (2001). *Indian art*. Oxford University Press.
7. Kapila, V. (2002). *Textiles and weavers in South India*. Marg Publications.
8. Saraswati, H. (1975). *The sacred arts of India*. Rizzoli International Publications.
9. Vatsyayan, K. (1977). *Classical Indian dance in literature and the arts*. Sangeet Natak Akademi.
10. Khokar, M. (2001). *Traditions of Indian classical dance*. Clarion Books.
11. Jain, J. (1999). *Kalātattvakośa: A dictionary of fundamental concepts of the Indian arts (Vols. 1–6)*. Indira Gandhi National Centre for the Arts.
12. Rowell, M. (1999). *Music and musical thought in early India*. University of Chicago Press.
13. Ghosh, M. (1951). *Natyashastra (2 vols.)*. Asiatic Society of Bengal.
14. Devi, R. (1990). *Mudras in Bharata Natyam*. D. K. Printworld.
15. Singh, K. (1994). *Himalayan art*. Roli Books.

16. Craven, R. C. (1976). *Indian art: A concise history*. Thames and Hudson.
17. Das, S. K. (2005). *A history of Indian literature: 500–1399 AD*. Sahitya Akademi.
18. Goswamy, B. N. (2010). *Indian paintings in the Punjab hills*. Niyogi Books.
19. Michell, G. (2005). *Hindu art and architecture*. Thames & Hudson.
20. Lal, A. (2004). *The Oxford companion to Indian theatre*. Oxford University Press.

Related/ Equivalent MOOC and Associated Certification:

1. ***Art Appreciation: An Introduction to Indian Art***

Platform: SWAYAM – CEC
Instructor: Dr. Kakoli Gogoi (Dibrugarh University)
Link: https://onlinecourses.swayam2.ac.in/cec24_as04/preview

2. ***Introduction to Indian Art – An Appreciation***

Platform: NPTEL via SWAYAM
Instructor: Prof. Soumik Nandy Majumdar (Visva Bharati)
Link: https://onlinecourses.nptel.ac.in/noc25_hs200/preview

3. ***Indian Art: Materials, Techniques and Artistic Practices***

Platform: NPTEL via SWAYAM
Instructor: Faculty from IIT Kanpur
Link: https://onlinecourses.nptel.ac.in/noc25_hs180/preview

4. ***Folk and Minor Art in India***

Platform: NPTEL via SWAYAM
Instructor: Prof. Shatarupa Thakurta Roy (IIT Kanpur)
Link: https://onlinecourses.nptel.ac.in/noc25_hs201/preview

5. ***Modern & Contemporary Indian Art***

Platform: MAP Academy (Art & Photography Foundation)
Instructor: Dr. Beth Citron & team
Link: https://courses.mapacademy.io/courses/modern-contemporary-indian-art

Detailed Syllabus Category-HSSM and LLC

Course Name: Various Dance Forms

Course Code: CC01

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Differentiate between various dance forms

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC01	2	-	2	-
-	-		-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC01)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Various Dance Forms	Dance, Definition, History, music, rhythm. Basic understanding of the term ABHINAYA and definition of its four aspects. Technical terminology of dance. Acquaintance with the traditional costumes. Dance forms: Indian Classical dance, folk dance, Bollywood, Jazz and performances	15 15
Total			**30**

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: Corporate and Social Etiquettes

Course Code: CC02

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

In today's dynamic and multicultural workplace, technical expertise alone is not enough. Success in the professional world hinges on one's ability to communicate effectively, behave appropriately, and uphold ethical standards. The Corporate and Social Etiquettes course equips individuals with essential soft skills that foster professionalism, enhance personal branding, and build confidence in both corporate and social settings. This course bridges the gap between academic knowledge and real-world workplace behavior, preparing participants to thrive in diverse professional environments with poise, clarity, and integrity.

Course Objectives:

- To develop essential corporate communication and interpersonal etiquette for professional settings.
- To build competence in public speaking, business interactions, and ethical decision-making.
- To enhance learners' ability to apply professionalism in diverse workplace and social scenarios.

Course Outcomes:

Learners will be able to:

CO1: Demonstrate willingness to adopt professional etiquette in communication, dress, and interpersonal conduct. (Receiving → Responding)

CO2: Participate actively in professional interactions, showing respect for workplace diversity and social norms. (Responding → Valuing)

CO3: Value ethical behavior and integrity as essential components of professional identity and decision-making. (Valuing)

CO4: Integrate appropriate etiquette into routine professional practices, including interviews, meetings, and networking. (Organizing)

CO5: Exemplify professionalism and responsible conduct consistently across diverse business and social situations. (Characterizing)

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC02	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC02)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Foundations of Corporate Etiquette & Professional Image	• Importance of corporate etiquette in modern workplaces • First impressions and body language • Dressing for success: grooming and attire • Professional conduct: punctuality, workspace manners • Cross-cultural and global etiquette basics	5
2	Business Communication & Digital Etiquette	• Verbal and non-verbal communication • Active listening and empathetic speaking • Email writing and etiquette • Telephone, messaging, and video conferencing protocols • Social media and digital footprint management	5
3	Public Speaking & Presentation Skills	• Overcoming stage fright • Structure of effective speeches and presentations • Visual aids and storytelling techniques	5

Module No.	Module Name	Content	No. of Hours
		• Q&A handling and engagement strategies • Persuasive speaking for business settings	
4	Business Meetings, Networking & Social Etiquette	• Preparing for and participating in meetings • Formal introductions and small talk • Networking at events, conferences, and dinners • Exchanging business cards appropriately • Business dining and RSVP etiquette	5
5	Interview Skills & Professional Advancement	• Resume walkthroughs and professional storytelling • STAR method for answering questions • Mock interviews: HR and panel types • Follow-up etiquette (emails, thank-yous) • Career etiquette: internships, promotions, resignations	5
6	Corporate Ethics, Integrity & Capstone Project	• Defining corporate ethics and code of conduct • Conflict of interest and workplace compliance • Handling ethical dilemmas and reporting concerns • Diversity, equity, and inclusion in behavior • Course wrap-up, capstone presentations, and reflection	5
Total			**30**

Reference Books / Resources:

1. **"**Business Communication Today" by Courtland L. Bovee and John V. Thill.
2. "The Etiquette Advantage in Business: Personal Skills for Professional Success" by Peter Post, Anna Post, and Lizzie Post.
3. "Speak with Confidence: How to Prepare, Learn, and Perform Effective Public Speaking" by Jack Valenti.
4. "Cracking the Code to a Successful Interview: 15 Insider Secrets from a Top-Level Recruiter" by Evan Pellett.
5. "Ethics and the Conduct of Business" by John R. Boatright.

Course Name: Global Citizenship Education

Course Code: CC03

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

Global Citizenship Education (GCE) equips students with the understanding, skills, and values they need to cooperate in resolving interconnected global challenges and to become responsible citizens of the world. This course introduces learners to the concepts of identity, diversity, sustainability, and human rights, while enhancing cross-cultural competence and promoting social responsibility in engineering practice.

Course Objectives:

- To understand core concepts related to identity, culture, sustainability, and global interdependence.
- To nurture empathy, critical thinking, and collaborative problem-solving.
- To empower students to take informed, reflective action in both local and global contexts.

Course Outcomes:

Learners will be able to:

CO1: Describe key global issues and cultural differences and appreciate the diversity of perspectives.

CO2: Analyze how engineering solutions can promote sustainable development and equity.

CO3: Demonstrate intercultural competence, ethical reasoning, and civic responsibility in personal and professional settings.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC03	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC03)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Understanding Global Citizenship	• Identity and belonging, Global vs. Local Citizenship, Rights and Responsibilities • India: Fundamental Duties, Gandhian universal values • Activities: Identity web, Reflective essay • Case Study: Teach for India Fellows	6
2	Diversity and Intercultural Understanding	• Cultural sensitivity, Stereotypes and bias, Inclusion and equity • India: Festivals and linguistic diversity • Activities: Role-play, Bias quiz • Case Study: Infosys/Tata global team management	6
3	Sustainability and Global Interdependence	• Environmental responsibility, SDGs, Global systems (economic, political, technological) • India: Ganga Project, SDGs 6 & 13 • Activities: Carbon calculator, Development debate • Case Study: Reliance renewable initiatives	6
4	Peace, Conflict, and Human Rights	• Human rights frameworks, Non-violent communication, Case studies • India: RTI, RTE, Peace in Northeast • Activities: Landmark legal discussion, Peace circles • Case Study: Narmada Bachao Andolan	6

Module No.	Module Name	Content	No. of Hours
5	Taking Action and Civic Engagement	• Ethical decision making, Civic responsibility, social entrepreneurship, Youth action • India: Goonj, SELCO, I Change My City • Activities: Civic campaign design, Volunteering simulation • Case Study: Zomato Feeding India	6
Total			**30**

Reference Books:

As suggested by the resource person in session

Course Name: Wellness- Body, Mind and Spirit

Course Code: CC04

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

Wide platter of Liberal Learning courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world.
- To develop broad knowledge of living and non-living world
- The course aims to provide students with a comprehensive understanding of wellness, with a focus on mental, emotional, social, and spiritual dimensions.

Course Outcomes:

Learner will be able to:

CO1: Holistic Understanding of Wellness

CO2: Proficiency in Yogic Practices

CO3: Application of Wellness Principles

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC04	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC04)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content
1	Introduction to Wellness	1.1 Understanding Wellness Definition and dimensions of wellness: mental, emotional, social, spiritual Importance of achieving a balanced and holistic lifestyle 1.2 Wellness Models Exploring different models of wellness (e.g., The Wheel of Wellness) Identifying factors that contribute to overall well-being 1.3 Assessing Personal Wellness Self-assessment tools for mental, emotional, and social well-being Goal-setting for wellness improvement
2	Yoga for Mind and Spirit	2.1 Introduction to Yoga History, philosophy, and different forms of yoga Yoga as a holistic approach to well-being 2.2 Yogic Asanas (Postures) Practicing basic yoga poses for mental and spiritual benefits Alignment, breathing, and mindfulness in yoga practice

Module No.	Module Name	Content
		2.3 Meditation and Mindfulness in Yoga Incorporating meditation and mindfulness techniques into yoga Developing mental clarity and focus through yogic practices
3	Mental and Emotional Wellness	3.1 Stress Management Recognizing sources of stress Yogic techniques for stress reduction 3.2 Emotional Intelligence Applying yogic principles to enhance emotional intelligence Cultivating compassion and self-awareness through yoga 3.3 Mindfulness and Relaxation Techniques Yoga nidra and other relaxation practices Using breathwork for emotional well-being
4	Spiritual Wellness	5.1 Exploring Spirituality through Yoga Connecting with one's inner self and values through yoga Understanding the spiritual dimensions of yoga 5.2 Practices for Spiritual Wellness Meditation, chanting, and other spiritual practices in yoga Integrating spirituality into daily life
5	Integrating Yoga into Daily Life	6.1 Creating a Personal Yoga and Wellness Plan Synthesizing knowledge from previous modules Developing a comprehensive and realistic yoga and wellness plan 6.2 Overcoming Challenges Strategies for overcoming obstacles to regular yoga practice

Module No.	Module Name	Content
		Building resilience and maintaining a positive mindset through yoga 6.3 Lifelong Yoga and Wellness Habits Establishing habits for sustained well-being through ongoing yoga practice Continuing personal growth and development with yoga
		Total Hours=30

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: IQ vs EQ

Course Code: CC05

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Understand strategies to enhance EQ as it is important in their personal as well as professional success.

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC05	2	-	2	-

-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC05)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	IQ vs EQ	Introduction to Emotional Intelligence, the ability to understand, use, and manage your own emotions in positive ways to relieve stress, communicate effectively, empathize with others, overcome challenges and defuse conflict. Applications of EQ skills for mental health and wellbeing, self-awareness, self-motivation, active listening. The EQ view and Neuroscience of emotional intelligence, Intrinsic motivation and goal setting	15 15
Total			**30**

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: Nutrition and Physical Wellness

Course Code: CC06

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Adapt healthy lifestyle and focus on overall wellbeing

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC06	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC06)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Nutrition and Physical Wellness	Nutrition, Types of nutrition, Human need, Carbohydrates, proteins, vitamins, water, fats, minerals Well-balanced diet and its advantages Physical activities, daily exercises, need of stretching in working hours, best time and duration for physical activities, risk of taking supplements, dangers of following harmful fads. Physical wellness, finding time to move your body, warning sign by body, maintaining regular sleep schedule, maintaining ideal weight.	15 15
Total			**30**

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: Facets of Astronomy

Course Code: CC07

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Develop an urge to research things that occur naturally on earth and in the universe.

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC07	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC07)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Facets of Astronomy	Astrophysics: applying the laws of physics in space. Astrometry: mapping celestial bodies. Astrogeology: examining rocks, terrain, and material in space. Astrobiology: Searching for life outside Earth. Use of physics, mathematics, chemistry in astronomy Types of telescopes, Refractor Telescopes. Reflector Telescopes. Dobsonian Telescopes. Maksutov-Cassegrain Telescopes. The scientific study of celestial objects visible at night, Various celestial objects to observe.	15 15
Total			**30**

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: Railways – Wonders of Infrastructure

Course Code: CC08

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Understand reach of Indian Railways and how can engineers contribute towards it

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC08	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC08)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content
1	Railways – Wonders of Infrastructure	History of civilization, Industrial revolution, early-stage steam engine, steam powered locomotives Liverpool to Manchester railways, Economic changes brought by railways. Indian Railways, Land and bridges, electrification, telecommunication, public sector undertakings, Reforms in railway sector.
		Total Hours=30

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: Financial Literacy for Engineers

Course Code: CC09

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

Financial literacy is a crucial skill for engineers to understand and manage their personal finances efficiently and make informed decisions in their professional roles. This course aims to equip engineering students with the knowledge and skills necessary to navigate financial matters effectively.

Prerequisite: NIL

Course Objective:

1. Introduce students to fundamental financial concepts, including budgeting, saving, and investing, tailored for engineering professionals.
2. Equip students with tools to analyze costs, returns, and economic feasibility in engineering projects.
3. Teach students effective strategies for managing personal finances, including debt management and tax planning.
4. Familiarize students with investment options, portfolio diversification, and strategies for long-term wealth generation.
5. Train students to make informed financial decisions by analyzing risks, benefits, and ethical considerations.
6. Prepare students to incorporate financial insights into project planning, resource allocation, and entrepreneurial ventures.

Course Outcomes: Learner will be able to:

CO1: Understand and apply basic financial concepts in both personal and professional contexts.

CO2: Evaluate the economic viability of engineering projects using cost-benefit and break-even analyses.

CO3: Create budgets, manage debts, and plan for taxes efficiently.

CO4: Assess various investment vehicles and design diversified portfolios to achieve financial goals.

CO5: Integrate financial considerations into engineering decision-making processes.

CO6: Solve real-world financial problems using analytical tools and ethical practices.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC09	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC09)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of hrs
1	Introduction to Financial Literacy	• Importance of financial literacy for engineers, Core financial concepts: income, expenses, savings, and budgeting, Introduction to financial statements: balance sheets and income statements • Understanding the time value of money.	5
2	Engineering Economics and Project Evaluation	• Basics of Engineering Economics: cost estimation and feasibility studies • Techniques for project evaluation: Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period, Break-even analysis and decision-making under uncertainty • Case studies on financial analysis in engineering projects.	5
3	Personal Finance Management	• Budgeting methods and tools for engineers, Debt management: understanding loans, credit cards, and interest rates • Basics of tax planning for salaried and entrepreneurial engineers, Insurance: life, health, and asset protection.	5

Module No.	Module Name	Content	No. of hrs
4	Investment and Wealth Management	• Overview of investment options: stocks, bonds, mutual funds, and real estate • Principles of portfolio diversification and risk management, Retirement planning and compounding benefits • Basics of cryptocurrency and its implications for engineers.	5
5	Ethical and Sustainable Financial Practices	• Ethical considerations in financial decision-making, financial fraud prevention and awareness, Sustainable financial planning: balancing profit with social responsibility • Corporate financial ethics and accountability.	5
6	Practical Applications and Case Studies	• Real-world case studies of engineering startups and financial challenges • Hands-on workshops: budgeting, financial analysis, and investment planning • Group project: evaluating the financial viability of an engineering project • Final assessment: creating a comprehensive personal financial plan.	5
Total			**30**

Reference Books:

1. The Richest Engineer: A Story of Wealth Building Strategies for Engineers by Raj Surya
2. Financial Freedom for Engineers: A Practical Guide to Wealth Creation by Neeraj Negi
3. The Intelligent Investor by Benjamin Graham
4. Rich Dad Poor Dad by Robert Kiyosaki

Course Name: Mastering Advanced Excel

Course Code: CC10

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

Microsoft Excel has become a vital tool for data analysis, financial modelling, and decision-making across industries. This course is designed to equip learners with advanced Excel skills, enabling them to solve complex problems, streamline workflows, and create impactful visualizations. It emphasizes hands-on learning through real-world applications, fostering confidence and expertise in advanced spreadsheet techniques.

Prerequisite:

Basic knowledge of Excel, including familiarity with basic formulas, formatting, and chart creation.

Course Objective:

1. Enable students to effectively use advanced Excel functions and formulas, including logical, statistical, and lookup functions, for complex data manipulation and problem-solving.
2. Teach students to organize, filter, and analyze large datasets using tools like PivotTables, Power Query, and advanced sorting techniques.
3. Equip students with the ability to create dynamic and visually impactful charts, dashboards, and reports for data-driven decision-making.
4. Introduce students to Excel automation using Macros and VBA (Visual Basic for Applications) to improve productivity and efficiency.
5. Familiarize students with tools such as Solver, Data Tables, Scenario Manager, and advanced conditional formatting to solve real-world business problems.
6. Provide practical exposure by solving real-world business challenges and projects using advanced Excel features, fostering hands-on learning and application.

Course Outcomes: Learner will be able to:

CO1: Apply advanced formulas and functions for complex data manipulation.

CO2: Perform data analysis using tools like PivotTables, Power Query, and Power Pivot.

CO3: Automate repetitive tasks using macros and Visual Basic for Applications (VBA).

CO4: Create interactive dashboards and dynamic visualizations.

CO5: Use advanced tools to solve real-world business problems.

CO6: Optimize Excel workflows and enhance productivity.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC10	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC10)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of hrs
1	Advanced Functions and Formulas	• Logical Functions: IF, AND, OR, IFERROR • Lookup Functions: VLOOKUP, HLOOKUP, XLOOKUP, INDEX-MATCH • Text Functions: CONCATENATE, TEXT, LEFT, RIGHT, MID, TRIM • Date and Time Functions: TODAY, NOW, DATEDIF, NETWORKDAYS • Array Formulas and Dynamic Arrays: FILTER, SORT, UNIQUE, SEQUENCE	5
2	Data Analysis and Management	• Working with Large Data Sets • Sorting, Filtering, and Subtotals • Data Validation Techniques • Advanced Data Analysis Tools • PivotTables and PivotCharts • Grouping and Ungrouping Data • Power Query for Data Transformation • Scenario Analysis and Forecasting	5

Module No.	Module Name	Content	No of hrs
		• What-If Analysis: Goal Seek, Data Tables, Scenario Manager • Using Solver for Optimization	
3	Advanced Charting and Data Visualization	• Creating Dynamic Charts • Combo Charts, Waterfall Charts, Histogram, Sparklines • Interactive Dashboards • Using Slicers and Timelines • Conditional Formatting for Visual Impact • Design Principles for Effective Visualizations	5
4	Automation with Macros and VBA	• Introduction to Macros • Recording, Editing, and Running Macros • Basics of VBA Programming • VBA Editor and Debugging • Writing VBA Code: Loops, Conditional Statements, and Functions • Automating Tasks: Sending Emails, Generating Reports • Customizing Excel with VBA • User Forms and Advanced Interactivity	5
5	Advanced Excel Tools and Techniques	• Power Pivot for Data Modeling • Relationships and DAX (Data Analysis Expressions) • Protecting and Sharing Workbooks • Workbook and Worksheet Protection • Sharing and Collaboration in Excel • Time-Saving Tips • Keyboard Shortcuts • Custom Ribbon and Quick Access Toolbar	5
6	Applications and Real-World Case Studies	• Solving Business Problems: • Financial Modelling • Budgeting and Forecasting • Inventory Management • Data Cleaning and Preparation for Analysis • Case Studies: • Sales Analysis Dashboard • Employee Productivity Tracker • Project Management Templates	5
Total			**30**

Reference Books:

1. Microsoft Excel 365 Bible by Michael Alexander, Dick Kusleika, and John Walkenbach.
2. Excel 2019 Power Programming with VBA by Michael Alexander and Richard Kusleika.
3. Data Analysis with Microsoft Excel by Kenneth N. Berk and Patrick Carey.
4. Online Resources: Microsoft Learn, ExcelJet, Chandoo.org

Course Name: Personal Grooming Essentials

Course Code: CC11

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

The Personal Grooming Essentials course aims to equip students with foundational skills and knowledge to enhance their personal appearance, confidence, and social etiquette. Through a blend of theoretical concepts and practical demonstrations, students will learn the importance of personal grooming in professional and social settings. The course aligns with the National Board of Accreditation (NBA) standards as per All India Council for Technical Education (AICTE) norms, focusing on holistic development and industry relevance.

Course Objective:

1. Introduce the importance of personal grooming and its impact on self-confidence and professional image.
2. Teach effective personal hygiene practices and skincare routines tailored to different skin types and needs.
3. Provide basic knowledge and techniques for maintaining hair and applying makeup for various occasions.
4. Educate students on choosing appropriate attire for professional, casual, and formal settings.
5. Train students to project confidence through effective verbal and non-verbal communication.
6. Equip students with strategies to manage their daily grooming routine efficiently without compromising quality.

Course Outcomes: Learner will be able to:

CO1: Apply consistent grooming habits to maintain a polished and presentable appearance.

CO2: Design skincare routines suited to their individual skin types and concerns.

CO3: Demonstrate basic hairstyling and makeup application techniques for professional and social occasions.

CO4: Select clothing and accessories that align with professional, casual, and formal etiquette.

CO5: Display poise and professionalism using refined communication and body language skills.

CO6: Integrate grooming into their daily schedule effectively, balancing personal and professional commitments.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC11	2	-	2	-
-	-	-	-	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC11)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of hrs
1	Foundations of Personal Grooming	• Importance of grooming for personal and professional growth • Assessing individual grooming needs and goals, Grooming and first impressions: psychological and social impacts.	5
2	Hygiene and Skincare Essentials	• Fundamentals of personal hygiene: habits and tools • Skin types and common concerns (e.g., acne, dryness, sensitivity) • Daily skincare routines: cleansing, moisturizing, and protection • Seasonal skincare adjustments and home remedies.	5
3	Hair Care and Makeup Basics	• Hair care routines: washing, conditioning, and styling tips • Identifying hair types and selecting suitable products	5

Module No.	Module Name	Content	No of hrs
		• Basic makeup application: foundation, eyeliner, and lipstick, Day vs. evening makeup: subtle and bold looks.	
4	Dressing and Styling Etiquette	• Understanding dress codes: formal, semi-formal, business casual, and casual • Choosing clothing based on body type and occasion • Accessorizing effectively: jewelry, watches, and belts, Color coordination and fabric selection.	5
5	Communication and Body Language	• Basics of verbal communication: tone, clarity, and courtesy • Non-verbal communication: eye contact, posture, and gestures • Building confidence through body language and self-awareness, Handling criticism and feedback gracefully.	5
6	Grooming Time Management and Application	• Creating a time-efficient grooming schedule, Adapting grooming routines for travel and emergencies • Real-life practice: grooming for interviews, meetings, and events, Final project: presenting a well-groomed, confident persona.	5
Total			**30**

Reference Books:

1. The Beauty Book by Ritu Kalra.
2. The Grooming Guide by Malini Singh.
3. The Essential Guide to Grooming by Kate Smith.
4. The Science of Personal Grooming by John Taylor.

Course Name: Various Music Forms

Course Code: CC12

Vertical/ Sub-Vertical: LLC_CC

K-S-A Mapping: Knowledge, Skill & Attitude

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 1 & 2

Preamble:

Music, often referred to as the universal language of humanity, is an art form that transcends boundaries of culture, geography, and time. The study of Various Music Forms provides learners with a deep appreciation of the diverse styles and traditions that have shaped human expression. From classical compositions and folk traditions to contemporary genres, music forms are reflection of societal evolution, emotional depth, and artistic creativity. This course offers a structured exploration of music as a cultural phenomenon, an emotional outlet, and a technical discipline. Students will engage with theoretical underpinnings, historical contexts, and practical demonstrations of distinct music forms, fostering a holistic understanding of:

- Classical Music: The disciplined and structured traditions of Western and Eastern classical genres.
- Folk Music: The rich and diverse expressions of communities and their oral traditions.
- Contemporary Genres: The dynamic and evolving sounds of modern music, including pop, rock, jazz, and electronic styles.
- Global Perspectives: The cross-cultural influences and fusion trends that redefine music in the globalized world.

By connecting theory with practice, the course aims to nurture a well-rounded appreciation for the role of music in individual lives and societal frameworks. Additionally, it encourages creativity and interdisciplinary thinking, equipping students with the skills to analyze, perform, and innovate across music forms. Whether approached as a performer, composer, listener, or critic, the study of Various Music Forms is a journey through the heart of human expression and artistic legacy.

Prerequisite: NIL

Course Objective:

1. Explore the historical and cultural development of various music forms across the globe.
2. Familiarize students with the key features, instruments, and structures of various music genres.
3. Enhance students' understanding of diverse musical traditions and their cultural significance.
4. Train students to identify and interpret rhythm, melody, harmony, and texture in different music forms.

5. Inspire students to explore their musical preferences and express themselves creatively.
6. Provide students with opportunities to perform, compose, and appreciate music in different styles.

Course Outcomes:

By the end of this course, students will: Course Outcomes: Learner will be able to:

CO1: Demonstrate an understanding of fundamental music forms, including their origins, evolution, and the key characteristics that define classical, folk, popular, sacred, and contemporary music traditions.

CO2: Analyze the structures, styles, and cultural significance of classical music traditions, including their influence on modern musical compositions and performances.

CO3: Explore and interpret the cultural roots, storytelling elements, and regional diversity of folk and traditional music forms across various societies.

CO4: Examine the development of popular music genres, identifying their socio-cultural impact, influential artists, and technological advancements that shaped their evolution.

CO5: Investigate the role of sacred and spiritual music in different traditions, recognizing its significance in rituals, worship, and community bonding.

CO6: Evaluate the influence of globalization on contemporary music, exploring how cross-cultural exchanges shape modern music forms and trends worldwide.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC12	2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (CC12)	25 (33.33%)	-	50 (66.66%)	075 (100%)

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of hrs
1	Introduction to Music Forms	• Definition and purpose of music • Overview of global music forms and their evolution, • Elements of music: rhythm, melody, harmony, and texture • Introduction to Western and non-Western music traditions.	5
2	Classical Music Traditions	• Western classical music: Baroque, Classical, Romantic, and Modern eras • Indian classical music: Hindustani and Carnatic traditions, Comparison of scales, rhythms, and instruments across traditions • Case studies: iconic composers and performances.	5
3	Folk and Traditional Music	• Characteristics of folk music: oral traditions, storytelling, and communal significance • Examination of regional folk music from India, Africa, Europe, and the Americas • Role of folk music in cultural identity and preservation • Hands-on: listening and interpreting folk songs.	5
4	Popular Music Genres	• Development of popular music genres: jazz, blues, rock, pop, and hip-hop • Evolution of modern music forms like electronic, EDM, and fusion • Analysis of instrumentation, lyrics, and cultural impact, Case studies: iconic artists and albums.	5
5	Sacred and Spiritual Music	• Role of music in religion and spirituality, Chanting, hymns, and devotional music across traditions • Sacred music in Christianity, Hinduism, Islam, Buddhism, and Indigenous cultures • Exploration of the therapeutic and meditative aspects of sacred music.	5
6	Contemporary Music and Global Influences	• Influence of technology and globalization on music production and distribution • Fusion music: blending of traditional and modern styles • Cross-cultural collaborations and their impact on music innovation • Final project: creating a presentation or performance blending multiple music forms.	5
Total			**30**

Reference Books:

1. My Music, My Life by Ravi Shankar
2. The Music of India by Raghunath Panigrahi
3. Indian Classical Music and Gharana Tradition by Shubha Mudgal
4. The Oxford Encyclopaedia of the Music of India by Ashok Ranade

Course Name: Wellness: Introduction to MOJO and Yoga

Course Code: CC013

Vertical/Sub-Vertical: Liberal Learning Course

K-S-A Mapping: Attitude

Pre-requisite required: Nil

Pre-requisite for: Nil

Recommended Semester: Semester I/II

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC013	--	15	--	0.5

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	50			50

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

In the contemporary digital era, maintaining physical, mental, and emotional well-being is essential for academic success and personal growth. This course introduces students to the principles of mindfulness, happiness, yoga, meditation, emotional wellness, and healthy lifestyle practices. Through experiential learning and self-reflection, students will develop resilience, self-awareness, stress-management skills, and positive habits, enabling them to lead balanced, healthy, and fulfilling lives.

Course Objectives:

- To introduce the concepts of happiness, well-being, and their role in achieving a balanced and fulfilling life.
- To familiarize students with fundamental yoga practices, pranayama techniques, and stress management strategies.
- To promote the use of meditation and therapeutic yoga practices for enhancing concentration, memory, and overall wellness.
- To cultivate emotional well-being through self-reflection, gratitude practices, and effective emotion management.
- To encourage healthy lifestyle habits, ergonomic awareness, and physical wellness for improved productivity and quality of life.

Course Outcomes:

Learner will be able to:

Course Outcomes	Course Outcome Statement	Bloom's Level
CO1	Understand the principles of happiness and well-being to enhance personal and social quality of life.	Understand
CO2	Practice yoga postures and pranayama techniques to improve physical fitness and manage stress effectively.	Apply
CO3	Practice meditation and therapeutic yoga to enhance concentration, memory, and overall wellness.	Apply
CO4	Comprehend strategies for emotional regulation and well-being through reflection and gratitude practices.	Understand
CO5	Implement healthy lifestyle, ergonomic, and wellness practices to promote physical health in digital learning and work environments.	Remember

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours	COs Mapped
1	Introduction to MOJO	Concept of happiness and well-being, Science of happiness, Dimensions of the Happiness Index	03	CO1
2	Holistic Health Development	Basic Asanas for Flexibility and Strength, Pranayam Techniques, Yoga as a Stress Management Tool Calmness	03	CO2
3	Therapeutic Wellness	Yoga for Concentration and Memory, Suitable Yoga therapies for various ailments	03	CO3
4	Emotional Well-being	Understanding and managing emotions, Developing a Gratitude Journal and Reflection practices	03	CO4
5	Healthy Lifestyle Practices	Ways to develop Dietary Habits, Posture Correction for Digital Learners, Desk Stretches	03	CO5
Total			**15**	

Textbooks:

1. S. Lyubomirsky, *The How of Happiness: A Scientific Approach to Getting the Life You Want*. New York, NY, USA: Penguin Press, 2008.
2. M. Williams and D. Penman, *Mindfulness: A Practical Guide to Finding Peace in a Frantic World*. London, U.K.: Piatkus, 2011.
3. B. K. S. Iyengar, *Light on Yoga*. New York, NY, USA: Schocken Books, 1979.
4. Swami Vivekananda Yoga Prakashana, *The Complete Book of Yoga*. Bengaluru, India: SVYASA University Press, 2010.
5. Autobiography of a Yogi, P. Yogananda, Los Angeles, CA, USA: Self-Realization Fellowship, 2005.

Reference Books:

1. S. Achor, *The Happiness Advantage: The Seven Principles of Positive Psychology That Fuel Success and Performance at Work*. New York, NY, USA: Crown Business, 2010.
2. T. N. Hanh, *The Miracle of Mindfulness: An Introduction to the Practice of Meditation*. Boston, MA, USA: Beacon Press, 2015.
3. J. Kaplan, *The Gratitude Diaries: How a Year Looking on the Bright Side Can Transform Your Life*. New York, NY, USA: Dutton, 2015.

Online Reference Material:

1. The Science of Well-Being – Yale University: https://www.youtube.com/results?search_query=Yale+The+Science+of+Well+Being
   Covers happiness, well-being, and positive psychology concepts.
2. TED Talk: The Happy Secret to Better Work By Shawn Achor
   https://www.youtube.com/watch?v=fLJsdqxnZb0
3. Pranayama for Beginners
   https://www.youtube.com/results?search_query=pranayama+for+beginners Introduces breathing techniques for stress management
4. The Neuroscience of Gratitude
   https://www.youtube.com/results?search_query=neuroscience+of+gratitude Explains the psychological benefits of gratitude

Course Name: Wellness: Joy of Giving

Course Code: CC014

Vertical/Sub-Vertical: Liberal Learning Course

K-S-A Mapping: Attitude

Pre-requisite required: Nil

Pre-requisite for: Nil

Recommended Semester: Semester I/II

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
CC014	--	15	--	0.5

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	50	--	--	50

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Preamble:

In an increasingly competitive and individualistic world, nurturing empathy, gratitude, social responsibility, and community engagement has become essential. The course Joy of Giving aims to inspire students to discover the happiness and fulfilment that arise from contributing to society and making a positive difference in the lives of others.

The course explores various dimensions of giving, including acts of kindness, volunteerism, gratitude, environmental stewardship, corporate social responsibility, and the application of engineering knowledge for societal benefit. Through real-life examples, case studies, reflective activities, and community-oriented projects, students will develop a deeper understanding of their role as responsible citizens and change-makers.

Course Objectives:

- To introduce students to the philosophy and importance of giving.
- To explore various forms of contribution beyond monetary donations.
- To cultivate gratitude, empathy, and emotional well-being.
- To understand the role of individuals, communities, and organizations during crises.
- To promote environmental responsibility and sustainable living.

- To encourage students to use their technical knowledge and skills for societal development.

Course Outcomes:

Learner will be able to:

Course Outcomes	Course Outcome Statement	Bloom's Level
CO1	Explain the concept of Joy of Giving and its impact on individual and societal well-being.	Understand
CO2	Identify and participate in different forms of giving and community engagement.	Apply
CO3	Study examples of social responsibility and collaborative humanitarian efforts during crises.	Understand
CO4	Demonstrate awareness of environmental sustainability and responsible citizenship.	Understand
CO5	Propose solutions that utilize engineering knowledge for social impact and community welfare.	Apply

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours	COs Mapped
1	Introduction to MOJO & Joy of Giving	Meaning and philosophy of giving; Science of happiness and altruism; Joy derived from service; Introduction to community engagement; Stories of impactful givers and social change-makers.	3	CO1
2	Different Ways of Giving Back	Giving time, skills, knowledge and resources; Volunteering and community service; Mentorship and peer support; Blood donation, crowdfunding and social initiatives; Everyday acts of kindness; Designing personal giving plans.	3	CO2
3	Corporate Social Responsibility (CSR) and Global Support	Introduction to CSR, humanitarian aid and disaster response; case studies of international cooperation during crises; role of NGOs, governments and citizens during emergencies.	3	CO3
4	Giving to Nature: Environment and Sustainability	Relationship between environment and society; Sustainable development goals; Environmental responsibility; Conservation movements; The Chipko Movement and other citizen-led initiatives; Waste management, biodiversity conservation and sustainable lifestyles.	3	CO4
5	Learn – Earn – Return	Concept of giving back through professional success; Social entrepreneurship; Engineering for humanity; Technology for social good; Designing solutions for local community challenges; Service-learning projects; Creating a personal social impact roadmap.	3	CO5

Total	15	

Textbooks:

A. Grant, *Give and Take: Why Helping Others Drives Our Success*, New York, NY, USA: Viking Press, 2013.
D. Lama and H. C. Cutler, *The Art of Happiness: A Handbook for Living*, New York, NY, USA: Riverhead Books, 2009.

S. Murty, *Wise and Otherwise: A Salute to Life*, New Delhi, India: Penguin Random House India, 2013.

M. Yunus, *Building Social Business: The New Kind of Capitalism that Serves Humanity's Most Pressing Needs*, New York, NY, USA: PublicAffairs, 2010.

Reference Books:

1. P. Singer, *The Life You Can Save: How to Play Your Part in Ending World Poverty*, New York, NY, USA: Random House, 2019.
2. R. Bansal, *I Have a Dream: Inspiring Stories of People Who Followed Their Heart and Made a Difference*, New Delhi, India: Westland Publications, 2012.
3. J. Haidt, *The Happiness Hypothesis: Finding Modern Truth in Ancient Wisdom*, New York, NY, USA: Basic Books, 2006.
4. M. Seligman, *Flourish: A Visionary New Understanding of Happiness and Well-being*, New York, NY, USA: Free Press, 2012.

Online Reference Material:

1. Greater Good Science Center, University of California Berkeley – Resources on gratitude, kindness, empathy, and well-being. [Online]. Available: https://greatergood.berkeley.edu

2. United Nations Environment Programme (UNEP) – Resources on sustainability and environmental responsibility. [Online]. Available: https://www.unep.org

3. The Better India – Stories of social innovation, environmental action, and citizen-led change. [Online]. Available: https://www.thebetterindia.com

4. United Nations Volunteers (UNV) – Resources and stories on volunteerism and community engagement. [Online]. Available: https://www.unv.org