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

Computer Engineering

Semester I Scheme & 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/ she is comfortable with, and this enables lifelong 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 Programme Courses consisting of Programme 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 Courses (OEC) and Multidisciplinary Minor (MDM). 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 other institutes of repute 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, our framework offers Honors/ Minor/ Honours by Research degree in each UG 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 Computer Engineering
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

Abbreviations used in this document

1. Basic Science and Engineering Science Courses (BSES)
2. Basic Science and Engineering Science Courses>Basic Science Courses (BSES_BSC)
3. Basic and Engineering Science Courses>Engineering Science Courses (BSES_ESC)
4. Programme Courses (PC)
5. Programme Courses>Programme Core Courses (PC_PCC)
6. Programme Courses> Programme Elective Course (PC_PEC)
7. Multidisciplinary Courses (MDC)
8. Multidisciplinary Courses>Multidisciplinary Minor (MDC_MDM)
9. Multidisciplinary Courses>Open Elective (MDC_OE)
10. Skill Courses (SC)
11. Skill Courses>Vocational and Skill Enhancement Course (SC_VSEC)
12. Humanities Social Science and Management (HSSM)
13. Humanities Social Science and Management>Ability Enhancement Course (HSSM_AEC)
14. Humanities Social Science and Management>Entrepreneurship/ Economics/ Management Course (HSSM_EEMC)
15. Humanities Social Science and Management>Indian Knowledge System (HSSM_IKS)
16. Humanities Social Science and Management>Value Education Course (HSSM_VEC)
17. Experiential Learning Courses (ELC)
18. Experiential Learning Courses>Research Methodology (ELC_RM)
19. Experiential Learning Courses>Comm. Engagement Project / Field Project (ELC_CEPFP)
20. Experiential Learning Courses>Project (ELC_PRJ)
21. Experiential Learning Courses>Internship/ OJT (ELC_IOJT)
22. Liberal Learning Courses (LLC)
23. Liberal Learning Courses>Co-Curricular Courses (LLC_CC)

First Year B. Tech. Computer Engineering **Preferred 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	BSC12	Engineering Mathematics-I	NIL	BSCO3	K	3	-	-	3	20	30	50	100	
BSES_ESC	ESC01T	Engineering Graphics	NIL	PCCE06	K	2	-	-	2	15	20	40	075	
BSES_ESC	ESC01P	Engineering Graphics Lab	NIL	PCCE06	S	-	2	-	1	25	-	25	050	
BSES_ESC	ESC11T	Fundamentals of Microprocessor and Assembly Language	NIL	PCCE11, ESC08	K	2	-	-	2	15	20	40	075	Y
BSES_ESC	ESC11P	Fundamentals of Microprocessor and Assembly Language Lab	NIL	PCCE11, ESC08	S	-	2	-	1	25	-	25	050	
BSES_ESC	ESC13T	Digital Logic Circuits	NIL	ESC08	K	2	-	-	2	15	20	40	075	
BSES_ESC	ESC13P	Digital Logic Circuits Lab	NIL	ESC08	S	-	2	-	1	25	-	25	050	
SC_VSEC	VSEC01T	Structured Programming	-	PCCE01, BSEC02	K	2	-	-	2	15	20	40	075	Y
SC_VSEC	VSEC01P	Structured Programming Lab	-	PCCE01, BSEC02	S	-	2	-	1	25	-	25	050	
HSSM_AEC	AEC01T	Effective Communication	-	-	S&A	2	-	-	2	15	20	40	075	
HSSM_AEC	AEC01P	Effective Communication Lab	-	-	S&A	-	2	-	1	25	-	25	050	
LLC_CC	CCXX*	Any LLC_CC course offered	As per list below						2.5	As per list below				
Total Credits									**20.5**					

*****Selection based on the subset of courses made available by the Institute for the semester.

$Details regarding Industry-Level Certification(s) can be obtained from syllabus of respective course.

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.
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.

List of Liberal Learning_ Cocurricular Courses

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&S	2	-	-	2	25	-	50	075	
CC02	Corporate and Social Etiquettes	-	-	K&A	2	-	-	2	25	-	50	075	
CC03	Global Citizenship Education	-	-	K&A	2	-	-	2	25	-	50	075	
CC04	Wellness – Body, Mind & Spirit	-	-	K&A	2	-	-	2	25	-	50	075	
CC05	IQ vs EQ	-	-	K&A	2	-	-	2	25	-	50	075	
CC06	Nutrition and Physical Wellness	-	-	K&A	2	-	-	2	25	-	50	075	
CC07	Facets of Astronomy	-	-	K&S	2	-	-	2	25	-	50	075	
CC08	Railways - Wonders of Infrastructure	-	-	K&S	2	-	-	2	25	-	50	075	
CC09	Financial Literacy for Engineers	-	-	K&S	2	-	-	2	25	-	50	075	
CC10	Mastering Advanced Excel	-	-	K&S	2	-	-	2	25	-	50	075	
													Continued next page....
CC11	Personal Grooming Essentials	-	-	K&A	2	-	-	2	25	-	50	075	
CC12	Various Music Forms	-	-	K&S	2	-	-	2	25	-	50	075	
CC13	Wellness: Introduction to MOJO and Yoga	-	-	-	-	1	-	0.5	25	-	-	025	
CC14	Wellness: Joy of Giving	-	-	-	-	1	-	0.5	25	-	-	025	
CC15	Wellness: Sports and Hobbies	-	-	-	-	1	-	0.5	25	-	-	025	
CC16	Wellness: Nutrition and Healthy Eating	-	-	-	-	1	-	0.5	25	-	-	025	

Detailed Syllabus of First Year Semester-I

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: 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)	8	

		1.3 Apply De Moivres theorem to trigonometric identities. (CO3) **Self-Learning Topics**: Geometric representation of complex numbers		
2	Hyperbolic & Logarithmic Functions	**Contents:** Circular and hyperbolic functions, inverse functions, separation of real and imaginary parts, logarithmic functions. **Learning Objective:** 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.	7	
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)	7	

		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.		
4	Partial Differentiation and Applications	**Content:** Partial derivatives (first and higher order), composite functions, maxima and minima of 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.	8	
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)	8	

		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) 5.5 **Self-Learning Topics**: Applications of Matrix Rank in Image Processing and Network Analysis.		
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:** 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.	7	
Total			45	

Textbooks:

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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: Engineering Graphics

Course Code: ESC01T & ESC01P

Vertical/ Sub-Vertical: BESC_ESE

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Basic Geometry

Pre-requisite for: Computer Graphics, Electrical Circuit Analysis, Probabilistic Graphical Model, Biological Modelling and Simulation, Robotics in Medicine, Installation & Maintenance of Medical devices

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ES01T	2	-	2	-
ES01P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (ES01T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (ES01P)	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:* 2. *Identify the importance of engineering graphics in technical communication. (PI-1.1.2**)** (CO1)* 3. *Explain the types of quadrants and methods of projection used in engineering drawings. (PI-1.2.2**)** (CO1)* 4. *Demonstrate the use of drawing instruments and perform basic dimensioning and line work. (PI-1.3.1) (CO1)* 5. *Navigate CAD software interface, menu systems, and toolbars to create basic drawings. (PI-1.4.2**)** (CO1)*	3
2	Engineering Curve	***Learning Objective:*** Develop the ability to construct engineering curves like cycloids, involutes, and helices using standard geometric methods. *(CO3)* **Contents:**	4

		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)*	
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)* **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
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	4

		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)* 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)* 4 Demonstrate CAD operations such as drawing, modifying, copying, dimensioning, and printing a technical drawing. (*PI-1.6.1*)*(CO1)*	8
6	Isometric Views	***Learning Objective:*** Construct isometric views of blocks with planar and cylindrical features using manual and CAD drafting techniques. *(CO1, CO5).* **Contents:**	7

		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)*	
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 communication. (P.I.- 1.1.2) (CO1)	• Define engineering graphics and its purpose in communication. • Explain real-world applications of engineering drawings. • List the industries where engineering graphics is used.	ISA, MSE
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: Fundamentals of Microprocessor and Assembly Language

Course Code: ESC11T and ESC11P

Vertical/ Sub-Vertical: PC_PCC

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: NIL

Pre-requisite for: Microcontrollers and Applications, Computer Networks

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ESC11T	2	-	2	-
ESC11P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (ESC11T)	15	20	40	75
Practical (ESC11P)	25	-	25	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:

This course introduces students to the basic concepts of computer organization, memory systems, and microprocessor architecture, along with an understanding of input/output devices, buses, and peripheral interfacing. It focuses on the architecture and operation of the Intel 8086 microprocessor, including segmentation and pipelining concepts, its addressing modes, instruction set, assembler directives, and interrupt structure. The accompanying laboratory course provides hands-on experience in 8086 assembly language programming, enabling learners to understand low-level operations such as arithmetic processing, data conversion, memory manipulation, and string operations using simulation tools. Together, the theory and laboratory components build a strong foundation for advanced studies in embedded systems and computer architecture.

Course Objectives:

1. To understand the basic organisation of computer systems, including functional units, memory hierarchy, input/output devices, buses, and peripheral devices.

2. To trace the evolution of Intel microprocessors and compare the features of different processor architectures, including the internal architecture of the 8086 (Bus Interface Unit, Execution Unit, segmentation and pipelined operation).

3. To apply knowledge of 8086 addressing modes, instruction sets, and assembler directives to interpret and construct assembly-level instructions.

4. To analyse the interrupt structure of the 8086 microprocessor, including types of interrupts, the interrupt vector table, and interrupt service routines.

5. To develop, execute and debug 8086 assembly language programs - using simulation/assembler tools - for arithmetic, logical, data-conversion, memory-manipulation and string-processing tasks.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Identify and explain the functional components of a computer system, memory organization, I/O devices, buses, and peripheral devices.	Understanding
CO2	Discuss the historical development of microprocessors and differentiate between major processor architectures based on their features.	Analysing
CO3	Illustrate the 8086 architecture and interpret the roles of its major units, address formation, and segmentation scheme.	Applying
CO4	Use 8086 addressing modes, instruction sets, and assembler directives correctly in assembly language problem-solving.	Applying
CO5	Examine and implement interrupt handling concepts in 8086, including interrupt vector table usage and interrupt service routine design.	Applying
CO6	Write and debug basic 8086 assembly language programs involving data transfer, arithmetic, logical operations, branching, and looping.	Evaluating

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
01	Basics of Computer System	***Learning Objective:*** *To understand the basic organisation of a computer system, its memory hierarchy, I/O devices, buses, and peripheral devices. (CO1)*	4

		Content: Basic organization of computers, Functional block diagram of computer system, Memory hierarchy, Classification of primary and secondary memory, Common I/O device types and characteristics, Introduction to buses, Introduction to peripheral devices of computer systems. ***Learning Outcomes:*** **1.1** ***Understand:*** Identify and list the functional units of a computer system (CPU, memory, I/O, buses). (CO1) PI 1.1.1 **1.2** ***Analyze:*** Explain memory hierarchy, I/O device types and peripheral organisation. (CO1) PI 1.2.1	
02	Evolution of Microprocessors	***Learning Objective:*** *To trace the evolution of Intel microprocessors and compare the features of different processor architectures. (CO2)* **Content:** Evolution of INTEL microprocessors, Features of various processor architectures. Self-Learning Topics: Registers as binary storage elements and their different uses in microprocessor organization. ***Learning Outcomes:*** **2.1** ***Understand:*** Recall the historical evolution of Intel microprocessors. (CO2) PI 2.1.1 **2.2** ***Analyze:*** Explain the use of registers as binary storage elements in microprocessor organisation. (CO2) PI 2.2.1 **2.3** ***Apply:*** Apply comparison criteria to evaluate features of different processor architectures. (CO2) PI 2.3.1 **2.4** ***Analyze:*** Differentiate between major processor architectures based on their features. (CO2) PI 2.2.2	4
03	8086 Architecture	***Learning Objective:*** *To describe the internal architecture of the 8086 microprocessor and its address formation scheme. (CO3)* **Content:** Bus Interface Unit, Execution unit, Pipelined Architecture, Concept of Segmentation, Physical Address, Logical Address.	6

		Learning Outcomes: **3.1** ***Understand:*** Identify the Bus Interface Unit and Execution Unit of the 8086. (CO3) PI 3.1.1 **3.2** ***Analyze:*** Explain the concept of segmentation and pipelined architecture of the 8086. (CO3) PI 3.2.1 **3.3** ***Apply:*** Compute the physical address from a given segment and offset (logical address). (CO3) PI 3.3.1	
04	8086 Addressing Modes & Instruction Set	***Learning Objective:*** *To apply knowledge of 8086 addressing modes, instruction sets, and assembler directives to interpret and construct assembly-level instructions. (CO4)* **Content:** Addressing Modes, Instruction Set, Assembler Directives. ***Learning Outcomes:*** **4.1** ***Understand:*** List the addressing modes and assembler directives of the 8086. (CO4) PI 4.1.1 **4.2** ***Analyze:*** Explain the purpose of various 8086 instructions and assembler directives. (CO4) PI 4.2.1 **4.3** ***Apply:*** Apply appropriate addressing modes and instructions to interpret and construct assembly-level statements. (CO4) PI 4.4.1	6
05	8086 Interrupt Structure	***Learning Objective:*** *To analyse the interrupt structure of the 8086 microprocessor, including interrupt types, the interrupt vector table, and interrupt service routines. (CO5)* **Content:** Types of Interrupts, Interrupt Structure, Interrupt Vector Table, Interrupt Service Routine. ***Learning Outcomes:*** **5.1** ***Understand:*** List the types of interrupts supported by the 8086. (CO5) PI 5.1.1 **5.2** ***Analyze:*** Explain the organisation of the Interrupt Vector Table. (CO5) PI 5.2.1 **5.3** ***Apply:*** Design an interrupt service routine for a given interrupt. (CO5) PI 5.5.1	4

06	Assembly Language Programming	***Learning Objective:*** *To develop assembly language programs using the 8086 microprocessor by employing proper program structure, data handling, instructions, flags, and control flow mechanisms. (CO6)* **Content:** Assembly Language Programming with 8086, Program Structure and data, Core Instructions and Flags, Control Flow. ***Learning Outcomes:*** **6.1** ***Understand:*** Recall the basic structure of an 8086 assembly language program. (CO6) PI 6.1.1 **6.2** ***Analyze:*** Explain the role of flags and control-flow instructions in an ALP. (CO6) PI 6.2.1 **6.3** ***Apply:*** Write 8086 ALPs using data transfer, arithmetic and logical instructions. (CO6) PI 6.4.1 **6.4** ***Apply:*** Analyse and trace the logic of branching/looping constructs in an ALP. (CO6) PI 6.5.1 **6.5** ***Evaluate:*** Debug and validate an 8086 assembly program for correctness. (CO6) PI 6.6.1	6
		Total	**30**

Suggested List of Practical:

Sr No.	Suggested Topic(s)
1.	Study of tools used for programming of microprocessors (assembler/simulator set-up). **Learning Outcome:** A learner will be able to: 1.3 Understand: Identify and set up the simulation/assembler tools used for 8086 programming. CO1 PI-1.1.2
2.	Develop Assembly Language Program using 8086 microprocessor for addition and subtraction of 16/32-bit numbers. **Learning Outcome:** A learner will be able to: 6.6 Apply: Develop and execute an ALP for addition/subtraction of 16/32-bit numbers. CO6 PI-6.3.1

3.	Develop Assembly Language Program using 8086 microprocessor for 16-bit multiplication and 16-bit division. **Learning Outcome:** A learner will be able to: 6.7 Apply: Develop and execute an ALP for 16-bit multiplication and division. CO6 PI-6.3.2
4.	Implementation of ALP to find the smallest and largest element in a given array. Learning Outcome: A learner will be able to: 6.8 Apply: Implement an ALP to find the smallest and largest element in an array. CO6 PI-6.3.3
5.	Develop an 8086 Assembly Language Program for conversions - (a) Packed to Unpacked BCD (b) Unpacked to Packed BCD (c) Packed BCD to ASCII. Learning Outcome: A learner will be able to: 4.4 Apply: Implement an ALP for BCD/ASCII data conversions. CO4 PI-4.3.1
6.	Implementation of memory block transfer with and without use of string instruction. Learning Outcome: A learner will be able to: 4.5 Apply: Implement memory block transfer with and without string instructions. CO4 PI-4.6.1
7.	Implementation of memory block exchange with and without use of string instruction. Learning Outcome: A learner will be able to: 4.6 Apply: Implement memory block exchange with and without string instructions. CO4 PI-4.6.2
8.	8086 Assembly Language Program to count odd and even numbers from the given block of numbers. Learning Outcome: A learner will be able to: 6.9 Apply: Implement an ALP to count odd and even numbers in a given block of numbers. CO6 PI-6.3.4
9.	Implementation of ALP to sort an array in ascending and descending order. Learning Outcome: A learner will be able to: 6.10 Analyze: Implement and analyse an ALP to sort an array in ascending/descending order. CO6 PI-6.4.2
10.	Implementation of ALP to reverse the user-entered string. Learning Outcome: A learner will be able to: 6.11 Apply: Implement an ALP to reverse a user-entered string. CO6 PI-6.3.5

11.	Implementation of ALP to check if the user-entered string is a palindrome. Learning Outcome: A learner will be able to: 6.12 Analyze: Implement and analyse an ALP to check whether a string is a palindrome. CO6 PI-6.2.2
12.	Implementation of ALP to calculate the area of a circle. Learning Outcome: A learner will be able to: 4.7 Apply: Implement an ALP to calculate the area of a circle. CO4 PI-4.3.2

Performance Indicators:

PI 1.1.1: Identify and list the functional units of a computer system (CPU, memory, I/O, buses). (Remember)
PI 1.2.1: Explain memory hierarchy, I/O device types and peripheral organisation. (Understand)
PI 2.1.1: Recall the historical evolution of Intel microprocessors. (Remember)
PI 2.2.1: Explain the use of registers as binary storage elements in microprocessor organisation. (Understand)
PI 2.3.1: Apply comparison criteria to evaluate features of different processor architectures. (Apply)
PI 2.2.2: Differentiate between major processor architectures based on their features. (Analyze)
PI 3.1.1: Identify the Bus Interface Unit and Execution Unit of the 8086. (Remember)
PI 3.2.1: Explain the concept of segmentation and pipelined architecture of the 8086. (Understand)
PI 3.3.1: Compute the physical address from a given segment and offset. (Apply)
PI 4.1.1: List the addressing modes and assembler directives of the 8086. (Remember)
PI 4.2.1: Explain the purpose of various 8086 instructions and assembler directives. (Understand)
PI 4.4.1: Apply appropriate addressing modes and instructions to interpret and construct assembly-level statements. (Apply)
PI 5.1.1: List the types of interrupts supported by the 8086. (Remember)
PI 5.2.1: Explain the organisation of the Interrupt Vector Table. (Understand)
PI 5.5.1: Design an interrupt service routine for a given interrupt. (Apply)
PI 6.1.1: Recall the basic structure of an 8086 assembly language program. (Remember)
PI 6.2.1: Explain the role of flags and control-flow instructions in an ALP. (Understand)
PI 6.4.1: Write 8086 ALPs using data transfer, arithmetic and logical instructions. (Apply)
PI 6.5.1: Analyse and trace the logic of branching/looping constructs in an ALP. (Analyze)
PI 6.6.1: Debug and validate an 8086 assembly program for correctness. (Evaluate)
PI 1.1.2: Identify and set up the simulation/assembler tools used for 8086 programming. (Remember)
PI 6.3.1: Develop and execute an ALP for addition/subtraction of 16/32-bit numbers. (Apply)
PI 6.3.2: Develop and execute an ALP for 16-bit multiplication and division. (Apply)
PI 6.3.3: Implement an ALP to find the smallest and largest element in an array. (Apply)
PI 4.3.1: Implement an ALP for BCD/ASCII data conversions. (Apply)
PI 4.6.1: Implement memory block transfer with and without string instructions. (Apply)
PI 4.6.2: Implement memory block exchange with and without string instructions. (Apply)
PI 6.3.4: Implement an ALP to count odd and even numbers in a given block of numbers. (Apply)
PI 6.4.2: Implement and analyse an ALP to sort an array in ascending/descending order.

(Analyze)
PI 6.3.5: Implement an ALP to reverse a user-entered string. (Apply)
PI 6.2.2: Implement and analyse an ALP to check whether a string is a palindrome. (Analyze)
PI 4.3.2: Implement an ALP to calculate the area of a circle. (Apply)

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, 4.3, 4.4, 4.5, 4.6, 4.7
CO5	5.1, 5.2, 5.3
CO6	6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10, 6.11, 6.12

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	2/32	-	-	-	1/32	-	-	-	-	-	-
CO2	2/32	2/32	-	-	-	-	-	-	-	-	-
CO3	2/32	1/32	-	-	-	-	-	-	-	-	-
CO4	2/32	-	2/32	1/32	-	-	-	-	-	-	-
CO5	2/32	-	1/32	-	-	-	-	-	-	-	-
CO6	2/32	3/32	3/32	4/32	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1: Learning Objective: To understand the basic organisation of a computer system, its memory hierarchy, I/O devices, buses, and peripheral devices.	1.1 - Identify and list the functional units of a computer system (CPU, memory, I/O, buses).	ISA
	1.2 - Explain memory hierarchy, I/O device types and peripheral organisation.	MSE
	1.3 - Identify and set up the	LAB

	simulation/assembler tools used for 8086 programming.	
LO2: Learning Objective: To trace the evolution of Intel microprocessors and compare the features of different processor architectures.	2.1 - Recall the historical evolution of Intel microprocessors.	ISA
	2.2 - Explain the use of registers as binary storage elements in microprocessor organisation.	MSE
	2.3 - Apply comparison criteria to evaluate features of different processor architectures.	MSE
	2.4 - Differentiate between major processor architectures based on their features.	ESE
LO3: Learning Objective: To describe the internal architecture of the 8086 microprocessor and its address formation scheme.	3.1 - Identify the Bus Interface Unit and Execution Unit of the 8086.	ISA
	3.2 - Explain the concept of segmentation and pipelined architecture of the 8086.	MSE
	3.3 - Compute the physical address from a given segment and offset.	ESE
LO4: Learning Objective: To apply knowledge of 8086 addressing modes, instruction sets, and assembler directives to interpret and construct assembly-level instructions.	4.1 - List the addressing modes and assembler directives of the 8086.	ISA
	4.2 - Explain the purpose of various 8086 instructions and assembler directives.	MSE
	4.3 - Apply appropriate addressing modes and instructions to interpret/construct assembly statements.	ESE
	4.4 - Implement an ALP for BCD/ASCII data conversions.	LAB
	4.5 - Implement memory block transfer with and without string instructions.	LAB
	4.6 - Implement memory block exchange with and without string instructions.	LAB
	4.7 - Implement an ALP to calculate the area of a circle.	LAB
LO5: Learning Objective: To analyse the interrupt structure of the 8086 microprocessor, including interrupt types, the interrupt vector table, and interrupt service routines.	5.1 - List the types of interrupts supported by the 8086.	ISA
	5.2 - Explain the organisation of the Interrupt Vector Table.	MSE
	5.3 - Design an interrupt service routine for a given interrupt.	ESE

LO6: Learning Objective: To develop assembly language programs using the 8086 microprocessor by employing proper program structure, data handling, instructions, flags, and control flow mechanisms.	6.1 - Recall the basic structure of an 8086 assembly language program.	ISA
	6.2 - Explain the role of flags and control-flow instructions in an ALP.	MSE
	6.3 - Write 8086 ALPs using data transfer, arithmetic and logical instructions.	MSE
	6.4 - Analyse and trace the logic of branching/looping constructs in an ALP.	ESE
	6.5 - Debug and validate an 8086 assembly program for correctness.	ESE
	6.6 - Develop and execute an ALP for addition/subtraction of 16/32-bit numbers.	LAB
	6.7 - Develop and execute an ALP for 16-bit multiplication and division.	LAB
	6.8 - Implement an ALP to find the smallest and largest element in an array.	LAB
	6.9 - Implement an ALP to count odd and even numbers in a given block of numbers.	LAB
	6.10 - Implement and analyse an ALP to sort an array in ascending/descending order.	LAB
	6.11 - Implement an ALP to reverse a user-entered string.	LAB
	6.12 - Implement and analyse an ALP to check whether a string is a palindrome.	LAB

Tools/ Technologies/ Programming Languages learnt:

1. 8086 Assembly Language (ALP) programming
2. 8086/8085 Simulator/Emulator (e.g., EMU8086, MASM/TASM Assembler)
3. DOS/BIOS interrupt utilities and command-line debugger (DEBUG.exe)
4. Microprocessor trainer kit / 8086 development kit
5. Basic computer organisation and memory-interfacing hardware demonstration setups

Textbooks:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing.
2. A.K. Ray & K.M. Bhurchandi, Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing, Tata McGraw-Hill Education.
3. Douglas V. Hall, Microprocessors and Interfacing: Programming and Hardware, Tata McGraw-Hill Education.

Reference Books:

1. Barry B. Brey, The Intel Microprocessors: Architecture, Programming and Interfacing, Pearson Education.
2. Walter A. Triebel & Avtar Singh, The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware and Applications, Pearson Education.
3. Yu-Cheng Liu & Glenn A. Gibson, Microcomputer Systems: The 8086/8088 Family - Architecture, Programming and Design, Prentice Hall.

Related/ Equivalent MOOC and Associated Certification:

1. Microprocessors and Microcontrollers by Prof. Santanu Chattopadhyay, IIT Kharagpur
    - Platform: NPTEL / SWAYAM
    - Link: https://nptel.ac.in/courses/108105102
2. Microprocessors and Interfacing by Prof. Shaik Rafi Ahamed, IIT Guwahati
    - Platform: NPTEL / SWAYAM
    - Link: https://nptel.ac.in/courses/108103157
3. Microprocessors and Microcontrollers/Interfacing with 8086 by Prof. M. Krishna Kumar, IISc Bangalore
    - Platform: NPTEL / SWAYAM
    - Link: https://nptel.ac.in/courses/106108100
4. Tutorials on 8085/8086, memory and I/O interfacing
    - Platform: GeeksforGeeks
    - Link: https://www.geeksforgeeks.org/computer-organization-architecture/physical-memory-organisation-of-8086/

Course Name: Digital Logic Circuits

Course Code: ESC13T and ESC13P

Vertical/ Sub-Vertical: BSES_ESC

K-S-A Mapping: Knowledge

Pre-requisite required: Nil

Pre-requisite for: COA,Sem 2

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ESC13T	2	-	2	-
ESC13P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory ESC13T	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical ESC13P	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 the fundamentals of digital electronics, including number systems, logic gates, Boolean algebra, and logic simplification techniques. It enables learners to design combinational circuits and understand the operation of memory elements, counters, and registers, providing a foundation for digital system analysis and implementation

Course Objectives:

- To understand number systems and codes.
- To understand Boolean algebra and logic simplification techniques.
- To understand logic gates and digital circuits.
- To implement combinational logic circuits.
- To understand memory elements and flip-flops.
- To analyze sequential logic circuits using counters and registers.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Describe number systems, codes, and digital logic fundamentals.	Understanding
CO2	Apply Boolean algebra and K-Map techniques for logic simplification.	Applying
CO3	Design combinational logic circuits using logic gates.	Creating
CO4	Design combinational circuits using multiplexers, decoders, and encoders.	Creating
CO5	Analyze the operation of flip-flops and memory elements.	Analysing
CO6	Compare synchronous and asynchronous sequential circuits	Analysing

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
01	Number Systems and Codes	***Learning Objective:*** *To understand number systems, codes, and digital mathematical operations (CO1)* **Content**: Review of Binary, Octal and Hexadecimal Number Systems, their inter-conversion, Binary code, Gray codeand BCD code., Binary Arithmetic, Addition, Subtraction using 1's and 2'sComplement, ***Learning Outcomes:*** *A learner will be able to:* *Recall of Binary, Octal and Hexadecimal Number Systems, their inter-conversion (P.I.- 1.3.1) (CO1)* *Convert numbers between decimal, binary, octal, and hexadecimal number systems. (P.I. – 1.3.3 and 1.4.2) (CO1)* *Explain the concept of Binary code, Gray code and BCD code (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO1)* *Solve the numerical for Binary Arithmetic, Addition, Subtraction using 1's and 2'sComplement (P.I.- 2.1.3,2.2.3) (CO1)*	4
02	Logic Gates and Boolean Algebra	***Learning Objective*****:** *To understand the operations of logic gates, apply Boolean algebra principles to realize digital logic circuits using basic and universal gates and to develop ability to reduce the given expression using K-Maps. (CO2)* **Content**: Analog and Digital signals, Digital logic gates, Universal gates, Realization using NAND and	6

		NOR gates, Boolean Algebra, De Morgan's Theorem SOP and POS representation, K-Map up to four variables ***Learning Outcomes:*** *A learner will be able to:* *Define Analog and Digital signals, Logic levels and Difference between both the signals (P.I. 1.3.1) (CO2)* *Discuss operations of Digital logic gates, Universal gates, De Morgan's Theorem (P.I. 1.3.2) (CO2)* *Apply concepts of Boolean algebra to reduce the given expression. (P.I. - 2.1.3,2.2.3 ,3.2.2, 5.1.3,5.2.3) (CO2)* *Understand the concept of SOP and POS Expression (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO2)* *Apply K-Map up to four variables for minimization of logic expressions (P.I. - 2.1.3,2.2.3 ,3.2.2, 5.1.3,5.2.3) (CO2)*	
03	Combinational Logic Design using Gates	***Learning Objective:*** *To develop the ability to design and analyze fundamental combinational circuits such as adders, subtractors and comparators (CO3)* **Content**: Arithmetic Circuits: Half adder, Full adder, Carry Look ahead adder, Half Subtractor, Full Subtractor, and Comparator. ***Learning Outcomes:*** *A learner will be able to:* *Understand the operation of Half and Full Adders, Half and full Subtractors, Comparators (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO3)* *Design Arithmetic Circuits such as Half adder, Full adder, Half Subtractor, Full Subtractor and Magnitude comparators using logic gates (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO2, CO3).*	4
04	Combinational Logic Design using ICs	***Learning Objective:*** *To develop the ability to design and analyze combinational circuits using IC'S such as* Multiplexer and De-Multiplexer, encoders and decoders (CO4) **Content:** Multiplexer and De-Multiplexer, Multiplexer operations, cascading of Multiplexer, Boolean function implementation using MUX, DEMUX, Encoder and Decoder, Concept of Tri-state Logic. ***Learning Outcomes:*** *A learner will be able to:*	6

		4.1 Understand Multiplexer operations, cascading of Multiplexer, Encoder and Decoder (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO4) *Apply the concepts for Boolean function implementation using MUX and DEMUX and logic gates (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO4)* *Design combinational logic using IC's using (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO4)*	
05	Basics of Memory Elements	***Learning Objective:*** *To understand the operation and characteristics of various flip-flops and conversion of Flip flops (CO5).* **Content:** Introduction to Flip flops: RS, JK, Master slave flip flops; T & D flip flops with various triggering methods, Characteristic table, Excitation table, state transition diagram, Conversion of flip flops. ***Learning Outcomes:*** *A learner will be able to:* *Understand Flip flops: RS, JK, Master slave flip flops; T & D flip flops with various triggering methods (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO5)* *Design various flip flops by applying conversions from one flip flop to the other (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO5)*	4
06	Sequential LogicDesign	***Learning Objective:*** *To understand the operation and characteristics of shift registers, and counters, and to analyze and design various types of counters. (CO6).* **Content:** Asynchronous and Synchronous counters with State transition diagram, Up/Down, MOD N Counter, Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register ***Learning Outcomes:*** *A learner will be able to:* *6.1 Explain Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register (P.I. – 1.3.2,1.4.2 and 2.1.2) (CO6)* *Explain Asynchronous and Synchronous counters with State transition diagram, Up/Down, MOD N Counters (P.I. – 1.3.2,1.4.2 and 2.1.2) (CO6)* *Analyze and design Up/Down, MOD N Counters (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO6)*	6

Suggested List of Practical:

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 all basic logic gates operation using Universal NAND and NOR Gates. ***Learning Outcomes:*** *A learner will be able to:* *Implement EX-OR operations using universal gates. (P.I. – 13.3, 1.3.4, 2.4.3) (CO1).*
3.	Design binary to gray and gray to binary code converter using logic gates. ***Learning Outcomes:*** *A learner will be able to:* *ign binary to gray and gray to binary converter 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) (CO4).*
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) (CO5).*
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) (CO6).*
10.	Design and implementation of various real-life applications such as washing machine, Fuel tank controller ***Learning Outcomes:*** *A learner will be able to:* *Design and implementation of various real lige applications (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 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:

CO	Mapped to Learning Outcomes
CO1	1.1,1.2,1.3,1.4
CO2	2.1,2.2,2.3,2.4,2.5
CO3	3.1,3.2
CO4	4.1,4.2,4.3
CO5	5.1,5.2
CO6	6.1,6.2,6.3

Mapping of Course Outcomes with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO7	PO8	PO9	PO10	PO11	PO12
CO1	5/63	2/63	--	--	2/63	--	--	--	--	--	--
CO2	3/63	4/63	3/63	--	6/63	--	--	--	--	--	--
CO3	4/63	1/63	1/63	--	2/63	--	--	--	--	--	--
CO4	6/63	1/63	1/63	--	4/63	--	--	--	--	--	--
CO5	4/63	--	--	--	4/63	--	--	--	--	--	--
CO6	6/63	2/63	--	--	2/63	--	--	--	--	--	--

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 numbers among different number systems.	MSE ISA ESE
LO 1.3: *Explain the concept of Binary code, Gray code and BCD code (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO1)*	• 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: *Solve the numerical for Binary Arithmetic, Addition,*	• The student can do binary numbers addition and subtraction.	ISA

Subtraction using 1's and 2'sComplement (P.I.-2.1.3,2.2.3) (CO1)	• 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.	MSE ISA
LO 2.1: *Define Analog and Digital signals, Logic levels and Difference between both the signals (P.I. 1.3.1) (CO2)*	• 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: *Discuss operations of Digital logic gates, Universal gates, De Morgan's Theorem (P.I. 1.3.2) (CO2)*	• The student can 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 able to implement logical expressions using logic and universal gates.	ISA LAB MSE ESE
LO 2.3: *Apply concepts of Boolean algebra to reduce the given expression. (P.I. - 2.1.3,2.2.3 ,3.2.2, 5.1.3,5.2.3) (CO2)*	• student will be able simplify logical expressions using Boolean algebra and Demorgan's theorem. • Students can identify the use and applications of Boolean algebra and Demorgan's theorem in real-life applications or systems	LAB LAB ISA MSE ESE
LO 2.4: *Understand the concept of SOP and POS Expression (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO2)*	• Student will be able represent and simplify logical functions using SOP and POS forms. • Student will be able to represent SOP and POS functions using NAND-NAND and NOR- NOR realizations.	ISA MSE ESE ISA
LO 2.5: *Apply K-Map up to four variables for minimization of logic expressions (P.I. - 2.1.3,2.2.3 ,3.2.2, 5.1.3,5.2.3) (CO2)*	• Student will be able represent and simplify logical functions using SOP and POS forms. using K-Map.	ISA MSE ESE
LO 3.1 *Understand the operation of Half and Full Adders, Half and full Subtractors, Comparators (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO3)*	• Student will be able to understand operation of arithmetic circuits such as Half Adder, Full Adder, Half and full Subtractors. • Student will be able to understand operation of comparators using logic gates	ISA MSE ESE
LO 3.2: Design Arithmetic Circuits such as Half adder, Full adder, Half Subtractor, Full Subtractor and Magnitude comparators using logic gates (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (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 comparators using logic gates	ISA MSE ESE
LO 4.1 Understand Multiplexer operations, cascading of	• Student will be able to understand operations of multiplexers, demultiplexers, decoders,	ISA

Multiplexer, Encoder and Decoder (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO4)	encoders, cascading of multiplexers and demultiplexers. • Student will be able to identify the use and applications of multiplexers, demultiplexers in real life systems. • Student can identify the use and applications of encoders and decoders in real life applications/systems.	MSE ESE
LO 4.2 Apply the concepts for Boolean function implementation using MUX and DEMUX and logic gates (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO4)	• Student will be able to apply concepts of Boolean functions implementation using multiplexers, demultiplexers,	ISA MSE ESE LAB
LO 4.3 Design combinational logic using IC's (P.I. – 1.3.3, 1.3.4, 2.4.3 and 3.4.2) (CO4)	• Student will be able to design combinational circuits implementation using IC's	ISA MSE ESE LAB
LO 5.1 Understand Flip flops: RS, JK, Master slave flip flops; T & D flip flops with various triggering methods (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO5)	• Student will be able to Describe the operation of basic flip-flops such as RS, JK, T, D, and master-slave configurations.	ISA MSE ESE
LO 5.2 Design various flip flops by applying conversions from one flip flop to the other (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO5)	• Student will be able to Compare and perform conversion between different types of flip-flops 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-flops and their triggering types in real life applications/systems.	ISA MSE ESE LAB
LO 6.1 Explain Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register (P.I. – 1.3.2,1.4.2 and 2.1.2) (CO6)	• Student will be able to understand the operation of shift registers (SISO, SIPO, PISO, PIPO) and universal shift registers. • Student will be able to analyse and design registers (SISO, SIPO, PISO, PIPO) and universal shift registers.	ISA MSE ESE LAB
LO 6.2 Explain Asynchronous and Synchronous counters with State transition diagram, Up/Down, MOD N Counters (P.I. – 1.3.2,1.4.2 and 2.1.2) (CO6)	• Student will be able to understand and explain Asynchronous counters • Student will be able to understand and explain synchronous counters	ISA MSE ESE LAB
LO 6.3 Analyze and design Up/Down, MOD N Counters (P.I.- 1.3.2,1.4.2, 5.1.3 and 5.2.3) (CO6)	• Student will be able to design Mod-N Asynchronous counters • Student will be able to design Mod-N synchronous counters	ISA MSE ESE LAB

Tools/ Technologies/ Programming Languages learnt:

- Basic logic gates and Universal gates.
- K-Map and Boolean Logic Minimization
- Flip flops
- Multiplexer and 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:

1. Digital System Design, NPTEL Course by Prof. Goutam
   Link: https://archive.nptel.ac.in/courses/108/105/108105132/

2. Digital Systems: From Logic Gates to Processors course Offered by: Universitat Autònoma de Barcelona
   Link: https://www.coursera.org/learn/digital-systems

3. Digital Design course Offered by Harvey Mudd College
   Link: https://www.edx.org/learn/design/harvey-mudd-college-digital-design

4. Digital System Design By Prof. Neeraj Goel IIT Ropar
   Link: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ee71

Course Name: Structured Programming

Course Code: VSEC01T

Vertical/ Sub-Vertical: SC_VSEC

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: NIL

Pre-requisite for: VSEC02T (Object Oriented Programming), PCCE01T (Data Structure)

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).* **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)*	4
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:***	2

		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. *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)* 5. *Integrate selection and looping statements in C programs to solve more complex problems. (P.I. – 2.2.3) (CO2).*	6
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:*	6

		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)*	
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 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.h 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
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 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	6

		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:***

	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	-	-	-	-	-	-	-	-
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.). • Write expressions using appropriate operators based on the problem statement. • Evaluate complex expressions involving multiple operators with correct precedence and associativity.	ISA, MSE, LAB

	• 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. • Apply field width, precision, and flags to format the output appropriately. • • Debug and correct input/output statements with incorrect specifiers.	ISA, MSE, LAB
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
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
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	• Analyse a given problem and identify logical sub-tasks that can be solved independently.	ISA, LAB, ESE

function to address a subproblem (P.I. –2.1.4) (CO3, CO6)	• 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.	
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
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

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
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.	ISA, LAB

	• Solve problems involving dynamic data structures and memory access using pointer-array combinations.	
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
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:

1. E. Balagurusamy, "Programming in ANSI C", 8th Edition, McGraw Hill Education, 2019.
2. Yashavant Kanetkar, "Let Us C", 17th Edition, BPB Publications, 2023.
3. Byron Gottfried, "Programming with C", 3rd Edition, McGraw Hill Education, 2017.
4. Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Prentice Hall, 1988.
5. Ashok N. Kamthane, "Programming in C", 3rd Edition, Pearson Education, 2015.
6. P.B. Mahapatra, "Thinking in C", 1st Edition, PHI Learning, 2010.

Reference Books:

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

2. 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, AEC01P

Vertical/ Sub-Vertical: HSSM/AEC

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:*** *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)*	10

		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)* **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*	4

		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 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
5		***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	2

	Comprehension And Summarization	***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)*	
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, writing clear digital messages by using various social media platforms ***Learning Outcomes:*** *6.2 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)* *6.3 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)*	4
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:* *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)* *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)* *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								7/95	6/95		3/95
CO2							2/95	3/95	6/95		5/95
CO3							2/95		6/95		5/95
CO4					5/95			7/95	5/95		4/95
CO5									3/95		3/95
CO6					5/95		2/95	7/95	5/95		4/95

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 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)	1.1 *Learners will practice public speaking through Speech delivery to enhance both verbal and non-verbal communication*	ISA LAB
LO 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)*	1.2 *Learners will document the speech, free of plagiarism, using various plagiarism checkers.*	ISA TH
LO 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)	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
LO 2.1 Learners will be able to apply effective listening techniques to enhance understanding, retention, and	2.1 *Learners will be able to apply effective listening techniques through various listening exercises*	ISA LAB

response in various communication contexts. (CO2) (P.I. 10.2.1, 10.2.2, 12.1.1, 12.1.2, 12.2.2)		
LO 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)	2.2 *Learners will complete MOOC on TCSion for effective verbal and non-verbal communication techniques.*	MSE
LO 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)	2.3 *Learners will deliver extempore public speeches by applying key public speaking tips.*	ISA LAB
LO 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)	3.1 *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 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)	3.2 *Learners will read research papers and summarise them to improve the accuracy and clarity of their written work.*	ESE LAB
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.	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

(CO3) (P.I.10.1.2, 12.1.1, 12.1.2, 12.2.2)		
LO 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)	4.1 *Learners will confidently deliver group presentations to an audience using effective verbal and non-verbal communication techniques to engage and inform listeners.*	ISA LAB
LO 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)	4.2 *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
LO 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)	4.3 *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.*	ISA LAB
LO 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)	5.1 *Learners will make reports of the Presentations to improve their writing prowess.*	ISA TH
LO 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)	5.2 *Learners will use graphic organizers like mind maps, flow charts, and tree diagrams to visually organize information from research papers.*	ISA LAB

LO 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)	5.3 *Learners will be able to accurately summarize technical passages within a specified word limit, capturing key points clearly and concisely.*	ISA LAB
LO 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)	6.1 *Learners will make Posters using different ICT tools and give presentations.*	ISA LAB
LO 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)*	*6.2 Learners will design and share a media post or campaign (e.g., image, video, reel, or story) that communicates a clear message to a target audience. They will justify their content choices based on message clarity, platform suitability, and responsible communication practices.*	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
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 Liberal Learning Co-Curricular Courses

Course Name: Various Dance Forms

Course Code: CC01

Vertical/ Sub-Vertical: LLC_CC

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.

Pre-requisites:

NIL

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:

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

Assessment Guidelines:

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

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	08
Total			**08**

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

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.

Pre-requisites:
NIL
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:

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

Assessment Guidelines:

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

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 • Q&A handling and engagement strategies • Persuasive speaking for business settings	5
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	5

		• 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	
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

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.

Pre-requisites:
NIL

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:

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

Assessment Guidelines:

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

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
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 / Resources:

6. UNESCO (2015). Global Citizenship Education: Topics and Learning Objectives.
7. Oxfam (2015). Global Citizenship Education – A Guide for Schools.
8. Nussbaum, M. (2010). Not for Profit: Why Democracy Needs the Humanities.
9. Hicks, D. (2003). Citizenship for the Future: A Practical Classroom Guide.
10. United Nations Sustainable Development Goals Portal (https://sdgs.un.org/goals)

Course Name: Wellness: Body, Mind and Spirit

Course Code: CC04

Vertical/ Sub-Vertical: LLC_CC

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.

Pre-requisites:

NIL

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:

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

Assessment Guidelines:

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

ISA: Quizzes

ESE: Performance

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 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 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

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

Preamble:

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

Pre-requisites:

NIL

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: Demonstrate effective oral communication
CO2: Demonstrate the ability to think critically and creatively
CO3: Apply quantitative reasoning concepts and skills to solve problems
CO4: Illustrate the ability to self-reflect and access relevant ethical values

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

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment

methodology for his/her course. However, the revised 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	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

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

Preamble:

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

Pre-requisites:

NIL

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: Demonstrate effective oral communication
CO2: Demonstrate the ability to think critically and creatively
CO3: Apply quantitative reasoning concepts and skills to solve problems
CO4: Illustrate the ability to self-reflect and access relevant ethical values

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

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment

methodology for his/her course. However, the revised 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	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.

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person/subject matter expert in session

Course Name: Facets of Astronomy

Course Code: CC07

Vertical/ Sub-Vertical: LLC_CC

Preamble:

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

Pre-requisites:

NIL

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: Demonstrate effective oral communication
CO2: Demonstrate the ability to think critically and creatively
CO3: Apply quantitative reasoning concepts and skills to solve problems
CO4: Illustrate the ability to self-reflect and access relevant ethical values

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

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment

methodology for his/her course. However, the revised 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	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.

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

Preamble:

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

Pre-requisites:

NIL

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: Demonstrate effective oral communication
CO2: Demonstrate the ability to think critically and creatively
CO3: Apply quantitative reasoning concepts and skills to solve problems
CO4: Illustrate the ability to self-reflect and access relevant ethical values

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

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment

methodology for his/her course. However, the revised 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.

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

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:

Contact hours		Credits assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	75

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment

methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised 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 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.
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.
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.
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	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.
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.

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

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:

Contact hours		Credits assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	75

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised 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	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
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 • 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
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	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
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

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

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.

Prerequisite: NIL

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:

Contact hours		Credits assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	75

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised 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	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.
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.
3	Hair Care and Makeup Basics	• Hair care routines: washing, conditioning, and styling tips • Identifying hair types and selecting suitable products • 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	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.
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.

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

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 appriciate 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:

Contact hours		Credits assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	75

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised 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 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.
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.
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.
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	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.
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.

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