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

Information Technology

Programme Structure (R-2025)

(As per NEP 2020, with effect from the Academic Year 2025-26)

Preamble

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

This multidisciplinary approach will encourage learners to follow their passion and inherent interests. The learner is free to learn at a pace that he is comfortable with, and this enables 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 Program Courses consisting of core courses (PCC) of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. This vertical also includes Professional 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 professional elective courses based on industrial requirements and organizing them into tracks is a special feature of this curricula ensuring employability.

The vertical Multidisciplinary Courses consists of Open Elective (OE) courses and multidisciplinary minor (MD M) courses. Special vocational and skill development courses are included as a part of Skill courses vertical that make student capable to work in industrial environment.

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

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

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

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

Chairman, Board of Studies
Department of Information Technology
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

Abbreviations used in this document

Basic Science and Engineering Science Courses (BSES)
Basic Science and Engineering Science Courses>Basic Science Courses (BSES_BSC)
Basic and Engineering Science Courses>Engineering Science Courses (BSES_ESC)
Programme Courses (PC)
Programme Courses>Programme Core Courses (PC_PCC)
Programme Courses> Programme Elective Course (PC_PEC)
Multidisciplinary Courses (MDC)
Multidisciplinary Courses>Multidisciplinary Minor (MDC_MDM)
Multidisciplinary Courses>Open Elective (MDC_OE)
Skill Courses (SC)
Skill Courses>Vocational and Skill Enhancement Course (SC_VSEC)
Humanities Social Science and Management (HSSM)
Humanities Social Science and Management>Ability Enhancement Course (HSSM_AEC)
Humanities Social Science and Management>Entrepreneurship/ Economics/ Management Course (HSSM_EEMC)
Humanities Social Science and Management>Indian Knowledge System (HSSM_IKS)
Humanities Social Science and Management>Value Education Course (HSSM_VEC)
Experiential Learning Courses (ELC)
Experiential Learning Courses>Research Methodology (ELC_RM)
Experiential Learning Courses>Comm. Engagement Project / Field Project (ELC_CEPFP)
Experiential Learning Courses>Project (ELC_PRJ)
Experiential Learning Courses>Internship/ OJT (ELC_IOJT)
Liberal Learning Courses (LLC)
Liberal Learning Courses>Co-Curricular Courses (LLC_CC)

First Year B. Tech. Information Technology **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_ESC	BSC01	Engineering Mathematics-I	NIL	BSC03	K	3	-	-	3	20	30	50	100	
	BSC09T	Physics	NIL	NIL	K	2	-	-	2	15	20	40	075	
	BSC09P	Physics Lab	NIL	NIL	S	-	2	-	1	25	-	25	050	
	ESC04T	Fundamentals of Computer Hardware and Networking	NIL	ESC08	K	2	-	-	2	15	20	40	075	
	ESC04P	Fundamentals of Computer Hardware and Networking Lab	NIL	ESC08	S	-	2	-	1	25	-	25	050	
	ESC05T	Fundamental of Logic Circuits	NIL	ESC08	K	2	-	-	2	15	20	40	075	
	ESC05P	Fundamental of Logic Circuits Lab	NIL	ESC08	S	-	2	-	1	25	-	25	050	
SC_VSEC	VSEC01T	Structured Programming	NIL	VSEC02T PCIT01T	K	2	-	-	2	15	20	40	075	
SC_VSEC	VSEC01P	Structured Programming Lab	NIL	VSEC02T PCIT01T	S	-	2	-	1	25	-	25	050	
HSSM_AEC	AEC01T	Effective Communication	NIL	NIL	A	2	-	-	2	15	20	40	075	
HSSM_AEC	AEC01P	Effective Communication Lab	NIL	NIL	A	-	2	-	1	25	-	25	050	
LLC_CC	CCXX*	Any LLC_CC course offered	NIL	NIL	K	2	-	-	2	25	-	50	075	
Total									**20**	**245**	**130**	**425**	**800**	

*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

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%)	
LLC_CC	CC01	Various Dance Forms	NIL	NIL		2	-	-	2	25	-	50	075	
LLC_CC	CC02	Corporate and Social Etiquettes	NIL	NIL		2	-	-	2	25	-	50	075	
LLC_CC	CC03	Global Citizenship Education	NIL	NIL		2	-	-	2	25	-	50	075	
LLC_CC	CC04	Wellness – Body, Mind & Spirit	NIL	NIL		2	-	-	2	25	-	25	050	
LLC_CC	CC05	IQ vs EQ	NIL	NIL		2	-	-	2	25	-	50	075	
LLC_CC	CC06	Nutrition and Physical Wellness	NIL	NIL		2	-	-	2	25	-	25	050	
LLC_CC	CC07	Facets of Astronomy	NIL	NIL		2	-	-	2	25	-	50	075	
LLC_CC	CC08	Railways - Wonders of Infrastructure	NIL	NIL		2	-	-	2	25	-	50	075	
LLC_CC	CC09	Financial Literacy for Engineers	NIL	NIL		2	-	-	2	25	-	50	075	
LLC_CC	CC10	Mastering Advanced Excel	NIL	NIL		2	-	-	2	25	-	50	075	
LLC_CC	CC11	Personal Grooming Essentials	NIL	NIL		2	-	-	2	25	-	50	075	
LLC_CC	CC12	Various Music Forms	NIL	NIL		2	-	-	2	25	-	50	075	
Total									**24**	**300**	**-**	**600**	**850**	

First Year B. Tech. Information Technology **Preferred Semester: II**

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	BSC03	Engineering Mathematics-II	BS01	BSC05	K	3	-	-	3	20	30	50	100	
BSES_BSC	ESC01T	Engineering Graphics	NIL	PCIT03	K	2	-	-	2	15	20	40	075	
BSES_BSC	ESC01P	Engineering Graphics Lab	NIL	PCIT03	S	-	2	-	1	25	-	25	050	
BSES_ESC	ESC08	Computer Organization and Architecture	ESC04 ESC05	PCIT17	K	3	-	-	3	20	30	50	100	
SC_VSEC	VSEC02T	Object-Oriented Programming	VSEC01	PCIT01	K	2	-	-	2	15	20	40	075	
SC_VSEC	VSEC02P	Object-Oriented Programming Lab	VSEC01	PCIT01	S	-	2	-	1	25	-	25	050	
HSSM_VEC	VEC01T	Professional Skills	NIL	NIL	A	2	-	-	2	15	20	40	075	
HSSM_VEC	VEC01P	Professional Skills Lab	NIL	NIL	A	-	2	-	1	25	-	25	050	
HSSM_IKS	IKSXX*	Any HSSM_IKS course	NIL	NIL	A	2	-	-	2	25	-	50	075	
LLC_CC	CCXX*	Any LLC_CC course offered	As per list below			2	-	-	2	25	-	50	075	
Total									**19**	**210**	**120**	**395**	**675**	

*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 Indian Knowledge System Courses

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%)	
IKS	IKS01	Indian Traditional Knowledge System	NIL	NIL	A	2	-	-	2	25	-	50	075	
IKS	IKS02	Indian Constitution	NIL	NIL	A	2	-	-	2	25	-	50	075	
IKS	IKS03	Exploring Indian Art	NIL	NIL	A	2	-	-	2	25	-	50	075	
Total									**06**	**75**	**130**	**150**	**225**	

List of Liberal Learning_ Cocurricular Courses

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%)	
LLC_CC	CC01	Various Dance Forms	NIL	NIL	S	2	-	-	2	25	-	50	075	
LLC_CC	CC02	Corporate and Social Etiquettes	NIL	NIL	A	2	-	-	2	25	-	50	075	
LLC_CC	CC03	Global Citizenship Education	NIL	NIL	A	2	-	-	2	25	-	50	075	
LLC_CC	CC04	Wellness – Body, Mind & Spirit	NIL	NIL	K S A	2	-	-	2	25	-	25	050	
LLC_CC	CC05	IQ vs EQ	NIL	NIL	A	2	-	-	2	25	-	50	075	
LLC_CC	CC06	Nutrition and Physical Wellness	NIL	NIL	K A	2	-	-	2	25	-	25	050	
LLC_CC	CC07	Facets of Astronomy	NIL	NIL	K	2	-	-	2	25	-	50	075	
LLC_CC	CC08	Railways - Wonders of Infrastructure	NIL	NIL	K	2	-	-	2	25	-	50	075	
LLC_CC	CC09	Financial Literacy for Engineers	NIL	NIL	K	2	-	-	2	25	-	50	075	
LLC_CC	CC10	Mastering Advanced Excel	NIL	NIL	S	2	-	-	2	25	-	50	075	
LLC_CC	CC11	Personal Grooming Essentials	NIL	NIL	A	2	-	-	2	25	-	50	075	
LLC_CC	CC12	Various Music Forms	NIL	NIL	S	2	-	-	2	25	-	50	075	
Total									**24**	**300**	**-**	**600**	**850**	

Detailed Syllabus of First Year Semester-I

Course Name: Engineering Mathematics-I

Course Code: BSC01

Vertical/ Sub-Vertical: BSES_BSC

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Nil

Pre-requisite for: BSES_BSC03 (Engineering Mathematics-II), and higher-level mathematical courses.

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
BSC01	3	-	3	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (BSC01)	20 (~20%)	30 (~30%)	50 (~50%)	100 (100%)

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

Preamble:

This course introduces first-year students to the foundational concepts of complex numbers, hyperbolic functions, partial differentiation, and multiple integrals. Emphasis is placed on analytical problem-solving and conceptual understanding essential for future engineering applications.

Course Objectives:

- To recall and remember basics of complex numbers, differential calculus, and integral calculus.
- To understand the foundational mathematical techniques for complex numbers, partial differentiation, and multiple integrals.
- To apply these mathematical methods in solving engineering problems.
- To solve and evaluate complex problems using special functions, partial derivatives, and integration techniques.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Recall key formulas and definitions related to complex numbers, hyperbolic functions, special functions, and integral calculus.	Remembering
CO2	Explain concepts from all six modules including De Moivre's theorem, hyperbolic identities, and integration techniques.	Understanding
CO3	Apply learned techniques from complex numbers, special functions, and integration to solve engineering problems.	Applying
CO4	Analyze the structure of complex, hyperbolic, and multi-variable functions and interpret their behavior under transformations.	Analysing
CO5	Evaluate integrals, maxima/minima, and convergence of expressions using advanced calculus and special function techniques.	Evaluating
CO6	Design real-world mathematical solutions involving all six topics to support IT and engineering applications.	Creating

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Complex Numbers	***Learning Objective:*** *Understand the use of De Moivre's Theorem and the operations on complex numbers.(CO1 to CO6)* **Contents:** De Moivre's Theorem, expansion of sinnθ and cosnθ, powers and roots of complex numbers. ***Self-Learning Topics***: *Geometric representation of complex numbers* ***Learning Outcomes:*** *A learner will be able to:* *1.1 Recall De Moivres Theorem and related expansions. (P.I.- 1.1.1) (CO1)* *1.2 Explain power and roots of complex numbers. (P.I.- 1.1.1) (CO2)* *1.3 Apply De Moivres theorem to trigonometric identities. (P.I.- 2.4.1) (CO3)* *1.4 Analyze different forms of complex numbers. (P.I.- 2.4.2) (CO4)* *1.5 Evaluate powers and roots using De Moivres. (P.I.- 2.4.1) (CO5)*	7

		1.6 Design Identities using Complex Numbers. (P.I.- 3.2.1) (CO6)	
2	Hyperbolic & Logarithmic Functions	***Learning Objective:*** *Understand circular, hyperbolic and logarithmic functions for real and complex inputs.(CO1 to CO5)* **Contents:** Circular and hyperbolic functions, inverse functions, separation of real and imaginary parts, logarithmic functions. ***Learning Outcomes:*** *A learner will be able to:* *2.1 Recall definition of circular and hyperbolic functions. (P.I.- 1.1.1) (CO1)* *2.2 Explain inverse and logarithmic functions. (P.I.- 1.1.1) (CO2)* *2.3 Apply separation of real/imaginary parts in problems. (P.I.- 2.4.1) (CO3)* *2.4 Analyze properties of complex numbers). (P.I.- 2.4.2) (CO4)* *2.5 Evaluate Complex logarithmic problems. (P.I.- 2.4.1) (CO5)*	7
3	Special Functions	***Learning Objective:*** *Understand Beta and Gamma functions and learn DUIS for solving integrals. (CO1 to CO4)* ***Self-Learning Topics:*** *Applications in statistics and probability* **Contents:** Beta and Gamma functions with properties, differentiation under integral sign with constant limits. ***Learning Outcomes:*** *A learner will be able to:* *3.1 Recall properties of Beta and Gamma functions. (P.I.- 1.1.1) (CO1)* *3.2 Explain DUIS Technique. (P.I.- 2.4.1) (CO2)* *3.3 Apply Beta and gamma to solve improper integrals. (P.I.- 2.4.1) (CO3)* *3.4 Analyze the convergence conditions. (P.I.- 2.4.2) (CO4)*	7
4	Partial Differentiation & Applications	***Learning Objective:*** *Apply partial derivatives and Euler's theorem to understand functions of several variables. (CO1 to CO5)*	8

		Content: Partial derivatives (first and higher order), composite functions, Euler's theorem, maxima and minima of two-variable functions. ***Learning Outcomes:*** *A learner will be able to:* *4.1 Recall formulae for partial derivatives. (P.I.- 1.1.1) (CO1)* *4.2 Explain Eulers theorem and conditions for maxima and minima. (P.I.- 2.1.1) (CO2)* *4.3 Apply partial derivatives in two variable problems. (P.I.- 2.4.1) (CO3)* *4.4 Analyze homogeneous functions. (P.I.- 2.4.2) (CO4)* *4.5 Evaluate extreme points using conditions of maxima & minima. (P.I.- 2.4.1) (CO5)*	
5	Multiple Integrals-I	***Learning Objective:*** *Learn to solve double integrals in Cartesian and polar form and apply to real-world regions. (CO1 to CO6)* **Content:** Double integrals in Cartesian and polar forms, evaluation over specified regions. ***Learning Outcomes:*** *A learner will be able to:* *5.1 Recall Double integration concepts. (P.I.- 1.1.1) (CO1)* *5.2 Explain conversion between cartesian and polar coordinates . (P.I.- 1.1.1) (CO2)* *5.3 Apply Double Integration to Area computation. (P.I.- 2.4.1) (CO3)* *5.4 Analyze region specific integration strategies. (P.I.- 2.4.2) (CO4)* *5.5 Evaluate integral using limit transformation.(P.I.- 2.4.1) (CO5)*	8
6	Multiple Integrals-II	***Learning Objective:*** *Learn to solve double integrals in Cartesian and polar form and apply to real-world regions.* **Contents:** Evaluation of double integrals by changing the order of integration. Evaluation of double integrals by changing to polar coordinates.	8

		Learning Outcomes: *A learner will be able to:* *6.3 Identify when and why changing the order of integration is beneficial. (P.I.-2.4.1) (CO3)* *6.4 Evaluate the double integral by correctly changing the order of integration. (P.I.- 2.4.2) (CO4)*	
Total			**45**

Performance Indicators:

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

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 2.1, 3.1, 4.1, and 5.1
CO2	1.2, 2.2, 3.2, 4.2, and 5.2
CO3	1.3, 2.3, 3.3, 4.3, and 5.3 ,6.3
CO4	1.4,2.4, 3.4, 4.4 and 5.4,6.4
CO5	1.5, 2.5, 3.5, 4.5, and 5.5
CO6	1.6

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	5/26	-	-	-	-	-	-	-	-	-	-
CO2	3/26	2/26	-	-	-	-	-	-	-	-	-
CO3	-	6/26	-	-	-	-	-	-	-	-	-
CO4	-	6/26	-	-	-	-	-	-	-	-	-
CO5	-	4/26	-	-	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: *Recall De Moivres Theorem and related expansions. (P.I.- 1.1.1) (CO1)*	• The student can state De Moivre's Theorem accurately. • The student can apply De Moivre's Theorem to find powers and roots of complex numbers. • The student can recall and use identities related to trigonometric expansions from De Moivre's form.	MSE ISA ESE
LO 1.2: *Explain power and roots of complex numbers. (P.I.- 1.1.1) (CO2)*	• The student can express a complex number in polar form. • The student can calculate powers of complex numbers using De Moivre's Theorem. • The student can find all nth roots of a given complex number.	MSE ISA ESE
LO 1.3: *Apply De Moivres theorem to trigonometric identities. (P.I.- 2.4.1) (CO3)*	• The student can derive trigonometric identities using De Moivre's Theorem.	MSE ISA

	• The student can express multiple-angle formulas using powers of complex numbers. • The student correctly applies identities in solving trigonometric problems.	ESE
LO 1.4: *Analyze different forms of complex numbers. (P.I.- 2.4.2) (CO4)*	• The student can identify and convert between rectangular, polar, exponential, and trigonometric forms. • The student can compare advantages of using different forms in solving problems. • The student can interpret geometric meaning of complex numbers in various forms.	MSE ISA ESE
LO 1.5: *Evaluate powers and roots using De Moivres. (P.I.- 2.4.1) (CO5)*	• The student can write a complex number in polar/trigonometric form. • The student can correctly apply De Moivre's Theorem to compute powers of complex numbers. • The student can determine all nth roots and represent them geometrically.	MSE ISA ESE
LO 1.6: *Design Identities using Complex Numbers. (P.I.- 3.2.1) (CO6)*	• The student can construct trigonometric identities (e.g., cosnθ,sinnθ using De Moivre's Theorem. • The student is able to develop expressions for $cos^n\theta, sin^n\theta$etcetc., in terms of multiple angles. • The student can apply designed identities to simplify or solve trigonometric expressions.	MSE ISA ESE
LO 2.1: *Recall definition of circular and hyperbolic functions. (P.I.- 1.1.1) (CO1)*	• The student can define circular functions • The student can define hyperbolic functions • The student can write fundamental identities of both circular and hyperbolic functions. • The student can differentiate between circular and hyperbolic function definitions.	MSE ISA ESE
LO 2.2: *Explain inverse and logarithmic functions. (P.I.- 1.1.1) (CO2)*	• The student can define inverse trigonometric and inverse hyperbolic functions. • The student can explain properties and domains/ranges of inverse and logarithmic functions. • The student can simplify expressions involving inverse and logarithmic functions	MSE ISA ESE
LO 2.3: *Apply separation of real/imaginary parts in problems. (P.I.- 2.4.1) (CO3)*	• The student can express a complex function in terms of its real and imaginary parts.	MSE ISA

	• The student is able to separate and simplify real and imaginary components in expressions involving exponential, trigonometric, or hyperbolic forms. • The student can apply Euler's formula to extract real and imaginary parts. • The student accurately solves problems involving separation and interpretation of parts.	ESE
LO 2.4: *Analyze properties of complex numbers). (P.I.- 2.4.2) (CO4)*	• The student can state and verify properties of complex numbers (e.g., conjugate, modulus, argument, additive and multiplicative properties). • The student can analyze operations (addition, subtraction, multiplication, division) with respect to these properties. • The student can justify the behavior of complex numbers under transformation (rotation, scaling). • The student can solve problems by applying these properties meaningfully.	MSE ISA ESE
LO 2.5: *Evaluate Complex logarithmic problems. (P.I.- 2.4.1) (CO5)*	• The student can define and interpret the logarithm of a complex number. • The student can express complex logarithms in standard form using modulus and argument. • The student can evaluate principal values and branches of complex logarithmic expressions. • The student can solve problems involving logarithmic identities and conversions.	MSE ISA ESE
LO 3.1: *Recall properties of Beta and Gamma functions. (P.I.- 1.1.1) (CO1)*	• The student can define Beta and Gamma functions using their standard integral forms. • The student can write reduction formulas for both functions. • The student is able to state domain, range, and special values of these functions.	MSE ISA ESE
LO 3.2: *Explain DUIS Technique. (P.I.- 2.4.1) (CO2)*	• The student can state the steps involved in the DUIS (Double Integration Using Symmetry) technique. • The student can apply DUIS to simplify evaluation of integrals over symmetric regions. • The student can identify whether symmetry exists in a given problem. • The student can justify simplifications made using the DUIS approach.	MSE ISA ESE

LO 3.3 *Apply Beta and gamma to solve improper integrals. (P.I.-2.4.1) (CO3)*	• The student can recognize integrals that can be expressed using Beta or Gamma functions. • The student can transform improper integrals into standard Beta/Gamma form. • The student can evaluate the integrals using known results and properties. • The student can justify steps taken in converting and solving the integrals.	MSE ISA ESE
LO 3.4: *Analyze the convergence conditions. (P.I.- 2.4.2) (CO4)*	• The student can define convergence of an integral and identify types of improper integrals. • The student can determine conditions under which Beta and Gamma integrals converge. • The student can justify convergence using limits and comparison tests. • The student is able to analyze and explain why certain integrals diverge.	MSE ISA ESE
LO 4.1: *Recall formulae for partial derivatives. (P.I.-1.1.1) (CO1)*	• The student can define a partial derivative of a function of two or more variables. • The student can state standard formulae for first and second-order partial derivatives. • The student can differentiate functions partially with respect to one variable, treating others as constants. • The student can recall and apply symmetry of mixed partial derivatives under continuity conditions.	MSE ISA ESE
LO 4.2: *Explain Eulers theorem and conditions for maxima and minima. (P.I.-2.1.1) (CO2)*	• The student can state and explain Euler's theorem for homogeneous functions. • The student can verify Euler's theorem for given functions. • The student can apply first and second derivative tests to identify maxima and minima of functions of two variables. • The student can justify the use of conditions (like the discriminant test) in classifying critical points.	MSE ISA ESE
LO 4.3: *Apply partial derivatives in two variable problems. (P.I.-2.4.1) (CO3)*	• The student can compute partial derivatives for functions of two variables. • The student can apply partial derivatives to solve problems involving total derivative, chain rule, and tangent planes. • The student can solve engineering-related problems using two-variable functions and partial differentiation.	MSE ISA ESE

LO 4.4: *Analyze homogeneous functions. (P.I.- 2.4.2) (CO4)*	• The student can define a homogeneous function and identify its degree. • The student can verify homogeneity of a given function. • The student can apply Euler's theorem to homogeneous functions. • The student can analyze properties and behavior of homogeneous functions in problem-solving.	MSE ISA ESE
LO 4.5: *Evaluate extreme points using conditions of maxima & minima. (P.I.- 2.4.1) (CO5)*	• The student can find critical points by setting first-order partial derivatives to zero. • The student can apply second-order partial derivative test • The student can classify critical points as maxima, minima, or saddle points. • The student can solve application-based problems involving extreme values.	MSE ISA ESE
LO 5.1: *Recall Double integration concepts. (P.I.- 1.1.1) (CO1)*	• The student can define double integration and explain its geometric meaning. • The student can recall the standard notation and order of integration. • The student can differentiate between definite and indefinite double integrals. • The student can identify regions of integration from given limits.	MSE ISA ESE
LO 5.2: *Explain conversion between cartesian and polar coordinates . (P.I.- 1.1.1) (CO2)*	• The student can state formulas for converting between Cartesian and polar coordinates. • The student can transform limits and integrands correctly during coordinate conversion. • The student can explain when and why polar coordinates are preferred. • The student can solve basic examples involving change of coordinates.	MSE ISA ESE
LO 5.3: *Apply Double Integration to Area computation. (P.I.- 2.4.1) (CO3)*	• The student can set up and evaluate double integrals to compute area. • The student can choose appropriate limits based on bounded regions. • The student can apply the concept to regular and irregular regions. • The student can verify results by alternate methods (if applicable).	MSE ISA ESE
LO 5.4: *Analyze region specific integration strategies. (P.I.- 2.4.2) (CO4)*	• The student can sketch and interpret regions bounded by curves. • The student can decide appropriate order of integration (dy dx or dx dy). • The student can handle piecewise regions with variable limits.	MSE ISA ESE

	• The student can justify strategies used for solving region-based problems.	
LO 5.5: *Evaluate integral using limit transformation. (P.I.- 2.4.1) (CO5)*	• The student can transform integration limits from one coordinate system to another. • The student can re-express integrands appropriately in new coordinates. • The student can solve integrals accurately after transformation.	MSE ISA ESE
LO 6.3: *Identify when and why changing the order of integration is beneficial. (P.I.-2.4.1) (CO3)*	• The student can identify regions where changing the order simplifies computation. • The student can explain the need for changing order when integration becomes difficult in the original form. • The student can recognize limitations of one order of integration over another. • The student can justify the switch using region analysis and limits.	MSE ISA ESE
LO 6.4: *Evaluate the double integral by correctly changing the order of integration. (P.I.- 2.4.2) (CO4)*	• The student can sketch the integration region accurately to determine new limits. • The student can rewrite the integral with correct new limits and integrand. • The student can solve the integral correctly after changing the order. • The student can verify the result with the original order if required.	MSE ISA ESE

Tools/ Technologies/ Programming Languages learnt:



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

Textbooks:

1. Higher Engineering Mathematics, Ramana B V, Tata McGraw Hill, 12th edition.
2. Linear Algebra, Seymour Lipschitz, Schaum's Outline 2012, 6th edition.

Reference Books:

1. Higher Engineering Mathematics, Dr. B. S Grewal, Khanna Publication, 9th edition.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Ltd, 9th edition.
3. Engineering Marhematics, Srimanta Pal and Subodh, C. Bhunia, Oxford University Press, 1st edition.
4. Advanced Engineering Mathematics, H.K.Das, S. Chand, 17th edition, 2008.

Related/ Equivalent MOOC and Associated Certification:

1. MATLAB on Ramp
    - Platform: MATLAB
    - Link: https://matlabacademy.mathworks.com/details/matlab-onramp/gettingstarted
2. MATLAB Fundamentals
    - Platform: MATLAB
    - Link: https://matlabacademy.mathworks.com/details/matlab-fundamentals/mlbe
3. Advanced calculus for Engineers
    - Platform: NPTEL (Swayam)- IIT Kharagpur
    - Link: https://onlinecourses.nptel.ac.in/noc25_ma77/preview
4. Advanced Engineering Mathematics
    - Platform: NPTEL (Swayam)- IIT Roorkee
    - Link: https://onlinecourses.nptel.ac.in/noc25_ma85/preview

Course Name: Physics

Course Code: BSC09T and BSC09P

Vertical/ Sub-Vertical: BSES_BSC

K-S-A Mapping: Knowledge

Pre-requisite required: Vector calculus, differential equations, and linear algebra., Basic 12th standard Physics.

Pre-requisite for: Memory devices, Digital Circuit, Magnetism, Semiconductor devices-LED, Photocells, solar cells, Diodes and Transistors**.**

Recommended Semester: 1 and 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
BSC09T	2	-	2	-
BSC09P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (BSC09T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (BSC09P)	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 students to the understanding of fundamental principles of Semiconductor Physics, Optics Laser, Optical Fibre, Fundamentals of Quantum Physics and their engineering applications. It also provides problem solving experience in semiconductor physics, in both the classroom and the laboratory learning environment. It will motivate the students through practical examples that demonstrates the role of physics in progress of engineering disciplines, so as to inculcate the interdisciplinary academic environment.

Course Objectives:

To impart fundamental and applied knowledge of modern physics concepts including semiconductors, wave optics, lasers, fibre optics, quantum mechanics, and sensor physics, focusing on their practical applications in engineering and technology.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Definitions: Fermi level, mobility, Hall effect, numerical aperture, de Broglie wavelength, PT100, piezoelectricity, photodiode, spontaneous emission, etc. - Equations: Schrödinger's equation, interference formulas, laser coefficients, etc.	Remembering
CO2	Working of semiconductors and optoelectronic devices - Interference and diffraction phenomena - Population inversion and LASER types - Total internal reflection, optical fibre principles - Quantum principles and wave-particle duality	Understanding
CO3	Calculate: ‣ Hall voltage, carrier mobility ‣ Fringe width, wavelength via Newton's rings/grating ‣ NA, V-number, number of fibre modes ‣ Energy levels in quantum wells ‣ Light intensity, temperature with sensors	Applying
CO4	Compare forward/reverse-biased junctions using Fermi diagrams - Interpret interference patterns for different film shapes - Differentiate LASERs based on construction and applications - Analyse phase and group velocity effects - Classify optical fibres based on mode and NA	Analysing
CO5	Assess sensor performance (accuracy, sensitivity) - Evaluate optical system (e.g., fibre link, grating resolution) - Choose appropriate LASER or optical method for given tasks - Judge experimental setup efficiency (e.g., surface flatness testing)	Evaluating

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
01	Semiconductors Physics	***Learning Objective:*** *To understand the fundamental properties of semiconductors, carrier dynamics, and working principles of optoelectronic devices. (CO1, CO2, CO3)* **Content**: Fermi level, Fermi dirac distribution, Fermi energy level in intrinsic & extrinsic semiconductors, effect of impurity concentration and temperature on fermi level, mobility, current density, Hall Effect, Fermi Level diagram for p-n junction (unbiased, forward bias, reverse bias), Semiconducting devices: LED, Solar Cell, Photo diode ***Learning Outcomes:***	6

		1.1 ***Remember****: Define and explain Fermi level and band structure. (CO1) PI 1.2.1* *1.2* ***Understand****: Explain the behavior of semiconductors under doping and temperature effects. (CO2 PI 1.2.1* *1.3* ***Apply****: Demonstrate Hall Effect and compute carrier concentration and mobility. (CO3) PI 2.4.1, 2.4.2* *1.4* ***Analyze****: Analyze the I–V characteristics of LED, solar cell, and photodiode. (CO3) PI 2.4.2* *1.5* ***Evaluate****: Evaluate the performance of semiconductor devices under varying conditions. (CO3) PI 2.4.4*	
02	Interference and Diffraction	***Learning Objective*****:** *To comprehend wave interference and diffraction principles and apply them in optical measurements and surface analysis. (CO1, CO2, CO3, CO4)* **Content**: Interference by division of amplitude, Interference in thin film of constant thickness due to reflected and transmitted light, Wedge shaped film, Newton's rings, Applications of interference – Determination of thickness of very thin wire or foil, refractive index of liquid, wavelength of incident light, testing of surface flatness, Anti-reflecting films and highly reflecting film. Diffraction: Fraunhofer diffraction at single slit, Diffraction Grating, resolving power of a grating, Determination of wavelength of light using plane transmission grating. ***Learning Outcomes:*** *2.1* ***Remember****: Explain interference by thin films and diffraction grating theory. (CO1) PI 1.2.1* *2.2* ***Understand****: Interpret Newton's rings and wedge film patterns. (CO2) PI- 4.1.2 |* *2.3* ***Apply****: Perform calculations for wavelength, refractive index, and surface flatness. (CO3) PI-4.1.2, 4.6.4* *2.4* ***Analyze****: Compare and analyze different interference and diffraction configurations. (CO4) PI-4.6.4* *2.5* ***Evaluate****: Evaluate the accuracy of experimental optical techniques. (CO4) PI-4.6.2, 4.6.4*	6

03	LASER	***Learning Objective*:** *To learn the physics of LASER action, types of LASERs, and their practical applications in optics and imaging. (CO1, CO2, CO3, CO4)* **Content**: Spontaneous emission and stimulated emission, metastable state, Population inversion, types of pumping, resonant cavity, Einstein's equations, Helium Neon LASER, Nd-YAG LASER, Semiconductor LASER, Applications of LASER- Holography ***Learning Outcomes:*** 1. ***Remember**: Explain spontaneous and stimulated emission. (CO1) PI- 1.3.1* 2. ***Understand**: Describe population inversion, pumping types, and resonant cavities. (CO2) PI-1.3.1* 3. ***Apply**: Perform LASER-based experiments and explain holography applications. (CO3) PI-5.2.2* 4. ***Analysis**: Compare construction and applications of different LASER types. (CO4)-PI-5.2.2.* 5. ***Evaluation**: Evaluate the effectiveness of LASERs for specific applications. (CO4) PI- 5.2.2*	4
04	Fibre Optics	***Learning Objective:** To understand the principles of light propagation in optical fibres and their use in communication systems. (CO1, CO2, CO3)* **Content**: Numerical Aperture for step index fiber; critical angle; angle of acceptance; V number; number of modes of propagation; types of optical fibres. Application: Fiber optic communication system. ***Learning Outcomes:*** *4.1 **Remember**: Define numerical aperture, critical angle, and V-number. (CO1) PI-1.2.1* *4.2 **Understand**: Describe propagation of light and fibre modes. (CO2) PI-1.2.1* *4.3 **Apply**: Calculate NA, V-number, and number of propagation modes. (CO3) PI- 2.4.1* *4.4 **Analyze**: Differentiate types of optical fibres and their communication roles. (CO4) PI-2.4.2* *4.5 **Evaluate**: Assess suitability of fibre optics in various systems. (CO4) PI-2.4.4*	4

05	Quantum Physics	***Learning Objective*:** *To grasp the core concepts of quantum mechanics, including matter waves, uncertainty, and quantum confinement. (CO1, CO2, CO3, CO5)* **Content**: De Broglie hypothesis of matter waves; properties of matter waves; wave packet, phase velocity and group velocity; Wave function; Physical interpretation of wave function; Heisenberg uncertainty principle; nonexistence of electron in nucleus; Schrodinger's time dependent wave equation; time independent wave equation; Particle trapped in one dimensional infinite potential well. ***Learning Outcomes:*** *5.1* ***Remember****: Recall de Broglie hypothesis and Heisenberg's uncertainty principle. (CO1) PI- 1.2.1* *5.2* ***Understand****: Explain wave-particle duality and Schrödinger's wave equations. (CO2) PI- 1.2.1* *5.3* ***Apply****: Solve Schrödinger's equation for a 1D potential well. (CO3) PI- 2.4.1* *5.4* ***Analyze****: Interpret wave functions and energy level diagrams. (CO4) PI- 2.4.2* *5.5* ***Evaluate****: Evaluate the quantum mechanical models for their physical relevance. (CO5) PI- 2.4.4*	6

06	Physics of Sensors	***Learning Objective*:** *To learn the working principles of resistive, piezoelectric, and optical sensors and their calibration techniques. (CO1, CO2, CO4)* **Content**: Resistive sensors: Temperature measurement: PT100 construction, calibration, Piezoelectric transducers: Concept of piezoelectricity, use of piezoelectric transducer as ultrasonic generator and application of ultrasonic transducer for distance measurement. Optical sensor: Photodiode, construction and use of photodiode as ambient light measurement and flux. ***Learning Outcomes:*** *6.1* ***Remember****: Identify types and working principles of PT100, piezoelectric, and photodiode sensors. (CO1) PI- 1.4.1* *6.2* ***Understand****: Explain sensor calibration and configuration techniques. (CO2) PI- 1.4.1* *6.3* ***Apply****: Operate and test sensors in practical settings. (CO3) PI-5.2.2* *6.4* ***Analyze****: Analyze sensor outputs and identify limitations. (CO4) PI-5.2.2*	4

		6.5 ***Evaluate**: Evaluate sensors for specific applications based on sensitivity and accuracy. (CO4) PI- 5.3.2*	
Total			**30**

Suggested List of Practical:

Sr No.	Suggested Topic(s)
1.	Determination of diameter of wire/hair or thickness of paper using Wedge shape film method. ***Learning Outcome:*** *A learner will be able to:* *Apply interference concept to determine small thickness of a wedge film.CO2* *P.I-1.2.1, 2.4.1*
2.	Determination of refractive index of water using Newton's Ring. ***Learning Outcome:*** *A learner will be able to:* *Analyse Newton's rings to calculate refractive index of a liquid. CO2* *P.I.-4.1.2, 4.6.4*
3.	Study of Hall Effect. ***Learning Outcome:*** *A learner will be able to:* *Apply Hall effect principles to determine carrier type and mobility. CO1* *P.I-1.2.1, 2.4.2*
4.	Determination of energy band gap of semiconductor. ***Learning Outcome:*** *A learner will be able to:* *Calculate the band gap of a semiconductor using temperature vs current graph.CO1* *P.I-2.4.1, 2.4.4*
5.	Study of I/V characteristics of LED. ***Learning Outcome:*** *A learner will be able to:* *Analyse the electrical behaviour of an LED to identify threshold voltage.CO1, CO3* *P.I.-1.3.1, 2.4.2*
6.	Determination of 'h' using Photocell. ***Learning Outcome:*** *A learner will be able to:* *Determine Planck's constant using photoelectric effect and graphical analysis.CO5* *P.I-2.4.1, 2.4.2*

7.	Study of I/ V characteristics of semiconductor diode ***Learning Outcome:*** *A learner will be able to:* *Analyse the behaviour of a semiconductor diode under forward/reverse bias. CO1* *P.I-1.3.1, 2.4.2*
8.	Determination of wavelength using Diffraction grating. (Hg/Na source) ***Learning Outcome:*** *A learner will be able to:* *Calculate the wavelength of light using diffraction grating and known light sources. CO2* *P.I-1.2.1, 4.1.2*
9.	Determination of number of lines on the grating surface using LASER Source. ***Learning Outcome:*** *A learner will be able to:* *Calculate number of lines on a grating using LASER diffraction.CO3* *P.I-5.2.2*
10.	Determination of Numerical Aperture of an optical fibre. ***Learning Outcome:*** *A learner will be able to:* *Measure numerical aperture and acceptance angle of a fibre.CO4* *P.I- 1.2.1, 2.4.1*
11.	Determination of wavelength using Diffraction grating. (Laser source) ***Learning Outcome:*** *A learner will be able to:* *Determine wavelength of LASER using diffraction method. CO3* *P.I-5.2.2*
12.	Study of divergence of laser beam. ***Learning Outcome:*** *A learner will be able to:* *Analyze divergence angle of a LASER beam through experimental setup.CO3* *P.I-5.2.2*
13.	Determination of refractive index of water using Laser source. ***Learning Outcome:*** *A learner will be able to:* *Evaluate refractive index of water using angle of incidence/refraction with LASER.CO2* *P.I-4.6.2, 4.6.4*

Performance Indicators:

P.I-1.2.1: Apply laws of natural science

P.I-1.3.1: Apply engineering fundamentals

P.I-2.4.1 – 2.4.4: Apply mathematics, analyze results, conclude

P.I-4.1.2, 4.6.2, 4.6.4: Design and analyze experiments

P.I-5.2.2: Use discipline-specific tools

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 2.1 ,3.1, 4.1, 5.1, 6.1
CO2	1.2, 2.2, 3.2, 4.2, 5.2, 6.2
CO3	1.3, 1.4, 1.5, 2.3, 3.3, 4.3, 5.3, 6.3
CO4	2.4, 2.5, 3.4, 3.5, 4.4, 4.5, 5.4, 6.4, 6.5
CO5	5.5

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	4/48	-	-	-	-	-	-	-	-	-	-
CO2	3/48	-	-	-	-	-	-	-	-	-	-
CO3	2/48	-	-	-	-	-	-	-	-	-	-
CO4	2/48	-	-	-	-	-	-	-	-	-	-
CO5	1/48	-	-	-	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1: Students will be able to explain Fermi level behavior, analyze semiconductor properties, and describe the operation of devices like LEDs, solar cells, and photodiodes	1.1-Define and explain Fermi level and band structure.	,MSE
	1.2 Analyze doping effects and carrier mobility.	ISA
	1.3 Demonstrate Hall effect setup and data analysis.	MS
	1.4 Explain LED/solar cell operation with diagrams.	ESE
	1.5 Perform lab experiments on diode characteristics	LAB
LO2: ***Learning Objective:*** *To comprehend wave interference and diffraction principles and apply them in optical measurements and surface analysis.*	2.1-Explain interference by thin films.	ESE
	2.2- Analyze Newton's rings and wedge film results.	ISA
	2.3- Describe diffraction grating theory.	MSE
	2.4- Calculate wavelength, thickness, or refractive index.	MSE
	2.5 - Perform Newton's ring and grating experiments.	LAB
LO3: ***Learning Objective:*** *To learn the physics of LASER action, types of LASERs, and their practical applications in optics and imaging.*	3.1- Explain spontaneous/stimulated emission.	MSE
	3.2- Compare types of lasers: HeNe, Nd:YAG, semiconductor.	ISA
	3.3 - Explain population inversion and pumping methods.	MSE
	3.4- Apply LASER principles in holography discussion.	ESE
	3.5 - Perform LASER-based experiments (divergence, grating).	LAB
LO4 ***Learning Objective:*** *To understand the principles of light propagation in optical fibres and their use in communication systems*	4.1- Calculate numerical aperture, V-number, acceptance angle.	MSE
	4.2- Explain light propagation and modes in fibres.	ESE
	4.3- Classify step-index vs graded-index fibres.	MSE
	4.4- Describe fibre communication block diagram.	ISA
	4.5- Perform NA and fibre optic demo.	LAB
LO5: ***Learning Objective:*** *To grasp the core concepts of quantum mechanics, including matter waves, uncertainty, and quantum confinement.*	5.1- Explain de Broglie hypothesis and wave-particle duality.	MSE
	5.2- Apply Schrödinger's equation to particle in a box.	ESE
	5.3- Use Heisenberg's principle in atomic models.	ISA

	5.4- Plot and interpret wave functions and energy levels.	MSE
	5.5- Conduct lab on Planck's constant or photoelectric effect.	LAB
LO6: ***Learning Objective:*** *To learn the working principles of resistive, piezoelectric, and optical sensors and their calibration techniques*	6.1- Explain PT100, piezoelectric and photodiode sensors.	ESE
	6.2- Demonstrate calibration and operation principles.	LAB
	6.3- Analyse output and measurement accuracy.	ISA
	6.4- Discuss sensor suitability for different applications.	MSE
	6.5- Perform lab on PT100, photodiode, piezo sensors	LAB

Tools/ Technologies/ Programming Languages learnt:

1. Semiconductor Physics: Semiconductor Kits
2. Interference and Diffraction: Optical Bench Setup (Newton's Rings, Wedge Film), Diffraction Grating Setup + Spectrometer
3. LASER: He-Ne Laser
4. Fibre Optics: Fibre Optic Trainer Kit, NA Measurement Setup
5. Quantum Physics: Mathematica / MATLAB / Python (NumPy)
6. Physics of Sensors: Ultrasonic Distance Sensors, Photodiode Circuits + Lux Meters, Arduino

Textbooks:

1. Engineering Physics, Kshirsagar and Avdhanulu, S-Chand Publications.
2. Engineering Physics, Gaur and Gupta, Dhanpat Rai Publications.
3. Engineering Physics, Rajendra Kumar, Tata McGraw Hill.
4. A Textbook of Engineering Physics, S. O. Pillai, New Age International Publishers.

Reference Books:

1. Solid State Electronic Devices- B. G. Streetman, Prentice Hall Publisher, B. G. Streetman, Prenticee Hall.
2. Modern Engineering Physics, Vasudeva, S. Chand.
3. Optics by Brij Lal and Subramaniam-S. Chand.
4. Concepts of Modern Physics, Arther Beiser, Tata McGraw Hill.
5. A Textbook of Engineering Physics, S. O. Pillai, New Age International Publishers.
6. Principles of Quantum Mechanics, R Shankar, John Wiley & Sons.

Related/ Equivalent MOOC and Associated Certification:

5. Semiconductor Devices by Columbia University
    - Platform: Coursera
    - Link: https://www.ee.columbia.edu/content/semiconductor-device-physics

6. Applied Optics By Prof. Akhilesh Kumar Mishra | IIT Roorkee

- Platform: SWAYAM
- Link: https://onlinecourses.nptel.ac.in/noc23_ph41/preview
-

7. Laser and Photonics by University of Colorado Boulder
    - Platform: Coursera
    - Link: https://www.colorado.edu/ecee/academics/online-programs/ms-ee-coursera/curriculum/photonics-and-optics

8. Fiber-Optic Communication Systems and Techniques, IIT Kanpur by Dr. Pradeep Kumar K
    - Platform: NPTEL (National Programme on Technology Enhanced Learning)
    - Link: https://nptel.ac.in/courses/108104113

9. Quantum Mechanics by University
    - Platform: Coursera
    - Link: https://www.coursera.org/learn/quantum-mechanics

10. Introduction to Sensors by University of Colorado Boulder
    - Platform: Coursera
    - Link: https://www.coursera.org/learn/sensors-circuit-interface

Course Name: Fundamentals of Computer hardware and networking

Course Code: ESC04T & ESC04P

Vertical/ Sub-Vertical: BSES_ESC

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: NIL

Pre-requisite for: Computer organization and Architecture, Microprocessor, Computer Network

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ESC04T	2	-	2	-
ESC04P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (ESC04T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (ESC04P)	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:

Study of computer hardware describes the basic structure of computer system and different ways of communicating with I/O devices and standard I/O interfaces. Network Fundamentals course provides the learners a clear understanding of how computer networks from local area networks to the massive and global Internet are built, how they allow computers to share information and communicate with one another. This course covers the physical aspects of computer hardware and computer networks.

Course Objectives:

- To introduce physical components and devices of a general-purpose computer
- To provide in-depth knowledge of the functions of different parts of computers
- To focus on balance between access time and cost in storage devices
- To introduce learners with the science of connectivity and networking between computing devices

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	To understand the organization and architecture of computer systems	Understanding
CO2	To understand memory management of computer system	Analysing
CO3	To understand input-output organization.	Understanding
CO4	To introduce concepts and fundamentals of data communication and computer networks	Understanding
CO5	Understand the concept of different communication medium	Evaluating
CO6	Understand networking concepts with reference to different types of models and topologies, study of different networking device.	Applying

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Fundamentals of computer system	***Learning Objective:*** Develop the ability to analyse different memory systems and their performance parameters. *(CO1)* **Contents:** Introduction, Basic orgnization of computer, Functional block diagram of computer system. ***Self-Learning Topics****: NIL* ***Learning Outcomes:*** *A learner will be able to:* 1.1 Students can understand technological evolutions of computers in terms of processor Mfg. main memory and secondary memory technology, as well as hardware and software features of computer evolutions. (CO1) (PI 1.3.1,1.4.1,2.1.2) 1.2 Students will learn block level functioning of computer systems.(CO1) (PI 1.4.1,2.2.1,2.3.1)	4
2	Memory	***Learning Objective:*** Develop the ability to analyse different memory systems and their performance parameters. *(CO2)* **Contents:** Memory hierarchy, Characteristics of memory, Classification of primary and secondary memory, Memory types. ***Self-Learning Topics****: NIL* ***Learning Outcomes:***	5

		A learner will be able to: 2.1 students can understand the necessity of hierarchical structure of computers and utility of each level of memory hierarchy of computers. (CO2) (PI 1.3.1,1.4.1,2.2.1,2.3.1) 2.2 Students can learn different types of memory classification and their working principles (CO2) (PI 1.3.1,1.4.1,2.1.2)	
3	I/O Devices and their interfaces	***Learning Objective:*** Understand working of arious IO devices and their data transfer techniues with computer system.(CO3) **Contents:** Common I/O device types and characteristics, Introduction to buses, Introduction to peripheral devices of computer systems. ***Learning Outcomes:*** *A learner will be able to:* 3.1 Students will learn important features of various Input and output devices of computer system along with their operating mechanism. (CO3) (PI 1.3.1,1.4.1,2.1.2) 3.2 Students will get familiar with different types of buses used to connect various peripherals with the computer system. (CO3) (PI 1.3.1,1.4.1,2.2.1) 3.3 Students will understand different IO data transfer method. (CO3) (PI 1.4.1,2.2.4,2.3.1)	6
4	Types of Networks	***Learning Objective:*** Understand different computer network topologies and network architectures. (CO4) **Content:** Introduction to computer network, network application, network software and hardware components, Features of computer network, types of network architecture (Peer-Peer, Client-Server), Computer Network types (LAN, MAN, WAN), Network Topologies (Bus, Ring, Tree, Mesh, Star, Hybrid), Transmission modes (Simplex, Half-Duplex, Full-Duplex). ***Learning Outcomes:*** *A learner will be able to:* 4.1 Students will be able to understand various ways of inter-connecting computers for resources sharing. (CO4) (PI 1.3.1,1.4.1,2.1.2) 4.2 Students will learn working principles of different networking devices like HUB, ROUTER, SWITCHES, BRIDGES etc. (CO4) (PI 1.4.1,2.2.2) 4.3 Students can design computer networking models like P2P , Client server to demonstrate various networking topologies.	6

		(CO4) (PI 2.2.1,2.3.1,2.4.2)	
5	Introduction to wired and wireless Network	***Learning Objective:*** Understand various communication mediums and analyse their important characteristics. Also, analyse different wave propagation techniques use in computer communication. (CO5) **Content:** Characteristic of wired network, need of wireless network, Introduction to different types of communication medium: Wired and Wireless medium, Wired Transmission Media: Twisted pair, coaxial cable, optical fibre cable, Wireless Transmission: Microwave Links, Satellite communication, Mobile communication, RF communication, Ground wave, Sky wave, space wave, Comparison of wired ***Learning Outcomes:*** *A learner will be able to:* 5.1 Students will understand important characteristics of wired and wireless transmission medias used in computer networking. (CO5) (PI 1.2.1,1.3.1,1.4.1) 5.2 Students will also learn different types of wave propagations used in mobile and satellite communication. (CO5) (PI 1.2.1,1.3.1,1.4.1)	5
6	Overview of ISO-OSI layer and Network Devices	***Learning Objective:*** Construct isometric views of blocks with planar and cylindrical features using manual and CAD drafting techniques. *(CO1, CO5).* **Contents:** Overview of Networking, Need for Networking, Layered architecture, Introduction to ISO-OSI, OSI reference model, TCP/IP Model, Different Network devices used in networking: Hub, Bridge, Switch, Router, Gateway. ***Learning Outcomes:*** *A learner will be able to:* 6.1 Students will be able to understand important networking models like OSI model and TCP/IP models and their file transfer protocols. (CO6) (PI 1.4.1,2.1.2,2.3.1) 6.2 Students can design networking models for home network, office network or institute network. (CO6) (PI 2.2.1,2.3.1,2.4.2)	4
Total			**30**

Suggested List of Practical:

Sr No.	Suggested Topic(s)
1.	PC assembling and dismantling. ***Learning Outcomes:*** *A learner will be able to:* 1.1 Students can understand technological evolutions of computers in terms of processor Mfg. main memory and secondary memory technology, as well as hardware and software features of computer evolutions. (CO1) (PI 1.3.1,1.4.1,2.1.2) 1.2 1.2 Students will learn block level functioning of computer systems. (CO1) (PI 1.4.1,2.2.1,2.3.1)
2.	Identify motherboard components, RAM identification, removal, installation. ***Learning Outcomes:*** *A learner will be able to:* 1.1 Students can understand technological evolutions of computers in terms of processor Mfg. main memory and secondary memory technology, as well as hardware and software features of computer evolutions. (CO1) (PI 1.3.1,1.4.1,2.1.2) 1.2 1.2 Students will learn block level functioning of computer systems. (CO1) (PI 1.4.1,2.2.1,2.3.1)
3.	Identifying external ports, PC cards and interfacing. ***Learning Outcomes:*** *A learner will be able to:* 1.1 Students can understand technological evolutions of computers in terms of processor Mfg. main memory and secondary memory technology, as well as hardware and software features of computer evolutions. (CO1) (PI 1.3.1,1.4.1,2.1.2) 1.2 1.2 Students will learn block level functioning of computer systems. (CO1) (PI 1.4.1,2.2.1,2.3.1)
4.	Study of RJ45 and CAT6 Cabling and connection using crimping tool ***Learning Outcomes:*** *A learner will be able to:* 1.1 Students can understand technological evolutions of computers in terms of processor Mfg. main memory and secondary memory technology, as well as hardware and software features of computer evolutions. (CO1) (PI 1.3.1,1.4.1,2.1.2) 1.2 1.2 Students will learn block level functioning of computer systems. (CO1) (PI 1.4.1,2.2.1,2.3.1)
5.	Use basic networking commands in Linux (ping, tracert, nslookup, netstat, ARP, RARP, Ip, ipconfig, dig, route) ***Learning Outcomes:*** *A learner will be able to:* Students will be able to understand various ways of inter-connecting computers for resources sharing. (CO4) (PI 1.3.1,1.4.1,2.1.2) 4.2 Students will learn working principles of different networking devices like HUB, ROUTER, SWITCHES, BRIDGES etc. (CO4) (PI 1.4.1,2.2.2) 4.3 Students can design computer networking models like P2P , Client server to demonstrate various networking topologies. (CO4) (PI 2.2.1,2.3.1,2.4.2)

6.	Study and understand CISCO packet tracer tool ***Learning Outcomes:*** *A learner will be able to:* Students will be able to understand various ways of inter-connecting computers for resources sharing. (CO4) (PI 1.3.1,1.4.1,2.1.2) 4.2 Students will learn working principles of different networking devices like HUB, ROUTER, SWITCHES, BRIDGES etc. (CO4) (PI 1.4.1,2.2.2) 4.3 Students can design computer networking models like P2P , Client server to demonstrate various networking topologies. (CO4) (PI 2.2.1,2.3.1,2.4.2)
7	Build a simple P2P network topology and configure it using packet tracer ***Learning Outcomes:*** *A learner will be able to:* Students will be able to understand various ways of inter-connecting computers for resources sharing. (CO4) (PI 1.3.1,1.4.1,2.1.2) 4.2 Students will learn working principles of different networking devices like HUB, ROUTER, SWITCHES, BRIDGES etc. (CO4) (PI 1.4.1,2.2.2) 4.3 Students can design computer networking models like P2P , Client server to demonstrate various networking topologies. (CO4) (PI 2.2.1,2.3.1,2.4.2).
8	Connect the computers in Local area network by router configuration on CPT ***Learning Outcomes:*** *A learner will be able to:* Students will be able to understand various ways of inter-connecting computers for resources sharing. (CO4) (PI 1.3.1,1.4.1,2.1.2) 4.2 Students will learn working principles of different networking devices like HUB, ROUTER, SWITCHES, BRIDGES etc. (CO4) (PI 1.4.1,2.2.2) 4.3 Students can design computer networking models like P2P , Client server to demonstrate various networking topologies. (CO4) (PI 2.2.1,2.3.1,2.4.2)
9	Implement different network topologies (STAR,RING,MESH) using CPT ***Learning Outcomes:*** *A learner will be able to:* Students will be able to understand various ways of inter-connecting computers for resources sharing. (CO4) (PI 1.3.1,1.4.1,2.1.2) 4.2 Students will learn working principles of different networking devices like HUB, ROUTER, SWITCHES, BRIDGES etc. (CO4) (PI 1.4.1,2.2.2) 4.3 Students can design computer networking models like P2P , Client server to demonstrate various networking topologies. (CO4) (PI 2.2.1,2.3.1,2.4.2)
10	Implementation of physical P2P network ***Learning Outcomes:*** *A learner will be able to:* Students will be able to understand various ways of inter-connecting computers for resources sharing. (CO4) (PI 1.3.1,1.4.1,2.1.2) 4.2 Students will learn working principles of different networking devices like HUB, ROUTER, SWITCHES, BRIDGES etc. (CO4) (PI 1.4.1,2.2.2) 4.3 Students can design computer networking models like P2P , Client server to demonstrate various networking topologies. (CO4) (PI 2.2.1,2.3.1,2.4.2)

Performance Indicators:

PI 1.3.1 Remembering: List fundamental engineering principles (e.g., Ohm's law, Bernoulli's equation) and their applications.
PI 1.4.1 Remembering: Identify key concepts and tools in specialized areas such as computer architecture, AI, or network systems.
PI 2.1.2 Understanding: Explain the key features and scope of a complex engineering problem.
PI 2.2.1 Remembering: List standard methodologies and tools applicable to solving engineering problems
PI 2.2.2 Understanding: Describe the steps involved in formulating a solution plan for an engineering problem.
PI 2.3.1 Remembering: Identify the types of models (e.g., mathematical, physical, computational) used in engineering problem-solving.
PI 2.4.2 Understanding: Explain the solution process and its relevance to the identified engineering problem.

Mapping of Course Outcomes with Learning Outcomes:

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

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	3/42	3/42	-	-	-	-	-	-	-	-	-
CO2	4/42	3/42	-	-	-	-	-	-	-	-	-
CO3	5/42	4/42	-	-	-	-	-	-	-	-	-
CO4	3/42	5/42	-	-	-	-	-	-	-	-	-
CO5	6/42	-	-	-	-	-	-	-	-	-	-
CO6	1/42	5/42	-	-	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1 Students can understand technological evolutions of computers in terms of processor Mfg. main memory and secondary memory technology, as well as hardware and software features of computer evolutions. (CO1) (PI 1.3.1,1.4.1,2.1.2)	1. Explain the evolution of processors from early generations to modern CPUs. 2. Compare different memory technologies (SRAM, DRAM, SSD, HDD) used across generations. 3. Identify major hardware and software milestones in computer development. 4. Analyze the impact of Moore's Law on computer system design.	MSE ISA ISA ESE
LO 1.2: Students will learn block level functioning of computer systems.(CO1) (PI 1.4.1,2.2.1,2.3.1)	1. Illustrate the functional units of a basic computer system using block diagrams. 2. Explain the role of control unit, ALU, memory, and I/O in program execution. 3. Trace the flow of data and control signals during instruction execution. 4. Identify the interconnection between components using buses.	MSE ISA ESE MSE
LO 2.1: students can understand the necessity of hierarchical structure of computers and utility of each level of memory hierarchy of computers. (CO2) (PI 1.3.1,1.4.1,2.2.1,2.3.1)	1. Describe the different levels of memory (registers, cache, RAM, HDD, etc.) with examples. 2. Justify the need for hierarchical memory structure in modern computers. 3. Compare performance and cost implications of various memory levels. 4. Analyze memory access times and their influence on system speed.	ISA MSE ISA ESE
LO 2.2: Students can learn different types of memory classification and their working principles (CO2) (PI 1.3.1,1.4.1,2.1.2)	1. Differentiate between volatile and non-volatile memory. 2. Describe the working principles of ROM, RAM, cache memory, and virtual memory. 3. Explain the use of memory chips like SRAM, DRAM, EEPROM, and Flash. 4. Classify memories based on access method (sequential, direct, random).	ISA MSE ESE ISA
LO 3.1: Students will learn important features of various Input and output devices of computer system along with their operating mechanism. (CO3) (PI 1.3.1,1.4.1,2.1.2)	1. Describe the working of keyboard, mouse, scanner, and printer. 2. Compare different display technologies (LCD, LED, OLED). 3. Explain the analog-to-digital and digital-to-analog conversion process. 4. Identify the role of device drivers in I/O operations.	ISA ISA ISA MSE
LO 3.2: Students will get familiar with different types of buses used to connect various peripherals with the computer system. (CO3) (PI 1.3.1,1.4.1,2.2.1)	1. Identify types of system buses: data, address, and control bus. 2. Compare synchronous vs asynchronous bus operations. 3. Explain the operation of PCI, USB, SATA, and other interface buses.	ISA MSE MSE

	4. Analyze the data transfer capability of different buses.	ISA
LO 3.3 Students will understand different IO data transfer method. (CO3) (PI 1.4.1,2.2.4,2.3.1)	1. Describe programmed I/O, interrupt-driven I/O, and DMA. 2. Compare polling vs interrupt mechanisms. 3. Explain the role of DMA in efficient data transfer. 4. Identify when each I/O method is best suited.	ESE MSE ESE ISA
LO 4.1: Students will be able to understand various ways of inter-connecting computers for resources sharing. (CO4) (PI 1.3.1,1.4.1,2.1.2)	1. Describe different types of networks (LAN, MAN, WAN). 2. Identify scenarios where resource sharing enhances system efficiency. 3. Explain client-server and peer-to-peer models. 4. Describe basic networking hardware needed for resources sharing.	LAB ISA LAB ESE
LO 4.2: Students will learn working principles of different networking devices like HUB, ROUTER, SWITCHES, BRIDGES etc. (CO4) (PI 1.4.1,2.2.2))	1. Describe the function of networking devices: Hub, Switch, Router, Bridge. 2. Compare performance and use cases of different networking devices. 3. Analyze packet forwarding techniques in switches and routers. 4. Explain the role of gateways and access points in networks.	ISA LAB LAB LAB
LO 4.3 Students can design computer networking models like P2P , Client server to demonstrate various networking topologies. (CO4) (PI 2.2.1,2.3.1,2.4.2)	1. Construct basic peer-to-peer and client-server network diagrams. 2. Explain networking topologies (bus, star, ring, mesh). 3. Evaluate the suitability of topologies for different environments. 4. Simulate simple networks using tools like Cisco Packet Tracer.	LAB MSE ISA LAB
LO 5.1: Students will understand important characteristics of wired and wireless transmission medias used in computer networking. (CO5) (PI 1.2.1,1.3.1,1.4.1)	1. Compare bandwidth, attenuation, and interference in copper, fiber, and wireless. 2. Identify use cases for each type of transmission media. 3. Explain the impact of media choice on network performance. 4. Evaluate the security concerns with different media types.	ISA MSE ISA ISA
LO 5.2: Students will also learn different types of wave propagations used in mobile and satellite communication. (CO5) (PI 1.2.1,1.3.1,1.4.1)	1. Describe line-of-sight, ground wave, and sky wave propagation. 2. Identify differences between cellular and satellite communication. 3. Explain signal loss and delay in satellite vs terrestrial systems. 4. Analyze the role of frequency and wavelength in transmission.	ESE ESE ISA ISA

LO 6.1: Students will be able to understand important networking models like OSI model and TCP/IP models and their file transfer protocols. (CO6) (PI 1.4.1,2.1.2,2.3.1)	1. Describe functions of each OSI and TCP/IP layer. 2. Map OSI layers to real-world protocols (e.g., HTTP, TCP, IP). 3. Compare file transfer protocols like FTP, SFTP, TFTP. 4. Identify the role of IP addressing and DNS in networking.	ESE MSE ISA LAB
LO 6.2: Students can design networking models for home network, office network or institute network. (CO6) (PI 2.2.1,2.3.1,2.4.2)	1. Develop topology for home, office, or institutional networks. 2. Choose appropriate hardware and media based on requirements. 3. Implement basic IP addressing and subnetting schemes. 4. Demonstrate networking model implementation using simulation tools.	LAB LAB LAB LAB

Tools/ Technologies/ Programming Languages learnt:

CISCO Packet Tracer

- Network simulation Practice Platforms: CPT, NS2, Net Sim

Textbooks:

1. William Stallings," Computer Organization and Architecture: Designing for Performance", 8th Edition, McGraw-Hill, 2023.
2. Andrew Tenenbaum "Computer networks", Fourth Edition, Pearson Publication, 2019.
3. B. A. Forouzan, "Data Communications and Networking" McGraw-Hill, 2021

Reference Books:

1. A Anandkumar, "Fundamentals of digital design", 2ndEdition, PHI, 2001.
2. Albert P Malvino, "Digital Principles and applications", TMH, 2005.
3. B. Govindrajalu, "Computer org. and Arch.", Tata McGraw-Hill Education India, 2011

Related/ Equivalent MOOC and Associated Certification:

1. Computer Organization and Architecture: A Pedagogical Aspect
   Platform: NPTEL
   Link https://onlinecourses.nptel.ac.in/noc19_cs04/preview
2. Fundamentals of digital system design
   - Platform: Coursera
   - Link: https://www.coursera.org/learn/digital-systems

3. Foundations of computer Networking
    - Platform: Micro soft
    - Link: https://www.edx.org/course/it-support-networking-essentials-microsoft-cld260x

Course Name: Fundamental of Logic Circuits

Course Code: ESC05T & ESC05P

Vertical/ Sub-Vertical: Engineering Science

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Nill

Pre-requisite for: ESC08 (Computer Organization and Architecture)**,** PCIT17T (Microprocessor),

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ESC05T	2	-	2	-
ESC05P	-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (ESC05T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (ESC05P)	25 (50%)	-	25 (50%)	50 (100%)

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

Preamble:

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

Course Objectives:

- To enable learner to recognize numbers in every base
- To express numbers in different coded forms and perform arithmetic operations on them.
- To introduce to BJT as switch, various logic gates and truth tables.

- To get acquainted with representation of Boolean expressions, logic diagrams and circuits.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Define and differentiate various number systems and perform base conversions among binary, octal, decimal, and hexadecimal.	Remembering
CO2	Explain commonly used codes and interpret basic electronic circuit components like diodes and BJTs in switching applications.	Understanding
CO3	Apply the concepts of binary arithmetic and code-based computations, including 1's and 2's complement and BCD addition.	Applying
CO4	Analyze the behavior and truth tables of logic gates and construct compound logic circuits using universal gates.	Analysing
CO5	Reduce complex Boolean expressions using Boolean algebra theorems and evaluate their simplified forms in SOP and POS.	Evaluating
CO6	Design and implement combinational circuits like adders, multiplexers, encoders, and simple memory units using flip-flops.	Creating

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Number System	***Learning Objective:*** *Identify, represent, and convert numbers between binary, octal, decimal, and hexadecimal systems, including signed forms, for use in digital logic applications. (C01).* **Contents:** Introduction to Number systems, Binary Number systems, Signed Binary Numbers, Binary, Octal, Decimal and Hexadecimal number and their interconversion. ***Learning Outcomes:***	4

		A learner will be able to: *1.1 Define the positional structure of binary, octal, decimal and hexadecimal systems and state the need for signed binary representation. (P.I.- 1.1.1) (CO1)* *1.2 Explain signed magnitude, 1's complement and 2's complement formats and how they encode negative integers. (P.I. – 1.4.2) (CO1, CO3)* *1.3 Convert any integer or fractional quantity among binary, octal, decimal and hexadecimal bases, and verify the result using both direct and intermediary base methods. (P.I. 1.3.3 and 1.1.4) (CO1, CO3)*	
2	Codes & Arithmetic Operations	***Learning Objective:*** *Interpret and apply digital codes and binary arithmetic techniques, including 1's and 2's complement and BCD operations, for accurate data representation and error detection in digital systems. (CO2, CO3)* **Contents:** Codes: Grey, BCD, Excess-3, ASCII, Parity Code, Hamming Code, Binary arithmetic operations using 1's and 2's complement, BCD addition. ***Self-Learning Topics****: Gray code to binary and binary to Gray code conversion, Real-world applications of ASCII and Unicode, Use of Hamming codes in memory and communication systems* ***Learning Outcomes:*** *A learner will be able to:* *2.1 Define and differentiate common digital codes such as BCD, Gray, Excess-3, ASCII, Parity, and Hamming Code. (P.I. –* 1.4.1 *and* 1.4.4*) (CO2)* *2.2 Explain the role of parity and Hamming codes in error detection and correction. (P.I. –* 1.4.2*) (CO2)* *2.3 Perform binary arithmetic operations using 1's and 2's complement and execute BCD addition. (P.I. –* 1.3.3*) (CO3)*	5

		2.4 Compare different coding schemes in terms of their efficiency and suitability for various digital applications. (P.I. – 1.4.4*) (CO2, CO3)*	
3	Basic Electronics Circuits	***Learning Objective:*** *Explain and evaluate how diodes and BJTs function as switches—using common emitter characteristics—to support reliable digital logic operations. (CO2)* **Contents:** Diode as a switch, Introduction to Bipolar Junction transistor, C-E configuration, Input output characteristics of BJT, Applications of BJT as a Switch. ***Self-Learning Topics****: Forward/reverse bias conditions and ideal diode equation, BJT regions of operation, Comparing BJT and MOSFET switches in logic families, Practical biasing networks and resistor selection for transistor switches.* ***Learning Outcomes:*** *A learner will be able to:* *3.1 State the bias conditions that make a diode or BJT act as an open or closed switch. (P.I. – 1.3.1*) *(CO2)* *3.2 Describe the operation of a BJT in common emitter (CE) configuration and sketch its input–output characteristic curves. (P.I. 1.3.2 and 4.3.2) (CO2)* *3.3 Calculate biasing and resistor values to implement a diode or BJT switch in a basic digital interface. (P.I. – 1.3.3*) *(CO2)* *3.4 Compare the switching speed, power dissipation and logic level compatibility of diode vs. BJT switches for simple logic circuits. (P.I. - 1.4.4 and 5.2.4) (CO2, CO4)*	5
4	Logic Gates	***Learning Objective:*** *Interpret, construct, and evaluate basic and universal logic-gate networks—including tri-state buffers—to realise specified digital functions. (CO4).*	4

		Content: Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Implementation of gates using universal gates, Tri-state buffer. ***Self-Learning Topics****: Logic family characteristics: TTL vs CMOS, Propagation delay and timing hazards in gate networks, Introduction to transmission gate and CMOS tristate implementations* ***Learning Outcomes:*** *A learner will be able to:* *4.1 List the symbols, truth tables, and Boolean expressions for AND, OR, NOT, NAND, NOR, XOR, and XNOR gates. (P.I. – 1.3.1) (CO4)* *4.2 Explain the functional differences between basic gates and describe how tristate buffers enable bus sharing. (P.I. – 1.3.2) (CO4)* *4.3 Implement a given Boolean function using only NAND or only NOR gates and verify its correctness with a truth table. (P.I. - 1.3.3 and 1.3.3) (CO4, CO5)* *4.4 Compare alternative universal gate implementations of the same logic function in terms of gate count and propagation delay. (P.I. – 1.4.4 and 5.2.4) (CO4, CO6)*	
5	Boolean Algebra	***Learning Objective:*** *Apply Boolean algebra theorems to convert and minimise logic expressions into optimal SOP or POS forms for efficient circuit realisation.* *(CO5).* **Content:** Theorems and Properties of Boolean Algebra, Standard SOP and POS form, Reduction of Boolean functions using Algebraic method.	5

		Self-Learning Topics**: Karnaugh maps and visual grouping for 3- to 6-variable functions, Quine–McCluskey tabulation technique for systematic minimisation.* ***Learning Outcomes: *A learner will be able to:* *5.1 State fundamental Boolean theorems (e.g., De Morgan, distributive, complement) and properties. (P.I. – 1.3.1) (CO5)* *5.2 Explain the difference between canonical (standard) SOP and POS forms and identify when each is advantageous. (P.I. – 1.3.2 and 1.4.4) (CO6)* *5.3 Reduce a given multivariable Boolean expression to minimal SOP or POS form using algebraic manipulation and verify equivalence. (P.I. - 1.3.3 and 1.3.4) (CO5)* *5.4 Compare the gate count and propagation delay implications of original versus simplified expressions, justifying the preferred solution. (P.I. – 1.4.4 and 5.2.4) (CO4, CO5)*	
6	Combinational Circuits	***Learning Objective:** Design, implement, and assess common combinational blocks and basic flipflop memory elements to meet specified digital logic functions. (CO1,CO2,CO3,CO5).* **Contents:** Introduction to combinational circuits, Half Adder, Full Adder, MUX, DEMUX, Encoder, Decoder, Introduction to Flip Flop: SR, JK, D, T (Truth table), Application of Flip-flop as a memory unit. ***Self-Learning Topics**: Ripple carry vs carry lookahead adders, Priority encoders and barrel shifters, Basic static RAM cell using cross coupled flipflops* ***Learning Outcomes:***	7

		A learner will be able to: *6.1 List the functions and truth tables of half adder, -full adder, MUX, DEMUX, encoder, decoder, and SR/JK/D/T -flip-flops.. (P.I. – 1.3.1) (CO6)* *6.2 Explain how combinational blocks differ from sequential (flipflop based) elements and outline the role of flipflops as 1bit memory cells. (P.I. – 1.3.2 and 1.4.2) (CO4, CO6)* *6.3 Design a 4bit ripple carry adder by cascading full adders and implement a 4to1 line selector using MUXs; verify both designs with truth tables and simulations. (P.I. - 3.4.3 and 5.2.3) (CO4, CO6)* *6.4 Compare different implementations of a given combinational function (e.g., adder with MUX vs decoder + OR gates) in terms of gate count and propagation delay, justifying the optimal choice. (P.I. – 1.4.4 and 5.2.4) (CO4. CO5)*	
Total			**30**

Suggested List of Practical's:

Sr No.	Suggested Topic(s)
1.	To verify truth table of different logic gates. ***Learning Outcomes:*** *A learner will be able to:* *4.1 List the symbols, truth tables, and Boolean expressions for basic gates. (P.I. – 1.3.1) (CO4)*
2.	Implement Ex-OR using NAND & NOR gate. ***Learning Outcomes:*** *A learner will be able to:* *4.3 Implement a Boolean function using only NAND or NOR gates and verify its truth table. (P.I. –* 1.3.3 *and* 5.2.3*) (CO4, CO5).*
3.	To design Binary to gray and Gray to binary code convertor using logic gates. ***Learning Outcomes:*** *A learner will be able to:*

	2.1 Define and differentiate common digital codes such as BCD, Gray, Excess3, ASCII, Parity, and Hamming Code. (P.I. – 1.3.1, 1.3.2 *and* 1.4.2*) (CO2).*
4.	Reduction of the Boolean expression using Boolean laws & realize it using basic gates. ***Learning Outcomes:*** *A learner will be able to:* *5.3 Reduce a multivariable Boolean expression to minimal SOP/POS form and verify equivalence. (P.I.* 1.3.3 *and* 1.3.4*) (CO5)*
5.	Design and implement half adder & full adder using logic gates. ***Learning Outcomes:*** *A learner will be able to:* *6.3 Design combinational circuits (e.g., ripple carry adder) and verify with truth tables. (P.I. –* 3.4.3 *and* 5.2.3*) (CO4, CO6)*
6.	Design and implement half subtractor & full subtractor using logic gates. ***Learning Outcomes:*** *A learner will be able to:* *6.3 Design combinational circuits and verify with truth tables. (P.I. -* 3.4.3 *and* 5.2.3*) (CO4, CO6)*
7.	Design and implement 2:1 MUX using logic gates. ***Learning Outcomes:*** *A learner will be able to:* *6.3 Design combinational circuits (e.g., line selectors/MUXes) and verify operation. (P.I. – 3.4.3. and 5.2.3) (CO4, CO6)*
8.	Design and implement 2:1 DEMUX using logic gates. ***Learning Outcomes:*** *A learner will be able to:* *6.3 Design combinational circuits and verify operation. (P.I.- 3.4.3 and 5.2.3) (CO4, CO6)*
9.	Realization of logic function using Multiplexer. ***Learning Outcomes:*** *A learner will be able to:*

	6.3 Design combinational circuits with multiplexers and evaluate efficiency. (P.I.- 3.4.3, 5.2.4 and 1.4.4) (CO4, CO6)
10	Implementation and Truth table verification of Flip-flops. ***Learning Outcomes:*** *A learner will be able to:* *6.1 List the functions and truth tables of SR, JK, D, and T flipflops. (P.I.- 1.3.1 and 1.4.2 (CO6)*

Performance Indicators:

P.I.- 1.1.1**: Remembering:** Recall key mathematical formulas and concepts relevant to engineering problems. This squarely covers remembering the positional-value principle for each radix and the rationale for signed magnitude.

P.I.- 1.4.2: **Understanding**: Explain the functions of specialized engineering systems in the computer-engineering domain. Negative-integer encodings are a core specialised concept, so this PI directly measures the required depth of explanation.

P.I.- 1.3.3: **Applying**: Perform calculations to solve engineering tasks. Base-conversion calculations (including fractional parts) fit this indicator exactly.

P.I.- 1.1.4: **Analyzing**: Break down a complex engineering problem into mathematical components to evaluate relationships. Using an intermediary base or a reverse conversion to cross-check results matches this analytical requirement.

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

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

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

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

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

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

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

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

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

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

PI 1.3.1 (Remembering): *List fundamental engineering principles (e.g., Ohm's law, Boolean algebra, etc.) and their applications.*

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

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

PI 5.2.3 (Applying): *Use discipline-specific tools (e.g., logic gates, Verilog) to design or analyze systems.*

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

PI 5.2.4 (Analyzing): *Compare different tools and techniques to identify the most effective option for solving a given engineering problem.*

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1, 1.2 and 1.3
CO2	2.1, 2.2, 2.4, 3.1, 3.2, 3.3 and 3.4
CO3	1.2, 1.3, 2.3 and 2.4
CO4	3.4, 4.1, 4.2, 4.3, 4.4, 5.4, 6.2, 6.3 and 6.4
CO5	4.3, 5.1, 5.3 and 5.4
CO6	4.4, 5.2, 6.1, 6.2, 6.3 and 6.4

Mapping of Course Outcomes with Programme Outcomes:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PO12**
CO1	4/35	-	-	-	-	-	-	-	-	-	-	-
CO2	8/35	-	-	1/35	1/35	-	-	-	-	-	-	-
CO3	5/35	-	-	-	-	-	-	-	-	-	-	-
CO4	10/35	-	1/35	-	4/35		-	-	-	-	-	-

CO5	7/35	-	-	-	2/35		-	-	-	-	-	-
CO6	6/35	-	1/35	-	2/35							

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: Define the positional structure of binary, octal, decimal and hexadecimal systems and state the need for signed binary representation. (P.I.-1.1.1) (CO1)	• Define number system bases and positional values. • Justify the need for signed binary representation.	ISA ISA
LO 1.2: Explain signed magnitude, 1's complement and 2's complement formats and how they encode negative integers. (P.I. – 1.4.2) (CO1, CO3)	• Differentiate between signed magnitude, 1's and 2's complement formats. • Represent negative integers using 2's complement format.	MSE ESE
LO 1.3: Convert any integer or fractional quantity among binary, octal, decimal and hexadecimal bases, and verify the result using both direct and intermediary base methods. (P.I. 1.3.3 and 1.1.4) (CO1, CO3)	• Convert a given number among binary, decimal, octal, and hexadecimal systems. • Cross-verify conversion using intermediary base (e.g., binary).	ISA/MSE/ESE ISA
LO 2.1: Define and differentiate common digital codes such as BCD, Gray, Excess-3, ASCII, Parity, and Hamming Code. (P.I. – 1.4.1 and 1.4.4) (CO2)	• Define digital codes (BCD, Gray, Excess-3, ASCII, Parity, Hamming). • Compare codes based on structure and use cases.	ISA/MSE ESE
LO 2.2: Explain the role of parity and Hamming codes in error detection and	• Explain even and odd parity with examples.	ESE ISA/MSE/ESE

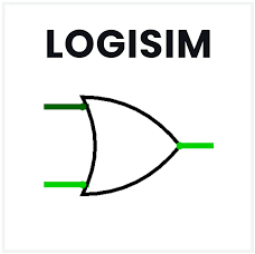
correction. (P.I. – 1.4.2) (CO2)	• Illustrate error detection and correction using Hamming code (7,4).	
LO 2.3: Perform binary arithmetic operations using 1's and 2's complement and execute BCD addition. (P.I. – 1.3.3) (CO3)	• Perform binary addition and subtraction using 1's and 2's complement. • Execute BCD addition and apply correction if needed.	ISA/MSE ISA/MSE/ESE
LO 2.4: Compare different coding schemes in terms of their efficiency and suitability for various digital applications. (P.I. – 1.4.4) (CO2, CO3)	• -Analyze coding efficiency in various applications (e.g., Gray in counters, ASCII in communication). • - Evaluate trade-offs among codes based on redundancy and error resistance.	ESE ESE
LO 3.1: State the bias conditions that make a diode or BJT act as an open or closed switch. (P.I. – 1.3.1) (CO2)	• Identify forward and reverse bias conditions in diodes and BJTs. • - State the role of cutoff and saturation in switching.	MSE ESE
LO 3.2: Describe the operation of a BJT in common emitter (CE) configuration and sketch its input–output characteristic curves. (P.I. 1.3.2 and 4.3.2) (CO2)	• Sketch and interpret input-output characteristics of CE configuration. • - Describe active, cutoff, and saturation regions of BJT.	ESE ESE
LO 3.3 Calculate biasing and resistor values to implement a diode or BJT switch in a basic digital interface. (P.I. – 1.3.3) (CO2)	• Calculate base resistor and bias voltage for switching circuit. • Design simple switch circuit using BJT or diode.	ESE ESE
LO 3.4: Compare the switching speed, power dissipation and logic level compatibility of diode vs. BJT switches for simple logic circuits. (P.I. - 1.4.4 and 5.2.4) (CO2, CO4)	• Compare BJT and diode switches in terms of speed and power. • Interpret trade-offs in logic level compatibility.	ESE ESE

LO 4.1: List the symbols, truth tables, and Boolean expressions for AND, OR, NOT, NAND, NOR, XOR, and XNOR gates. (P.I. – 1.3.1) (CO4)	• List logic gate symbols, Boolean expressions, and truth tables. • Identify gate outputs for given combinations.	Lab ISA Lab ISA
LO 4.2: Explain the functional differences between basic gates and describe how tristate buffers enable bus sharing. (P.I. – 1.3.2) (CO4)	• Explain high-impedance state in tri-state buffer. • Differentiate tri-state from basic gates with truth table.	MSE/ESE MSE/ESE
LO 4.3: Implement a given Boolean function using only NAND or only NOR gates and verify its correctness with a truth table. (P.I. - 1.3.3 and 1.3.3) (CO4, CO5)	- Convert Boolean functions to NAND/NOR-only implementations. - Validate logic using truth table.	LAb ISA LAb ISA
LO 4.4: Compare alternative universal gate implementations of the same logic function in terms of gate count and propagation delay. (P.I. – 1.4.4 and 5.2.4) (CO4, CO6)	• Compare two universal gate implementations of the same function. • Estimate and justify which has lower propagation delay.	MSE/LAB ESE
LO 5.1: State fundamental Boolean theorems (e.g., De Morgan, distributive, complement) and properties. (P.I. – 1.3.1) (CO5)	• State and apply basic Boolean theorems (e.g., DeMorgan's). • Use properties to transform logic expressions.	MSE MSE/ESE
LO 5.2: Explain the difference between canonical (standard) SOP and POS forms and identify when each is advantageous. (P.I. – 1.3.2 and 1.4.4) (CO6)	• Differentiate SOP and POS forms with examples. • Identify canonical form for a given truth table.	ISA ISA

LO 5.3: Reduce a given multivariable Boolean expression to minimal SOP or POS form using algebraic manipulation and verify equivalence. (P.I. - 1.3.3 and 1.3.4) (CO5)	• Reduce multivariable expressions using Boolean algebra. • Confirm simplification by comparing truth tables.	ISA/MSE/ESE ISA/Lab ISA
LO 5.4: Compare the gate count and propagation delay implications of original versus simplified expressions, justifying the preferred solution. (P.I. – 1.4.4 and 5.2.4) (CO4, CO5)	• Calculate and compare gate count and delay before and after simplification. • Justify the preferred logic implementation.	ISA/Lab ISA Lab ESE
LO 6.1: List the functions and truth tables of half adder, full adder, MUX, DEMUX, encoder, decoder, and SR/JK/D/T flipflops.. (P.I. – 1.3.1) (CO6)	• List function, logic symbol, and truth table for basic combinational and sequential circuits. • Match logic elements with their applications.	ISA/MSE ISA
LO 6.2: Explain how combinational blocks differ from sequential (flipflop based) elements and outline the role of flipflops as 1bit memory cells. (P.I. – 1.3.2 and 1.4.2) (CO4, CO6)	• Explain difference between combinational and sequential circuits. • Describe flip-flop role as 1-bit memory.	LAB ESE ISA
LO 6.3: Design a 4bit ripple carry adder by cascading full adders and implement a 4to1 line selector using MUXs; verify both designs with truth tables and simulations. (P.I. - 3.4.3 and 5.2.3) (CO4, CO6)	• Design and simulate 4-bit ripple carry adder and 4-to-1 MUX. • Validate designs using truth tables or waveform outputs.	Lab ISA LAB ISA
LO 6.4: Compare different implementations of a given combinational function (e.g., adder with MUX vs decoder + OR gates) in	• Compare alternate implementations for the same function (e.g., MUX vs decoder).	Lab ISA/ MSE/ESE LAB ISA

terms of gate count and propagation delay, justifying the optimal choice. (P.I. – 1.4.4 and 5.2.4) (CO4. CO5)	• Analyze gate count and delay to select optimal circuit.	

Tools/ Technologies/ Programming Languages learnt:



Logisim: This is a free software tool can be used to perform all the experiments.

Textbooks:

1. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill, Third edition.
2. Donald A. Neamen, "Electronic Circuit Analysis and Design", TATA McGraw Hill, Second.
3. Anand Kumar, "Fundamentals of Digital Circuits", PHI, 2018.
4. Morris Mano, "Digital Design",Pearson Education.

Reference Books:

1. M. Morris Mano, "Digital Logic and computer Design", PHI.
2. Robert L. Boylestad, Louis Nashelsky, "Electronic devices and circuit Theory", PHI.
3. Donald P Leach, Albert Paul Malvino, "Digital Principals & Applications", TATA McGraw Hill.
4. John M. Yarbrough, "Digital Logic Applications and Design", Thomson Publications, 2006.
5. John F. Warkerly, "Digital Design Principles and Practices", Fourth Edition, 2008.

Related/ Equivalent MOOC and Associated Certification:

1. Digital Circuits course by By Prof. Santanu Chattopadhyay, IIT Kharagpur-This is advance course to Fundamentals of logic circuit designs.

- Platform: NPTEL platform

- Link: https://onlinecourses.nptel.ac.in/noc25_ee125/

2. Full Course in Fundamentals of logic design- Digital Logic Design

- Platform: Udemy
- Link: https://www.udemy.com/course/full-course-in-fundamentals-of-logic-design/

3. Digital Electronics & Logic Design Circuits-Completeness of Each Topic of Digital Electronics & Logic Design Circuits with Utmost Clarity

- Platform: Udemy
- Link: https://www.udemy.com/course/digital-circuits-from-basics-to-advance-level/

Course Name: Structured Programming

Course Code: VSEC01T and VSEC01P

Vertical/ Sub-Vertical: SC_VSEC

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: --

Pre-requisite for: VSEC02 (OOP)

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ES04T	2	-	2	-
ES04P	-	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	**Explain** the syntax and semantics of C programming constructs such as identifiers, variables, data types, operators, input/output functions and control structures.	Understand
CO2	**Develop** logic using conditional and iterative control structures.	Apply
CO3	**Decompose** the problem and solve it using modular programming approach.	Analyse
CO4	**Implement** algorithms using arrays, strings, pointers, and structures in C.	Analyse
CO5	**Perform** file operations and dynamic memory allocation to handle data processing and storage requirements in software applications.	Evaluate
CO6	**Integrate** debugging and testing methodologies using standard development tools to ensure degree of correctness.	Evaluate

Detailed Syllabus:

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

		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:* *1.4 Describe syntax, keywords, data types and variables. (P.I. – 1.3.1) (CO1)* *1.5 Use appropriate operators in expressions to perform various calculations and operations. (P.I. 1.3.2) (CO1)* *1.6 Use math library functions to perform mathematical computations within C programs. (P.I. 1.3.3) (CO1)* *1.7 Explain the purpose of preprocessor directives. (P.I. 1.3.2) (CO1)*	
2	Input and Output	***Learning Objective:*** *Understand the format specifiers and their utility in input/output functions (CO1, CO6)* **Contents:** Unformatted and formatted I/O, scanf(), printf() functions, concept of field width, precision and flags and basic programs on computation. ***Self-Learning Topics***: *Format specifiers, flags and their effect* ***Learning Outcomes:*** *A learner will be able to:* *2.5 Use appropriate format specifiers for various data types in both input and output operations. (P.I. – 1.3.2 (CO1)*	2

		2.6 Collaborate with peers to debug and improve computational programs, applying learned concepts effectively. (P.I. – 2.1.3, 9.2.1) (CO1, CO6)	
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. (CO1, CO2, CO6)* **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:* *3.5 Analyse the flow of control in programs using selection statements to make decisions based on specific conditions. (P.I. – 2.1.2) (CO1, CO2)* *3.6 Implement multi-choice logic using switch statements to manage multiple options conditions effectively. (P.I. 2.1.2) (CO1, CO2)* *3.7 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)* *3.8 Analyse loop control mechanisms (break, continue) and their effect on loop execution. (P.I. - 2.1.2) (CO2, CO6)* *3.9 Integrate selection and looping statements in C programs to solve more complex problems. (P.I. – 2.2.3) (CO2, CO6).*	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. (CO1, CO3, CO6)* **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:* *4.1 Write function declarations and definitions to modularize C programs effectively. (P.I. – 1.3.3, 2.2.3) (CO1, CO3)* *4.2 Demonstrate how to divide the problem into subproblems and propose a function to address a subproblem (P.I. –2.1.4) (CO3, CO6)* *4.3 Identify and apply appropriate storage classes (auto, extern, static, register) to control variable lifetime and linkage. (P.I. - 2.1.2) CO3)* *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)*	6
5	Arrays, Strings and Structures	***Learning Objective:*** *To declare, initialize, and manipulate one-dimensional and multi-dimensional arrays, perform operations on strings using built-in and user-defined functions, and design and implement structures—including nested structures and arrays of structures—to manage grouped data efficiently in C programs.*	6

		(CO2, CO3, CO4, CO6). **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:* *5.5 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)* *5.6 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)* *5.7 Define and use structures, including nested structures, to represent complex data types in C. (P.I. – 1.3.2) (CO2, CO4)* *5.8 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)*	
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. (CO1, CO4, CO5, CO6).* **Contents:**	6

		Pointer introduction, pointer variable, reference and dereference, operators and void pointer, Pointer call by reference, pointer arithmetic, pointer to pointer, pointer and array, passing arrays to function, array of pointers and dynamic memory allocation, Types of files, file operations – opening, closing, creating, reading and processing file ***Self-Learning Topics**: File Operations.* ***Learning Outcomes:*** *A learner will be able to:* *6.5 Explain the concept of pointers, including referencing, dereferencing, and the use of pointer operators. (P.I. – 1.3.2) (CO1, CO4)* *6.6 Apply pointers for call-by-reference, and pointer arithmetic in solving programming problems. (P.I. – 2.2.3) (CO1, CO4)* *6.7 Use pointers effectively with arrays, including passing arrays to functions and working with arrays of pointers. (P.I. – 1.3.4) (CO4, CO6)* *6.8 Implement dynamic memory allocation using functions like malloc(), calloc(), realloc(), and free() to manage memory during runtime. (P.I. – 2.4.5) (CO5)* *6.9 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)*	
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, CO6)
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, CO6)
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. *4.3* (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 *5.2* (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) (CO4, CO6)
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) (CO5)

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**
LO1: Explain and apply fundamental elements of the C programming language, including syntax, keywords, data types, variables, operators, preprocessor directives, and math library functions, to write and evaluate basic computational expressions.	1.1 Identify and use appropriate C syntax, keywords, data types, and variables.	LAB
	1.2 Use operators and math library functions in expressions	ISA, LAB
	1.3 Explain the role of preprocessor directives.	ISA
	1.4 Write programs using mathematical functions.	ISA, MSE, LAB
	1.5 Debug and troubleshoot issues in code implementations	LAB
LO2: Apply appropriate input/output operations using format specifiers for various data types and collaborate effectively with peers to debug and enhance C programs by integrating foundational programming concepts.	2.1 Write program using correct format specifiers in input/output functions to perform basic computations	LAB
	2.2 Collaborate with peers to debug and troubleshoot issues in code implementations.	LAB
LO3: Analyse and implement control flow constructs in C programs using selection statements (if-else, switch) and iterative structures (for, while, do-while), including loop control mechanisms (break, continue), to design solutions for complex computational problems.	3.1 Frame conditional expressions to validate the required criteria.	LAB, MSE
	3.2 Solve 3 programs on Leet Code / Hacker Rank Platform	ISA, LAB, MSE
	3.3 Develop a logic and implement it for the problems which demands usage of Iterative Constructs.	ISA, MSE, ESE
	3.4 Develop a logic to display various patterns by using nested loops.	ISA, ESE, LAB
	3.5 Attempt to solve some standard methods belonging to	LAB

	computational mathematics by proposing programming solution	
LO4: Design modular C programs by defining and organizing functions to solve subproblems, apply appropriate storage classes to manage variable scope and lifetime, and evaluate recursive and iterative approaches to select the most effective solution strategy.	4.1 Propose a solution which uses divide and conquer approach to solve the challenging tasks programs on Leet Code / Hacker Rank Platform	LAB
	4.2 Analyse the problem statement to identify the scope of using recursion and accordingly implement it.	ISA, LAB, ESE
	4.3 Demonstrate the usage and effect of different storage classes.	MSE, LAB, ESE
	4.4 Use and test the library functions used for character processing	LAB
LO5: Develop C programs that utilize arrays (one-dimensional and multidimensional), strings, and structures—including nested and array-based structures—to efficiently store, process, and manipulate grouped and complex data using appropriate standard library functions and data operations.	5.1. Perform operations like sorting, insertion, deletion and searching on One dimensional array.	ISA, LAB, MSE, ESE
	5.2. Perform operations like Matrix Multiplication, Addition, Transform, Magic Square generation etc.	ISA, LAB, MSE, ESE
	5.3 Propose user defined functions for: string length, string copy, string reverse, string concatenation, searching for substring.	ISA, LAB
	5.4 Declare a structure for representing the data about the entity, perform operations like, data population, updating, searching and displaying the records	LAB, ESE
LO6: Explain and apply pointer concepts in C programming—including referencing,	6.1 Demonstrate how pointer arithmetic is different from non-pointer arithmetic.	LAB, ESE

dereferencing, pointer arithmetic, and dynamic memory allocation—and use pointers effectively with arrays and functions to solve memory and data-handling problems.	6.2 Write a program to process elements of 1 D array and 2 D array with the help of pointers	LAB, ISA
	6.3 Solve programming challenges from Leet Code / Hacker Rank platform which involves dynamic memory allocation	ISA, LAB
	6.4 Develop an application to insert records into text file, delete and update them as per the need.	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*

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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*

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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*

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4. **Introduction to Programming in C**

- **Platform**: Coursera (Duke University)
- **Link**: https://www.coursera.org/learn/c-programming
- 🚀 *Hands-on certification course with beginner to intermediate content*

Course Name: Effective Communication

Course Code: AEC01T and AEC01P

Vertical/ Sub-Vertical: 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:***	4

		3.1 Learners will be able to enhance their vocabulary through etymology, synonyms, antonyms, and one-word substitutes, while strengthening grammar proficiency in articles, prepositions, tenses, and punctuation to excel in TOEFL, GRE, and other proficiency tests. (CO3) (P.I.10.1.1, 10.1.2, 10.1.3, 12.1.1, 12.1.2, 12.3.1, 12.3.2) *3.2 Learners will be able to identify common writing errors and effectively use grammar checkers and sentence correction tools to improve the accuracy and clarity of their written work. (CO3) (P.I. 10.1.2, 12.1.1, 12.1.2, 12.2.2)* *3.3 Learners will be able to apply grammar knowledge and utilize digital correction tools to produce clear, professional written communication essential for career success. (CO3) (P.I.10.1.2, 12.1.1, 12.1.2, 12.2.2)*	
4	Presentation Skills	***Learning Objective:*** *To build confidence and effectiveness in delivering oral presentations, including the use of visual aids and proper body language. (CO1, CO4)* **Contents:** Introduction to Presentation Skills, Creating Presentations-Content, Delivering Presentations before an audience, Using Presentation Software-Modern Presentation Tools ***Learning Outcomes:*** *4.1 Learners will be able to design well-structured presentations by effectively organizing content and applying fundamental presentation skills. (CO4) (P.I. 10.1.3, 10.3.1, 10.3.2, 5.1.1, 5.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1)* *4.2 Learners will be able to confidently deliver presentations to an audience using effective verbal and non-verbal communication techniques to engage 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	Comprehension And Summarization	***Learning Objective:*** *To improve the ability to quickly read, interpret, and respond to complex texts such as manuals, technical articles, and instructions. (CO5)* **Contents:** Comprehension & Reading Strategies, Graphic Organizers (Mind Maps, Flow Charts, Tree Diagrams etc.), Summarization of technical passages within specified word limit ***Learning Outcomes:*** *5.1 Learners will be able to apply effective comprehension and reading strategies to analyse, interpret, and critically evaluate various types of texts. (CO5) (P.I.10.1.1, 12.1.1, 12.1.2)* *5.2 Learners will be able to use graphic organizers like mind maps, flow charts, and tree diagrams to visually organize information and enhance understanding and retention. (CO5) (P.I.10.3.1, 12.1.1)* *5.3 Learners will be able to accurately summarize technical passages within a specified word limit, capturing key points clearly and concisely. (CO5) (P.I.10.1.1, 10.1.2, 12.1.1, 12.3.1)*	2
6	Communication Strategies for Virtual Age	***Learning Objective****: To raise awareness of secure digital communication practices, develop online content, and master the use of ICT tools in accordance with professional and ethical standards. (CO6)* **Contents:** Digital Content Creation, Infographics, ICT Tools, Social and Popular Media Self-learning topics: List of self-learning topics on communication strategies for the virtual age are: Virtual communication etiquette by watching relevant videos, writing clear digital messages by using various social media platforms ***Learning Outcomes:*** *6.1 Learners will be able to create engaging digital content and infographics using various ICT tools to effectively communicate information. (CO6) (P.I.10.3.2, 10.3.1, 12.1.1, 12.1.2, 12.2.2, 5.1.1,5.2.1, 5.2.2, 5.3.1, 5.3.2)*	4

		6.2 Learners will be able to critically analyse and effectively use social and popular media platforms to engage audiences and communicate messages responsibly. (CO6) (P.I. 10.1.2, 10.1.3, 5.2.2, 5.3.2, 8.1.1, 8.4.2, 12.1.1, 12.1.2, 12.2.2)	
Total			**30**

Suggested List of Practical:

Sr No.	Suggested Topic(s)
1.	Practice and Delivery of Public Speech. Document a speech, free of plagiarism. ***Learning Outcomes:*** *A learner will be able to:* *2.2 Learners will be able to craft clear, organized speeches and deliver them confidently using effective verbal and non-verbal communication techniques. (CO2) (P.I. 10.3.2, 10.2.1, 10.2.1, 8.1.1, 8.4.2, 12.1.1, 12.1.2)* *2.3 Learners will be able to distinguish different types of speeches and apply key public speaking tips to deliver engaging and effective presentations. (CO2) (P.I. 10.1.3, 10.2.2, 10.3.2, 9.2.1, 9.2.2, 9.2.3, 12.1.1,12.1.2, 12.2.2)* *3.2 Learners will be able to identify common writing errors and effectively use grammar checkers and sentence correction tools to improve the accuracy and clarity of their written work. (CO3) (P.I. 10.1.2, 12.1.1, 12.1.2, 12.2.2)* *3.3 Learners will be able to apply grammar knowledge and utilize digital correction tools to produce clear, professional written communication essential for career success. (CO3) (P.I.10.1.2, 12.1.1, 12.1.2, 12.2.2)*
2.	MOOC TCSion Course ***Learning Outcomes:*** *A learner will be able to:* *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									5/26		5/26
CO2							2/26	3/26	7/26		8/26
CO3									5/26		10/26
CO4					4/26			21/26	10/26		
CO5									4/26		5/26
CO6					7/26		2/26		4/26		6/26

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1: Students develop proficiency in verbal and non-verbal communication relevant to academic and professional settings.	1.1 Learners will practice public speaking through Speech delivery to enhance both verbal and non-verbal communication	ISA LAB
	1.2 Learners will document the speech, free of plagiarism, using various plagiarism checkers.	ISA TH
	1.3 Learners will perform role plays to identify and analyse physical, mechanical, psychological, semantic, socio-cultural, and	ISA LAB

	cross-cultural barriers to communication, and propose strategies to overcome them effectively. (Activity)	
LO2: Improves Listening and Speaking in both academic and professional interactions.	2.1 Learners will be able to apply effective listening techniques through various listening exercises	ISA LAB
	2.2 Learners will complete MOOC on TCSion for effective verbal and non-verbal communication techniques.	MSE
	2.3 Learners will deliver extempore public speeches by applying key public speaking tips.	ISA LAB
LO3: Equips students with strategies to perform well in verbal aptitude sections of standardized tests and engineering placement assessments.	3.1 Learners will attempt various grammar tests, in the form of comprehension exercises, thereby, strengthening grammar proficiency in articles, prepositions, tenses, and punctuation to excel in TOEFL, GRE, and other proficiency tests.	ISA TH
	3.2 Learners will read research papers and summarise them to improve the accuracy and clarity of their written work.	ESE LAB
	3.3 Learners will write Blogs/ Travelogues, etc. to apply grammar knowledge and utilize digital correction tools to produce clear, professional written communication essential for career success.	ESE LAB
LO4: Builds confidence and effectiveness in delivering oral presentations, including the use of visual aids and proper body language.	4.1 Learners will confidently deliver group presentations to an audience using effective verbal and non-verbal communication techniques to engage and inform listeners.	ISA LAB
	4.2 Learners will be able to proficiently use modern presentation software and tools to create visually engaging and impactful presentations. Various ICT tools may also be used for enhanced content delivery.	MSE
LO5: Improves the ability to quickly read, interpret, and respond to complex texts such as	5.1 Learners will make reports of the Presentations to improve their writing prowess.	ISA TH

manuals, technical articles, and instructions.	5.2 Learners will use graphic organizers like mind maps, flow charts, and tree diagrams to visually organize information from research papers.	ISA LAB
LO6: Students become aware of secure digital communication practices, develop online content, and master the use of ICT tools in accordance with professional and ethical standards.	6.1 Learners will make Posters using different ICT tools and give presentations.	ISA LAB

Textbooks:

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

Liberal Learning/ Co-curricular Courses

Course Name: Various dance forms

Course Code: CC01

NEP Vertical _Basket: 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	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

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: Corporate and Social Etiquettes

Course Code: CC02

Category: General Education

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	-	25	050

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 • Conflict of interest and workplace compliance • Handling ethical dilemmas and reporting concerns • Diversity, equity, and inclusion in behavior • Course wrap-up, capstone presentations, and reflection	5
Total			**30**

Reference Books / Resources:

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

Course Name: Global Citizenship Education

Course Code: CC03

NEP Vertical _Basket: HSSM_VEC

Preamble:

In an increasingly interconnected world, students must be prepared not only as professionals but also as informed and responsible global citizens. This course aims to develop an awareness of global interdependence, foster respect for cultural diversity, and encourage civic engagement in addressing complex global challenges such as inequality, climate change, conflict, and social justice. Through interdisciplinary and experiential learning, learners will critically reflect on their roles in shaping a more inclusive, peaceful, and sustainable future.

Prerequisite:

Open to all undergraduate students with an interest in societal issues, global affairs, and personal development. No prior experience in international studies is required.

Course Objectives:

1. Understand the foundational concepts and principles of global citizenship.
2. Examine global challenges including poverty, inequality, climate change, and conflict.
3. Foster respect for cultural diversity and promote intercultural communication skills.
4. Promote ethical reasoning, human rights awareness, and civic responsibility.
5. Encourage active engagement in sustainable practices and social justice initiatives.
6. Develop critical thinking, media literacy, and digital citizenship skills.CO1: Define and explain the principles of global citizenship.

Course Outcomes:

CO1: Define and explain the meaning, relevance, and scope of global citizenship.

CO2: Analyze the causes and effects of key global challenges and development goals.

CO3: Demonstrate intercultural sensitivity and communicate across diverse backgrounds.

CO4: Apply principles of human rights and ethics in real-world decision-making.

CO5: Propose or participate in local actions with global impact.

CO6: Critically evaluate media, technology, and social narratives influencing global understanding.

Course Scheme:

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

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	75	-	-	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.

Suggested Assessment & Evaluation:

1. Assignments: Reflective essay on the benefits of natural farming (20%).
2. Quizzes: On core principles and environmental impact (20%).
3. Case Study Analysis: Evaluate a case study on chemical farming's impact vs. natural farming's benefits (30%).
4. Group Presentation: Develop a plan to implement natural farming in a chosen area (30%).

Detailed Syllabus:

Module No.	Module Name	Content
1	Foundations of Global Citizenship	• Definition, scope, and importance of global citizenship. • The interconnected world: globalization, global systems, and responsibilities. • Overview of global issues: poverty, inequality, environment, migration. • Opportunities and roles of youth in global problem-solving. • Introduction to SDGs and their global significance.
2	Culture, Diversity, and Communication	• Understanding cultural identity, norms, and differences. • Developing cultural awareness and reducing stereotypes. • Skills for effective intercultural communication. • Diversity and inclusion in the global context. • Gender, LGBTQ, and social equity in cultural narratives.
3	Human Rights, Social Justice, and Peace	• Historical evolution and significance of human rights. • Universal Declaration of Human Rights and related frameworks. • Social justice movements (civil rights, women's rights, LGBTQ). • Conflict and peace: understanding root causes and resolution strategies. • Building inclusive, peaceful societies through civic engagement.

4	Environment, Sustainability, and Global Health	• Climate change causes, global impacts, and policy responses. • Conservation of biodiversity and ecosystems. • Individual actions for sustainability and responsible consumption. • Global health disparities and healthcare access. • Importance of mental health and well-being in the global agenda.
5	Economy, Technology, and Media Literacy	• Impact of globalization on economies and societies. • Fair trade principles and ethical consumer choices. • Role of technology in solving global challenges. • Digital divide, access, and digital citizenship. • Media's influence on shaping global narratives and critical media evaluation.
6	Action, Reflection, and Global Engagement	• Civic responsibility and youth-led advocacy and activism. • Ethical frameworks for decision-making in global contexts. • Sustainable living: practical steps to apply global citizenship daily. • Integrating global citizenship in education and experiential learning. • Final project: student-led presentations and action plans.

Reference Books:

1. Learning to Live Together: UNESCO Global Citizenship Education Guide
2. Pedagogy of the Oppressed by Paulo Freire
3. Educating for Global Citizenship by Lloyd Kornelsen
4. Factfulness: Ten Reasons We're Wrong About the World – and Why Things Are Better Than You Think by Hans Rosling

Course Name: Wellness: Body, Mind and Spirit

Course Code: CC04

Category: General Education

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
Total Hours		**30**

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: IQ vs EQ

Course Code: CC05

NEP Vertical _Basket: 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

NEP Vertical _Basket: 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

NEP Vertical _Basket: 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 the 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

NEP Vertical _Basket: 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. IndianRailways,Landandbridges,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

NEP Vertical _Basket:

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	75	-	-	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

NEP Vertical _Basket: 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	75	-	-	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

NEP Vertical _Basket: 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 nonverbal 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 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	75	-	-	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

NEP Vertical _Basket: 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	75	-	-	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

Detailed Syllabus of First Year Semester-II

Course Name: Engineering Mathematics-II

Course Code: BESE_BSC03

Vertical/ Sub-Vertical: BESE_BSC

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Nil

Pre-requisite for: BESE_BSC_05 & BESE_BSC_41 (Engineering Mathematics-III) and higher-level mathematical courses.

Recommended Semester: 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
BSC03	3	-	3	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (BSC03)	20 (~20%)	30 (~30%)	50 (~50%)	100 (100%)

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

Preamble:

This course provides a deeper insight into topics that build on the first semester. Students will study linear algebra, vector calculus, and numerical techniques focusing on methods directly applicable to engineering fields such as computer science, electronics, and mechanical engineering.

Course Objectives:

- To enable learners to apply numerical methods for solving transcendental equations and systems of linear equations using iterative techniques such as Newton-Raphson, False Position, Gauss-Jacobi, and Gauss-Seidel.
- To develop the ability to compute the rank of matrices using various methods, solve homogeneous and non-homogeneous linear systems, and assess the consistency of equations through matrix operations.

- To equip learners with the knowledge to compute eigenvalues and eigenvectors, understand their properties, apply the Cayley-Hamilton Theorem, and perform matrix diagonalization and classification.
- To build a foundational understanding of vector spaces, subspaces, orthogonality, norms, and vector operations using analytical and computational tools, including the Gram-Schmidt process.

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Recall key formulas and definitions related to rank of matrix , eigen values, Cayley Hamilton theorem , vector spaces and Numerical integration.	Remembering
CO2	Explain the differences between various numerical methods, matrix rank determination techniques, types of linear systems, and properties of orthogonality and vector norms.	Understanding
CO3	Apply numerical and linear algebra techniques such as Newton-Raphson, Gauss-Seidel, eigenvalue computation, and Gram-Schmidt orthogonalization to solve mathematical problems and implement them using computational tools.	Applying

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Rank of Matrix	***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 CO3)* **Contents:** Rank of matrix using echelon forms, reduction to normal form ,PAQ forms. ***Learning Outcomes:*** *A learner will be able to:* *1.1 Recall Definition of rank of matrix . (P.I.- 1.1.1) (CO1)* *1.2 Explain normal and PAQ form of rank of matrix. (P.I.- 1.1.1) (CO2)* *1.3 Compute the rank using ,echelon form,PAQ form . (P.I.- 2.4.1) (CO3)*	7
2	System of Linear Equations	***Learning Objective:*** *To develop an understanding of how matrix rank is applied to analyze and solve systems of linear equations. (CO1 to CO3)* **Contents:**	7

		System of homogeneous and non-homogeneous equations their consistency and solution. Linear Independence and Dependence of Vectors. ***Learning Outcomes:*** *A learner will be able to:* *2.1 Recall definition of solution of system of homogenous and non homogeneous equations. (P.I.- 1.1.1) (CO1)* *2.2 Describe linear dependence and independence of vectors. (P.I.- 1.1.1) (CO2)* *2.3 Solve non-homogeneous and homogeneous linear systems using matrix methods.. (P.I.- 2.4.1) (CO3)*	
3	Eigen Values and Eigen Vectors	***Learning Objective:*** *To introduce the concept of eigenvalues and eigenvectors and develop the ability to compute and interpret them in different contexts. (CO1 to CO3)* **Contents:** Characteristic equation, Eigen values and Eigen vectors, properties of Eigen values and Eigen vectors. ***Learning Outcomes:*** *A learner will be able to:* *3.1 Recall properties of eigen values and eigen vectors of matrix . (P.I.- 1.1.1) (CO1)* *3.2 Explain the properties of eigenvalues and eigenvectors in matrix computations. . (P.I.- 2.4.1) (CO2)* *3.3 Compute eigen values and eigen vectors of matrix . (P.I.- 2.4.1) (CO3)*	8
4	Cayley Hamilton Theorem	***Learning Objective:*** *To enable learners to apply the Cayley-Hamilton theorem in matrix computations, including functions of matrices, diagonalization, and similarity transformations. (CO1 to CO3)* **Contents:** Cayley-Hamilton theorem (without proof), examples based on verification of Cayley- Hamilton theorem. Similarity of matrices, Diagonalisation of matrices. Functions of square matrix, derogatory and non-derogatory matrices. ***Learning Outcomes:*** *A learner will be able to:* *4.1 Recall the cayley Hamilton theorem. (P.I.- 1.1.1) (CO1)*	7

		4.2 Explain the significance of the Cayley-Hamilton Theorem. (P.I.- 2.1.1) (CO2) *4.3 Compute function of square matrix, and perform diagonalization of a matrix . (P.I.- 2.4.1) (CO3)*	
5	Vector Spaces	***Learning Objective:*** *To understand and apply the properties of vector spaces, orthogonality, and related processes like Gram-Schmidt orthogonalization. (CO1 to CO3)* **Contents:** Vectors in n-dimensional vector space: properties, dot product, cross product, norm, and distance properties in n-dimensional vector space. Vector spaces over real field, properties of vector spaces over real field, subspaces, The Cauchy-Schwarz inequality, Orthogonal Subspaces, Gram-Schmidt process. ***Learning Outcomes:*** *A learner will be able to:* *5.1 Recall the definition of orthogonal vectors, inner product, norms and properties of vector space. (P.I.- 1.1.1) (CO1)* *5.2 Determine the angle between vectors and assess orthogonality. (P.I.- 1.1.1) (CO2)* *5.3 Apply Gram Schmidth process, to construct orthonomal basis and determine if a given set forms a vector space (P.I.- 2.4.1) (CO3)*	8
6	Numerical Solutions of Transcendental and Linear Algebraic Equations	***Learning Objective:*** *To introduce numerical techniques for solving transcendental equations and systems of linear equations, emphasizing iterative methods and computational implementation. (CO2 to CO3)* **Contents:** Solution of Transcendental Equations using Newton-Raphson method and Regula-Falsi method. Solution of system of linear algebraic equations using Gauss-Jacobi Iteration Method and Gauss-Seidel Iteration Method. ***Learning Outcomes:*** *A learner will be able to:* *6.1 Explain the rationale for using approximate methods over exact ones. (P.I.- 2.4.1) (CO2)* *6.2 Compute approximate roots and system of linear equation using approximate method (P.I.- 2.4.1) (CO2)*	8
Total			**45**

Performance Indicators:

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

Mapping of Course Outcomes with Learning Outcomes:

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

Mapping of Course Outcomes with Programme Outcomes:

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

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: *Recall Definition of rank of matrix . (P.I.- 1.1.1) (CO1)*	• The student can define the rank of a matrix using the concept of non-zero minors. • The student can state conditions under which a matrix has a specific rank. • The student can identify basic properties related to the rank of matrices. • The student can recognize the role of rank in solving systems of equations	MSE ISA ESE
LO 1.2: *Explain normal and PAQ form of rank of matrix. (P.I.- 1.1.1) (CO2)*	• The student can define the normal form and PAQ form of a matrix. • The student can explain the structure and significance of each form. • The student can differentiate between normal and PAQ forms in terms of matrix transformation. • The student can describe the role of elementary operations in obtaining these forms.	MSE ISA ESE
LO 1.3: *Compute the rank using ,echelon form,PAQ form . (P.I.- 2.4.1) (CO3)*	• The student can perform row transformations to reduce a matrix to echelon form.	MSE

	• The student can apply PAQ transformations using elementary matrices. • The student can compute the rank by identifying the number of non-zero rows. • The student can justify the steps and verify results using both methods.	ISA ESE
LO 2.1: *Recall definition of solution of system of homogenous and non homogeneous equations. (P.I.- 1.1.1) (CO1)*	• The student can define homogeneous and non-homogeneous systems. • The student can state the conditions for the existence and uniqueness of solutions. • The student can differentiate between trivial and non-trivial solutions. • The student can identify augmented matrices and their role in solution sets.	MSE ISA ESE
LO 2.2: *Describe linear dependence and independence of vectors. (P.I.- 1.1.1) (CO2)*	• The student can define linear dependence and independence. • The student can identify linearly dependent/independent vectors through examples. • The student can verify dependence/independence using the rank method or determinant test. • The student can describe implications in terms of vector space basis and dimension.	MSE ISA ESE
LO 2.3: *Solve non-homogeneous and homogeneous linear systems using matrix methods.. (P.I.- 2.4.1) (CO3)*	• The student can formulate systems in matrix form (AX = B). • The student can use echelon form, inverse matrix, or rank method to find solutions. • The student can analyze solution types: unique, infinite, or no solution. • The student can justify each step with matrix operations and interpretation.	MSE ISA ESE
LO 3.1: *Recall properties of eigen values and eigen vectors of matrix . (P.I.- 1.1.1) (CO1)*	• The student can define eigenvalues and eigenvectors of a matrix. • The student can recall conditions for existence of real or complex eigenvalues. • The student can recognize implications of repeated and distinct eigenvalues.	MSE ISA ESE
LO 3.2: *Explain the properties of eigenvalues and eigenvectors in matrix computations. . (P.I.- 2.4.1) (CO2)*	• The student can interpret the role of eigenvalues and eigenvectors in matrix transformations. • The student can explain diagonalizability and its dependence on eigenvectors. • The student can describe effects of scalar multiplication and matrix powers on eigenvalues.	MSE ISA ESE

	• The student can discuss applications in stability analysis, systems of differential equations, etc.	
LO 3.3 *Compute eigen values and eigen vectors of matrix . (P.I.- 2.4.1) (CO3)*	• The student can formulate the characteristic equation • The student can solve for eigenvalues accurately. • The student can find corresponding eigenvectors • The student can verify results by substitution into the original equation	MSE ISA ESE
LO 4.1: *Recall the cayley Hamilton theorem. (P.I.- 1.1.1) (CO1)*	• The student can state the Cayley-Hamilton Theorem correctly. • The student can recall definitions of characteristic polynomial and matrix powers. • The student can recognize the applicability of the theorem to square matrices. • The student can identify basic implications.	MSE ISA ESE
LO 4.2: *Explain the significance of the Cayley-Hamilton Theorem. (P.I.- 2.1.1) (CO2)*	• The student can explain how Cayley-Hamilton helps in computing higher powers of matrices. • The student can justify the use of the theorem in finding the inverse of a matrix. • The student can relate the theorem to the minimal polynomial and matrix functions. • The student can illustrate its applications through examples.	MSE ISA ESE
LO 4.3: *Compute function of square matrix, and perform diagonalization of a matrix . (P.I.- 2.4.1) (CO3)*	• The student can compute matrix polynomials using Cayley-Hamilton Theorem. • The student can determine if a matrix is diagonalizable based on its eigenvalues and eigenvectors. • The student can diagonalize a matrix • The student can compute powers of a matrix using its diagonal form.	MSE ISA ESE
LO 5.1 *Recall the definition of orthogonal vectors, inner product, norms and properties of vector space. (P.I.- 1.1.1) (CO1)*	• The student can define orthogonal vectors and the concept of inner product. • The student can recall the definition of norm (magnitude/length of a vector). • The student can state basic properties of vector spaces (closure, associativity, etc.). • The student can recognize valid inner product spaces.	MSE ISA ESE
LO 5.2: *Determine the angle between vectors and*	• The student can compute the inner product of two vectors.	MSE

assess orthogonality. (P.I.- 1.1.1) (CO2)	• The student can use the dot product formula to determine the angle between vectors. • The student can analyze vector relations using geometric interpretation.	ISA ESE
LO 5.3: *Apply Gram Schmidth process, to construct orthonomal basis and determine if a given set forms a vector space (P.I.- 2.4.1) (CO3)*	• The student can apply the Gram-Schmidt process to convert a basis into an orthonormal one. • The student can normalize vectors after orthogonalization. • The student can verify if a given set satisfies vector space axioms. • The student can interpret the significance of an orthonormal basis in vector representation..	MSE ISA ESE
LO 6.2: *Explain the rationale for using approximate methods over exact ones. (P.I.- 2.4.1) (CO2)*	• The student can identify situations where exact solutions are difficult or impossible. • The student can explain the role of approximation in real-world engineering problems. • The student can justify the need for iterative methods (e.g., for transcendental equations, large systems). • The student can differentiate between exact and approximate approaches with examples.	MSE ISA ESE
LO 6.3: *Compute approximate roots and system of linear equation using approximate method (P.I.- 2.4.1) (CO2)*	• The student can apply Newton-Raphson and Regula-Falsi methods to find approximate roots. • The student can solve systems of equations using Gauss-Jacobi and Gauss-Seidel methods. • The student can perform multiple iterations to reach a desired accuracy. • The student can analyze and compare results of different methods.	MSE ISA ESE

Tools/ Technologies/ Programming Languages learnt:

- Python
- MATLAB
- MS Excel
- Desmos

- Scientific Calculator

Textbooks:

1. Higher Engineering Mathematics, Ramana B V, Tata McGraw Hill, 12th edition.
2. A Textbook of Applied Mathematics, P.N.Wartikar, J.N.Wartikar, Pune Vidyarthi Grih, Vol. I & II

Reference Books:

1. Higher Engineering Mathematics, Dr. B. S Grewal, Khanna Publication, 9th edition.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Ltd, 9th edition.
3. Engineering Mathematics, Srimanta Pal and Subodh, C. Bhunia, Oxford University Press, 1st edition.
4. Matrices, Shanti Narayan, S.Chand, 10th edition.
5. Applied Numerical Methods with MATLAB for Engineers and Scientists, Steven Chapra, McGraw Hill, 3rd edition
6. Elementary Linear Algebra with Application, Howard Anton and Chrisr Rorres, John Wiley & Sons Inc., 6th edition.

Related/ Equivalent MOOC and Associated Certification:

11. Make and Manipulate Matrices
    - Platform: MATLAB
    - Link: https://matlabacademy.mathworks.com/details/make-and-manipulate-matrices/otmlmmm
12. Calculations with Vectors and Matrices
    - Platform: MATLAB
    - Link: https://matlabacademy.mathworks.com/details/calculations-with-vectors-and-matrices/otmlcv
13. Maths Bridging Course- Algebra, trigonometry and Calculus
    - Platform: Udemy
    - Link: https://www.udemy.com/course/mathematics-bridging-course-high-school-to-university/?kw=maths&src=sac&couponCode=KEEPLEARNING
14. Advanced Engineering Mathematics
    - Platform: NPTEL (Swayam)- IIT Roorkee
    - Link: https://onlinecourses.nptel.ac.in/noc25_ma85/preview

Course Name: Engineering Graphics

Course Code: ESC01T & ESC01P

Vertical/ Sub-Vertical: BESC_ESC

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 & 2

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:* *1.1 Identify the importance of engineering graphics in technical communication. (PI-1.1.2**)** (CO1)* *1.2 Explain the types of quadrants and methods of projection used in engineering drawings. (PI-1.2.2**)** (CO1)* *1.3 Demonstrate the use of drawing instruments and perform basic dimensioning and line work. (PI-1.3.1) (CO1)* *1.4 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:* *2.1.* Construct the path of a cycloid using basic geometric techniques. (*PI-3.1.1*) *(CO3)* *2.2.* Draw the involute of a circle and apply it in mechanical contexts such as gear tooth profiles. (*PI-3.1.2*) *(CO3)* *2.3.* 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:* *3.1.* Interpret the concept of reference planes and first angle projection system. (*PI-2.1.2*) *(CO2)* *3.2.* Construct projections of lines inclined to both HP and VP using graphical methods. (*PI-3.1.4*) *(CO3)* *3.3.* 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:* *4.1* Identify different types of planes (rectangular, triangular, polygonal, and circular) and their positions with respect to reference planes. (*PI-2.2.3*)*(CO2)*	4

		4.2 Construct accurate projections of inclined planes using the first angle projection method. (*PI-3.1.6*)*(CO3)* *4.3* 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:* *5.1.* Interpret pictorial views and convert them into accurate orthographic projections using the first angle method. (*PI-4.1.1*)*(CO4)* *5.2.* Generate sectional orthographic views of simple machine components using sketchbook and CAD software. (*PI-4.1.2*)*(CO4)* *5.3.* Use CAD tools to apply dimensions, annotations, layers, and line properties effectively. (*PI-1.5.1*)*(CO1)* *5.4.* 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:** Drawing Isometric views from given views of simple blocks with plane, cylindrical surfaces, and circular holes.	7

		- 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:* *6.1.* Convert orthographic views into isometric drawings of objects with planar, cylindrical surfaces, and circular holes. (*PI-5.1.1*)*(CO5)* *6.2.* Create isometric drawings manually and by using CAD tools, including switching ISO planes and drawing ISO circles. (*PI-5.1.2*)*(CO5)* *6.3.* 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: Computer Organization and Architecture

Course Code: ESC08

Vertical/ Sub-Vertical: BSES_ESC

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Fundamentals oof computer hardware and networking(ES06)

Pre-requisite for: Microprcessor (PCIT17)

Recommended Semester: 1

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
ESC08	3	-	3	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (ESC08)	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:

Study of computer hardware describes the basic structure of computer system and different ways of communicating with I/O devices and standard I/O interfaces. Network Fundamentals course provides the learners a clear understanding of how computer networks from local area networks to the massive and global Internet are built, how they allow computers to share information and communicate with one another. This course covers the physical aspects of computer hardware and computer networks.
Course Objectives:

- Basics of organizational and architectural issues of the digital Computer
- Various algorithms for computer arithmetic in digital Computer
- Analyze performance issues in Processor and Memory Design of digital Computer, also analyze processor performance, improvement using instruction--level parallelism **.**

Course Outcomes:

Learner will be able to:

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	To learn basic structure of computer system.	Understanding
CO2	To demonstrate the arithmetic algorithms.	Applying
CO3	To understand the basic concepts instruction handling of processor.	Analysing
CO4	To understand the generation of control signals of processor.	Analysing
CO5	To demonstrate the memory organization.	Evaluating
CO6	To describe the concepts of parallel processing for performance improvement of processor.	Analysing

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Overview of computer system	***Learning Objective:*** Develop the ability to analyse utility of different functional units of computer and their technological evolutions. *(CO1)* **Contents:** • Basic of computer Organization and Architecture . • Block Level functionalUnits. • Von- Neumann Model • Computer Evolutions ***Self-Learning Topics****: Basic operating principle of simple processor* ***Learning Outcomes:*** *A learner will be able to:* 1.1 Students can understand technological evolutions of computers in terms of processor Mfg. main memory and secondary memory technology, as well as hardware and software features of computer evolutions. (CO1) (PI 1.3.1,1.4.1,2.1.2) 1.2 Students will learn block level functioning of computer systems. (CO1) (PI 1.4.1,2.2.1,2.3.1)	4
2	Data Representation and Arithmetic algorithms	***Learning Objective:*** Develop the ability to analyse different arithmetic Algorithms and their impact on processors performance. *(CO2)* **Contents:** • IEEE-754 Floating point Representation	7

		• Binary Arithmetic units for Addition, Subtraction,Multiplication, Division • Booths Multiplication Algorithm. • Restoring and Non-restoring Division Algorithm • Floating point arithmetic unit's implementation ***Self-Learning Topics**: NIL* ***Learning Outcomes:*** *A learner will be able to:* 2.1 Students will learn various data representation techniques for fixed points and floating-point numbers. (CO2) (PI 1.3.1,1.4.1,2.2.1,2.3.1) 2.2 Students can implement different types of fixed-point arithmetic units, and their hardware tested algorithms. (CO2) (PI 1.3.1,1.4.1,2.1.2)	
3	**Processor Organization and Architecture**	***Learning Objective:*** Understand instruction Architecture and instruction handling process of standard processor. (CO3) **Contents:** • Register Organization, • Instruction Cycle, Instruction sequencing • Instruction Formats • Addressing modes • Instruction Interpretation ***Learning Outcomes:*** *A learner will be able to:* 3.1 Students will learn details of instruction handling by standard processor Students will learn details of instruction handling by standard processor. (CO3) (PI 1.3.1,1.4.1,2.1.2) 3.2 Students will understand various instruction formats and their addressing techniques. (CO3) (PI 1.3.1,1.4.1,2.2.1)	6
4	**Control Unit Design**	***Learning Objective:*** Understand different methods of control unit design and various processor architecture. (CO4) **Content:** • Hardwired Control Unit: State Table Method, Delay Element Method and sequence counter method . • Microprogrammed Control Unit: Micro Instruction- Format, Sequencing and execution, Micro operations, Examples of microprograms, wikies design. • RISC vs CISC	8

		Learning Outcomes: *A learner will be able to:* 4.1 Students can implement control units of processor using different methods of hardwired control unit (CO4) (PI 1.3.1,1.4.1,2.1.2) 4.2 Students will also learn different types of processor architecture and their performance parameters (CO4) (PI 1.4.1,2.2.2)	
5	**Memory Organization**	***Learning Objective:*** Understand various communication mediums and analyse their important characteristics. Also, analyse different wave propagation techniques use in computer communication. (CO5) **Content:** • Introduction and characteristics of memory, Types of RAMS and ROM, Memory Hierarchy, 2-level Memory Characteristic. • Cache Memory: Concept, locality of reference, Cache mapping techniques, Cache • Coherence and writing policies ***Learning Outcomes:*** *A learner will be able to:* 5.1 students can understand the necessity of hierarchical structure of computers and utility of each level of memory hierarchy of computer. (CO5) (PI 1.2.1,1.3.1,1.4.1) 5.2 Students can learn different types of memory classification and their working principles. (CO5) (PI 1.2.1,1.3.1,1.4.1)	10
6	**Principles of Advanced Processor and Buses**	***Learning Objective:*** Construct isometric views of blocks with planar and cylindrical features using manual and CAD drafting techniques. *(CO1, CO5).* **Contents:** • Basics of Pipelining • Instruction pipelining (4, 5,6 stages) • Datapath pipelining and pipelining hazards • Flynn's Classification, Introduction to multicore architecture ***Learning Outcomes:*** *A learner will be able to:* 6.1 Students will learn how pipelining can improve the performance of processor. (CO6) (PI 1.4.1,2.1.2,2.3.1)	10

		6.2 Students will be familiarized with various parallel computer Architecture. (CO6) (PI 2.2.1,2.3.1,2.4.2)	
Total			**45**

Performance Indicators:

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

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

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

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

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

PI 1.4.2 Understanding: Explain the functions of specialized engineering systems in the computer engineering domain

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

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

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

Mapping of Course Outcomes with Learning Outcomes:

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

Mapping of Course Outcomes with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO7	PO8	PO9	P010	PO11	PO12
CO1	8/47	-	-	-	-	-	-	-	-	-	-
CO2	3/47	2/47	1/47	-	-	-	-	-	-	-	-
CO3	5/47	1/47		-	-	-	-	-	-	-	-
CO4	7/47	1/47	-	-	-	-	-	-	-	-	-
CO5	6/47	1/47	-	-	-	-	-	-	-	-	-
CO6	8/47	4/47-	-	-	-	-	-	-	-	-	-

Assessment Criteria of Learning Outcomes:

Learning Outcomes: **The Learner will:**	**Assessment Criteria:** **The Learner can:**	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: Students can understand technological evolutions of computers in terms of processor Mfg. main memory and secondary memory technology, as well as hardware and software features of computer evolutions. (CO1) (PI 1.3.1,1.3.2,1.4.1,1.4.2,1.4.4)	1. Describe key milestones in processor and memory technology evolution. 2. Compare hardware/software features across generations. 3. Explain changes in primary and secondary memory technologies.	ISA ESE MSE
LO 1.2: Students will learn block level functioning of computer systems. (CO1) (PI 1.4.1,1.4.2,1.4.3)	1. Identify and explain major functional blocks of a computer. 2. Describe data flow among CPU, memory, and I/O blocks. 3. Analyse the interactions among components during instruction execution	ISA MSE ISA
LO 2.1: Students will learn various data representation techniques for fixed points and floating-point numbers. (CO2) (PI 1.1.1,1.1.2,1.3.3)	1. Convert between binary, decimal, and hexadecimal representations. 2. Represent integers and real numbers in fixed and floating-point formats.	ISA, MSE MSE, ESE

	3. Identify precision and range limitations of various formats.	ISA
LO 2.2: Students can implement different types of fixed-point arithmetic units, and their hardware tested algorithms. (CO2) (PI 2.2.3,2.2.4,3..4.3)	1. Design circuits for addition, subtraction using fixed-point logic. 2. Simulate fixed-point units using Virtual Lab simulation tools. 3. Analyse performance of implemented units.	ESE, MSE ISA ISA
LO 3.1: Students will learn details of instruction handling by standard processor Students will learn details of instruction handling by standard processor. (CO3) (PI 1.4.1,1.4.2,2.1.2)	1. Describe fetch-decode-execute cycle. 2. Explain role of control unit in instruction handling. 3. Trace execution of simple instruction sequences.	MSE MSE, ESE ISA
LO 3.2: Students will understand various instruction formats and their addressing techniques. (CO3) (PI 1.4.1,1.4.2,1.4.3)	1. Identify different instruction formats (1/2/3-address). 2. Explain various addressing techniques with examples. 3. Evaluate suitability of addressing modes for different instructions.	ISA MSE, ESE ESE
LO 4.1: Students can implement control units of processor using different methods of hardwired control unit (CO4) (PI 1.4.2,1.4.3,1.4.4,1.4.6)	1. Design a hardwired control unit using control signals. 2. Simulate timing sequences for instruction control. 3. Evaluate pros and cons of hardwired vs. microprogrammed control	ESE ISA MSE,ESE

LO 4.2: Students will also learn different types of processor architecture and their performance parameters (CO4) (PI 1.4.1,1.4.2,1.4.4,2.1.4)	1. Compare RISC, CISC, VLIW architectures. 2. Define and interpret performance metrics (CPI, MIPS, etc.). 3. Evaluate design trade-offs for different architectures.	MSE, ESE ISA ISA
LO 5.1: students can understand the necessity of hierarchical structure of computers and utility of each level of memory hierarchy of computer. (CO5) (PI 1.3.2,1.3.4,2.1.2)	1. Identify levels of memory hierarchy and their characteristics. 2. Explain the need for memory hierarchy in computing. 3. Discuss impact of hierarchy on system performance.	MSE, ESE MSE MSE
LO 5.2: Students can learn different types of memory classification and their working principles.(CO5) (PI 1.3.1,1.3.2,1.3.3,1.3.4*)*	1. Classify memory types (SRAM, DRAM, ROM, Cache). 2. Explain how each memory type operates and is accessed. 3. Design basic memory modules for given specifications.	ESE MSE, ISA ESE
LO 6.1: Students will learn how pipelining can improve the performance of processor. (CO6) (PI 1.4.2,1.4.3,1.4.4,2.1.4,2.2.4)	1. Explain stages of instruction pipeline. 2. Identify hazards in pipeline execution (data, control). 3. Evaluate speedup due to pipelining.	ISA MSE ISA, ESE
LO 6.2: Students will be familiarized with various parallel computer Architecture. (CO6) (PI 1.4.1,1.4.2,1.4.41.4.6,2.1.2,2.2.3)	1. Classify parallel architectures (SIMD, MIMD, etc.). 2. Compare performance of different parallel systems. 3. Justify use of architecture for specific applications.	ESE ESE ISA

Tools/ Technologies/ Programming Languages learnt:

Git Hub Logisim

- Simulation Platforms: Git Hub Logisim, IIT Kharagpur Virtual Lab

Textbooks:

1. Williem Stalling" Structured Computer Organization", 8th Edition, Pearson, 2021.
2. Kai Hwang, Fayé Alayé Briggs, "Computer architecture and parallel processing", McGrawHill publication, 2017.
3. Andrew S. Tanenbaum, "Structured Computer Organization" 8th Edition, McGrawHill publication, 2023.

Reference Books:

1. Smruti Ranjan Sarangi, "Computer Organization and Architecture", McGraw-Hill Publication..
2. John P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 1988.
3. B.Govindarajalu, "Computer Architecture and Organization", Tata McGraw-Hill Education India, 2018

Related/ Equivalent MOOC and Associated Certification:

1. Digital System design video lectures
   - Platform: YOU Tube
   - Link: http://freevideolectures.com/Course/2319/Digital-Systems-Design/3
2. Introduction to Pipeline hazards
   - Platform: NPTEL (National Programme on Technology Enhanced Learning)
   - Linkhttp://nptel.ac.in/courses/106108055/22,
3. Pipelined Processor Design Basic Idea Pipelined Processor Design Basic Idea
   - Platform: Coursera
   - Link: https://www.coursera.org/learn/data-structures
   - Memory Hierarchy : Basic Idea
   - Platform: Coursera
   - Link: http://nptel.ac.in/courses/106102062/28

Course Name: Object Oriented Programming

Course Code: VSEC02T & VSEC02P

Vertical/ Sub-Vertical: SC_VSEC

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: VSEC01T & VSEC01P (Structured Programming)

Pre-requisite for: VSEC03 (Python Programming)**,** PRJCE01 (Project)

Recommended Semester: 2

Course Scheme:

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

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (VSEC02T)	15 (~20%)	20 (~30%)	40 (~50%)	75 (100%)
Practical (VSEC02P)	25 (50%)	-	25 (50%)	50 (100%)

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

Preamble:

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

Course Objectives:

1. To introduce students to the foundational concepts of Java programming, including its features, platform independence for developing basic programs.
2. To enable learners to implement object-oriented programming principles such as classes, objects, constructors, method overloading, and object passing, fostering modular and reusable Java code.

3. To apply advanced OOP concepts like inheritance, interfaces, polymorphism, and wrapper classes (String, StringBuffer, Vector) to develop extensible and maintainable Java applications.
4. To develop the ability to handle runtime errors gracefully by applying exception handling mechanisms for building robust applications.
5. To introduce students to concurrent programming and application modularization for building interactive and scalable Java programs.

Course Outcomes:

Learner will be able to:

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

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction to Java	***Learning Objective:*** *To enable students to understand and apply the foundational concepts of Java programming such as platform independence, data types, control structures, static members, and arrays to develop simple and structured programs.(CO1, CO2)* **Contents:** Features of Java, Platform Independence – Byte Code, JVM, JRE. Data Types, Operators, Control Structures, Static Data, Static Function, 1D Array and 2D Array ***Self-Learning Topics***: *Array Data Structure* **Learning Outcomes:** LO1.1: Describe the features of Java and explain how bytecode, JVM, and JRE contribute to its platform independence.(PI1.4.1 & PI 2.1.2)(CO1)	4

		LO1.2: Use data types, operators, and control structures to write basic Java programs. (PI1.3.3 & PI1.4.3) (CO2) **LO1.3**: Implement static variables and static functions to demonstrate shared functionality in Java. (PI2.4.3)(CO2) **LO1.4**: Construct Java programs using one-dimensional and two-dimensional arrays to manipulate tabular data. (PI2.2.3 & PI1.3.3) (CO2)	
2	Object Oriented Programming	***Learning Objective:*** *To enable students to construct modular and reusable programs by applying core object-oriented programming concepts such as class design, constructors, method overloading, object passing, and array of objects in Java.(CO3)* **Contents:** Classes and Objects, Instance Variables, Constructors, Object Passing Methods, Method Overloading, Array of Objects ***Learning Outcomes:*** *A learner will be able to:* ***LO2.1****: Define and use classes, objects, and instance variables to model real-world entities in Java programs. (PI1.4.1 & PI1.3.2)(CO3)* ***LO2.2****: Implement constructors (default and parameterized) to initialize Java objects (PI1.3.3 & PI2.4.3) (CO3)* ***LO2.3****: Demonstrate method overloading and object passing techniques to achieve functional flexibility. (PI1.4.3 & PI2.2.3)(CO3)* ***LO2.4****: Create and manipulate arrays of objects to organize and manage grouped object data. (PI1.3.6 & PI1.4.6)(CO3)*	4
3	Inheritance	***Learning Objective:*** *To equip students with the ability to develop flexible and reusable Java programs by applying advanced object-oriented concepts such as inheritance, interfaces, method overriding, and wrapper classes.(CO4)* **Contents:** Concept and Types, Constructors in Inheritance, Method Overriding and Dynamic Method Dispatch, abstract and final keyword, Interfaces – Concept and Significance, Wrapper Classes – String, StringBuffer, Vector ***Learning Outcomes:*** *A learner will be able to:* ***LO3.1****: Explain the concept and types of inheritance and the use of constructors in inheritance(PI2.1.2 & PI1.3.2)(CO4)* ***LO3.2****: Apply method overriding and dynamic method dispatch to implement runtime polymorphism.(PI1.4.3 & PI2.4.3)(CO4)* ***LO3.3****: Use abstract classes, final keywords, and interfaces to build structured and extendable programs.(PI1.4.4 & PI2.2.4)(CO4)*	4

4	Exception Handling	***Learning Objective:*** *To enable students to develop robust Java applications by applying exception handling mechanisms such as try-catch blocks, throws/throw keywords, and custom exception classes to manage runtime errors effectively.(CO5)* **Content:** To enable students to develop robust Java applications by applying exception handling mechanisms such as try-catch blocks, throws/throw keywords, and custom exception classes to manage runtime errors effectively. ***Learning Outcomes:*** *A learner will be able to:* ***LO4.1****: Explain the need for exception handling and distinguish between checked and unchecked exceptions (PI2.1. & PI2.4.2) (CO5)* ***LO4.2****: Analyze the flow of control in nested or multiple catch blocks to ensure error handling effectiveness. (PI2.4.4) (CO5)* ***LO4.5****: Create and use user-defined exceptions to handle domain-specific errors in Java applications.(PI2.4.5 & PI1.4.6) (CO5)*	7
5	Multithreaded Programming	***Learning Objective:*** *To enable students to design and manage concurrent programs by applying thread creation techniques, thread lifecycle methods, synchronization mechanisms, and exception handling in Java.* **Content:** Creating Thread – Different Methods, Using Thread Methods, Thread Exceptions, Priorities, Life Cycle of Thread Synchronization ***Learning Outcomes:*** *A learner will be able to:* ***LO5.1****: Explain the thread lifecycle and different ways of creating and managing threads in Java. (PI2.1.2 & PI3.2.2)(CO6)* ***LO5.2****: Implement multithreading using Thread class and Runnable interface with appropriate thread methods and priorities.(PI1.4.3 & PI2.4.3)(CO6)* ***LO5.3****: Handle thread-related exceptions and apply synchronization to avoid race conditions in concurrent programs.(PI2.4.4 & PI3.1.4)(CO6)* ***LO5.4****: Design efficient multithreaded applications incorporating synchronization, priorities, and exception handling.(PI1.4.6 & PI2.2.6)(CO6)*	5
6	Hashing	***Learning Objective*** *To enable students to design modular and interactive Java applications by organizing code using packages and developing applets using life cycle methods and graphical capabilities.(CO6)* **Contents:**	5

		Inbuilt Package, Importing Packages, User Defined Packages, Naming Packages, Advantages of Packages, Applet Basics, Applet Life Cycle, Applet Drawing Methods. ***Learning Outcomes:*** *A learner will be able to:* ***LO6.1****: Explain the concept, purpose, and benefits of using inbuilt and user-defined packages in Java. terms of efficiency and reliability. (PI2.1.2 & PI3.2.3) (CO6)* ***LO6.2****: Implement modular Java applications using package creation, importing, and naming conventions.(PI2.4.3 & PI1.4.3)(CO6)* ***LO6.3****: Develop interactive Java applets using applet life cycle methods and override paint() to draw on the screen.(PI1.4.6 & PI2.2.6)(CO6)* ***LO6.4****: Analyze the structure of modular Java programs using packages and applets to ensure maintainability and scalability.(PI2.4.4 & PI3.1.4)(CO6)*	
Total			**30**

Performance Indicators:

PI 1.1.1 Remembering: Recall key mathematical formulas and concepts relevant to engineering problems.
PI 1.3.1 Remembering: List fundamental engineering principles (e.g., Ohm's law, Bernoulli's equation) and their applications.
PI 1.3.2 Understanding: Explain the relevance of basic engineering principles to real-world problems.
PI 1.3.3 Applying: Perform calculations and simulations to solve simple engineering tasks.
PI 1.3.6 Creating: Design a system or solution integrating basic engineering fundamentals to meet specific requirements
PI 1.4.1 Remembering: Identify key concepts and tools in specialized areas such as computer architecture, AI, programming
PI 1.4.3 Applying: Implement domain-specific tools and technologies
PI 1.4.4 Analyzing: Compare and contrast different specialized engineering approaches for solving a given problem
PI 1.4.6 Creating: Propose innovative solutions using advanced computer engineering knowledge and tools.
PI 2.1.1 Remembering: Recall relevant engineering principles, theories, and concepts to identify a problem.
PI 2.1.2 Understanding: Explain the key features and scope of a complex engineering problem.
PI 2.1.3 Applying: Use standard problem-identification techniques (e.g., root cause analysis) to define an engineering challenge
PI 2.1.4 Analyzing: Decompose a complex engineering problem into its constituent parts to identify critical aspects
PI 2.1.5 Evaluating: Assess the relevance and significance of various problem aspects using evidence-based reasoning

PI 2.2.1 Remembering: List standard methodologies and tools applicable to solving engineering problems.
PI 2.2.2 Understanding: Describe the steps involved in formulating a solution plan for an engineering problem
PI 2.2.3 Applying: Develop a basic solution plan using a systematic approach to solve an identified problem.
PI 2.2.4 Analyzing: Evaluate various solution methodologies to determine the most effective approach for a given problem
PI 2.2.6 Creating: Design a comprehensive and innovative solution plan, integrating multidisciplinary methods if necessary
PI 2.4.1 Remembering: Recall procedures and tools required for executing an engineering solution process.
PI 2.4.2 Understanding: Explain the solution process and its relevance to the identified engineering problem.
PI 2.4.3 Applying: Implement the solution process using appropriate tools, software, or experimental setups.
PI 2.4.4 Analyzing: Examine the results of the solution process to determine trends, patterns, and inconsistencies
PI 2.4.5 Evaluating: Critically assess the solution's accuracy and efficiency, and propose improvements if necessary
PI3.1.3 Applying: Translate real-world challenges into structured engineering problem statements.
PI 3.1.4 Analyzing: Break down the problem into sub-problems and evaluate its complexity in engineering terms
PI 3.2.1 Remembering: List potential design approaches and tools relevant to solving the problem.
PI 3.2.2 Understanding: Describe the principles and methodologies used to generate alternative design solutions
PI 3.2.3 Applying: Propose multiple design concepts addressing the problem's constraints and requirements.
PI 4.1.4 Analyzing: Break down the problem into components and critically assess the relationships between them

Mapping of Course Outcomes with Learning Outcomes:

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

Mapping of Course Outcomes with Programme Outcomes:

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

Assessment Criteria of Learning Outcomes:

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

	• Debug and correct operator-related errors in given C code snippets.	
Implement static variables and static functions to demonstrate shared functionality in Java. (PI2.4.3)(CO2)	• Declare and initialize static variables • Define and use static functions • Demonstrate the sharing of static variables across multiple objects • Differentiate static and non-static context	ISA, MSE, ESE, LAB
Construct Java programs using one-dimensional and two-dimensional arrays to manipulate tabular data. (PI2.2.3 & PI1.3.3) (CO2)	• Declare and initialize one-dimensional and two-dimensional arrays • Access and manipulate array elements • Display array contents in a tabular format • Implement input/output operations for arrays	ISA, MSE, ESE, LAB
Define and use classes, objects, and instance variables to model real-world entities in Java programs. (PI1.4.1 & PI1.3.2)(CO3)	• Define a Java class representing a real-world entity • Use instance variables to store and access individual object data • Demonstrate encapsulation by using methods to operate on object data • Implement a Java program that interacts with multiple objects	ESE, LAB
Implement constructors (default and parameterized) to initialize Java objects (PI1.3.3 & PI2.4.3) (CO3)	• Define a default constructor • Define a parameterized constructor • Create and initialize objects using both types of constructors	ISA, MSE, LAB
Demonstrate method overloading and object	• Implement method overloading	ISA, MSE, ESE, LAB

passing techniques to achieve functional flexibility. (PI1.4.3 & PI2.2.3) (CO3)	• Demonstrate correct selection of overloaded methods • Define a method that accepts an object as a parameter • Demonstrate functional flexibility using overloading and object passing	
Create and manipulate arrays of objects to organize and manage grouped object data. (PI1.3.6 & PI1.4.6) (CO3)	• Declare and initialize an array of object references • Use loops to populate object arrays with user or predefined data • Traverse the object array to access or update attributes	ISA, ESE, LAB
Explain the concept and types of inheritance and the use of constructors in inheritance (PI2.1.2 & PI1.3.2) (CO4)	• Define and explain the concept of inheritance • Identify and describe different types of inheritance supported by Java • Demonstrate inheritance using a Java program • Explain constructor calling mechanism in inheritance	ISA, MSE, ESE, LAB
Apply method overriding and dynamic method dispatch to implement runtime polymorphism. (PI1.4.3 & PI2.4.3) (CO4)	• Override a method in a subclass • Execute overridden method at runtime using dynamic dispatch • Demonstrate polymorphic behavior through multiple subclass types	ISA, ESE, LAB
Use abstract classes, final keywords, and interfaces to build structured and extendable programs. (PI1.4.4 & PI2.2.4) (CO4)	• Define and use an abstract class and method • Define and implement interfaces • Use the final keyword appropriately	ISA, MSE, ESE, LAB

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

Implement multithreading using Thread class and Runnable interface with appropriate thread methods and priorities. (PI1.4.3 & PI2.4.3)(CO6)	• Apply appropriate thread methods • Set and utilize thread priorities effectively	ESE, LAB
Handle thread-related exceptions and apply synchronization to avoid race conditions in concurrent programs. (PI2.4.4 & PI3.1.4)(CO6)	• Apply synchronization using synchronized methods or blocks	LAB
Design efficient multithreaded applications incorporating synchronization, priorities, and exception handling. (PI1.4.6 & PI2.2.6)(CO6)	• Create a multithreaded application using Thread/Runnable • Use thread priorities to influence execution order	LAB
Explain the concept, purpose, and benefits of using inbuilt and user-defined packages in Java. terms of efficiency and reliability. (PI2.1.2 & PI3.2.3) (CO6)	• Define packages and differentiate between inbuilt and user-defined packages • Explain the purpose of using packages in Java • Describe efficiency and reliability benefits of using packages	ISA, LAB
Implement modular Java applications using package creation, importing, and naming conventions. (PI2.4.3 & PI1.4.3)(CO6)	• Import and use inbuilt and custom packages correctly • Demonstrate modular application design using packages	LAB

Develop interactive Java applets using applet life cycle methods and override paint() to draw on the screen. (PI1.4.6 & PI2.2.6)(CO6)	• mplement applet life cycle methods (init(), start(), stop(), destroy()) correctly • Compile and run the applet successfully in a browser or applet viewer	ISA, ESE, LAB
Analyze the structure of modular Java programs using packages and applets to ensure maintainability and scalability. (PI2.4.4 & PI3.1.4)(CO6)	• Evaluate how applet components are integrated within the program	LAB

Tools/ Technologies/ Programming Languages learnt:

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

Textbooks:

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

Reference Books:

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

Related/ Equivalent MOOC and Associated Certification:

1. Programming in Java (NPTEL) –
    - SWAYM-NPTEL
    - Link: https://nptel.ac.in/courses/106105191

Course Name: Professional Skills

Course Code: VEC01T

Vertical/ Sub-Vertical: HSSM_VEC

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

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 2

Course Scheme:

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

Assessment guidelines:

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

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

Preamble:

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

Course Objectives:

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

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

Course Outcomes:

Learner will be able to:

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

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Employment Skills:	***Learning Objective:*** Students will be able to demonstrate essential employment skills by effectively participating in group discussions, preparing professional resumes, and performing confidently in job interviews. *(C01).* **Contents:** Job Application & Resume Writing Group Discussion Interview Skills ***Self-Learning Topics***: Nil ***Learning Outcomes:*** *A learner will be able to:* 1.1 *Demonstrate effective participation and articulation of viewpoints in group discussions. (P.I.- 9.1.1, 9.1.2, 9.2.2, 9.2.3, 9.3.1, 10.2.1 (CO1)* 1.2 *Prepare for and perform confidently in various interview formats. (P.I. –9.2.3, 9.2.4, 10.2.1, 10.2.2 (CO1)*	10

		1.3 *Create a professional and tailored resume, and portfolios highlighting skills and achievements. (P.I. 10.1.2, 10.1.3 (CO1)*	
2	Professional Etiquettes	***Learning Objective:*** Students will be able to demonstrate appropriate professional etiquette in academic and workplace environments by practicing respectful communication, maintaining decorum in formal interactions, and following accepted norms of behavior during meetings, emails, and networking events. (*CO2)* **Contents:** Techniques Corporate Grooming and Workplace Etiquette Telephone Etiquette Netiquettes, Telephone Etiquette Digital Footprints, Social Media, Personal Profile Privacy Digital Profile Building (ePortfolio, LinkedIn) ***Self-Learning Topics****: Nil* ***Learning Outcomes:*** *A learner will be able to:* *2.7 Apply appropriate grooming and etiquette to project a professional image at the workplace. (P.I. –9.2.3, 9.2.4) (CO2)* *2.8 Practice responsible and respectful behavior in telephone and all forms of digital communications. (P.I. –9.2.2, 9.2.3, 10.1.1) (CO2)* *2.9 Manage digital footprints and ensure privacy across social media platforms and maintain a professional digital profile using ePortfolio and LinkedIn. (P.I. – 9.2.1, 10.1.1, 10.3.2) (CO2)*	4
3	Interpersonal Skills:	***Learning Objective:*** Students will be able to **develop effective interpersonal communication skills** by engaging in active listening, expressing ideas clearly, providing constructive feedback, and collaborating productively in diverse teams and professional environments. *(CO3)* **Contents:** Assertiveness, Negotiation Leadership, Team Building Problem Solving, Decision Making Cultural and Emotional Intelligence ***Self-Learning Topics:*** *Nil* ***Learning Outcomes:*** *A learner will be able to:* *3.10 Demonstrate assertive communication, effective negotiation skills, and leadership qualities to influence and guide individuals and teams toward common goals. (P.I. –9.1.1, 9.2.1, 10.2.1) (CO3)*	6

		3.11 Collaborate effectively within teams to solve problems and make informed decisions in dynamic professional environments. (P.I. –9.1.1, 9.2.1, 9.3.1, and 12.1.2) (CO3) *3.12 Apply cultural awareness and emotional intelligence to foster inclusive, empathetic, and productive interpersonal interactions. (P.I. –9.1.1, 9.1.2, 9.2.1) (CO3)*	
4	Ethics	***Learning Objective:*** Students will be able to analyze and apply ethical principles in engineering practices by recognizing moral dilemmas, evaluating consequences, and making decisions that reflect integrity, responsibility, and social accountability. *(CO4).* **Content:** Introduction to Ethics Plagiarism and Online Plagiarism Checker Patents Trademark and Copyrights and GI – Geographical Indicators Professional Ethics Corporate Social Responsibility (CSR) –Information Confidentiality ***Self-Learning Topics:*** *Nil* ***Learning Outcomes:*** *A learner will be able to:* *4.5 Recognize and apply ethical principles in professional decision-making. (P.I. – 8.1.1 and 8.2.2) (CO4)* *4.6 Identify plagiarism, understand IPR and utilize tools to ensure academic and professional integrity. (P.I. – 8.1.1 and 8.2.1) (CO4)* *4.7 Demonstrate understanding of CSR principles and the importance of maintaining information confidentiality. (P.I. - 8.2.2) (CO4)*	4
5	Personality Enrichment:	***Learning Objective:*** *Students will be able to enhance their personal and professional identity by developing self-awareness, confidence, emotional intelligence, and a positive mindset that supports personal growth, stress management, and career readiness. (CO5)* **Content:** SWOT Analysis and JOHARI window Developing Positive Attitude Personality Types and Learning Styles Vision and Goal Setting Stress Management and Time Management	2

		Self-Learning Topics: *Nil* ***Learning Outcomes:*** *A learner will be able to:* *5.9 Apply SWOT analysis, JOHARI Window to enhance self-awareness and personal development and also set personal and professional goals aligned with a clear vision. (P.I. 9.1.1, 10.2.1) (CO5)* *5.10 Identify different personality types and adapt learning strategies accordingly. (P.I.-9.1.1) (CO5)* *5.11 Employ strategies to effectively manage stress and optimize time. (P.I. – 9.2.4, 10.2.1) (CO5)*	
6	21st Century Skills	***Learning Objective:*** *Enable students to apply creative and critical thinking, analyze and solve problems collaboratively, and communicate ideas effectively in diverse professional and social contexts.(CO5).* **Contents:** Creative Thinking Critical Thinking Collaboration and Communication ***Self-Learning Topics: All*** ***Learning Outcomes:*** *A learner will be able to:* *6.10 Generate original ideas and innovative solutions to problems. (P.I. – 10.1.2, 10.2.2 and 12.2.1, 12.2.2) (CO6)* *6.11 Analyze information logically to make informed decisions and solve complex problems. (P.I.-12.1.2) (CO6)* *6.12 Collaborate effectively and communicate ideas clearly in diverse team environments. (P.I. –9.3.1, 10.1.1, 10.2.1) (CO6)*	4
Total			**30**

Suggested List of Practicals:

Sr No.	Suggested Topic(s)
1.	Group Discussion ***Learning Outcomes:*** *A learner will be able to:* *1.1 Demonstrate effective participation and articulation of viewpoints in group discussions. (P.I.- 9.1.1, 9.1.2, 9.2.2, 9.2.3, 9.3.1, 10.2.1 (CO1)*
2.	Mock Interviews (Participate in Peer Interviews and learn the skills required to ace the Interviews) ***Learning Outcomes:*** *A learner will be able to:* 1.2 *Prepare for and perform confidently in various interview formats. (P.I. –9.2.3, 9.2.4, 10.2.1, 10.2.2 (CO1)*

3.	Case Study on Ethics ***Learning Outcomes:*** *A learner will be able to:* *4.8 Recognize and apply ethical principles in professional decision-making. (P.I. – 8.1.1 and 8.2.2) (CO4)*
4.	E-Portfolio ***Learning Outcomes:*** *A learner will be able to:* 1.3 *Create a professional and tailored resume, and portfolios highlighting skills and achievements. (P.I. 10.1.2, 10.1.3 (CO1)*
5.	Video Resume ***Learning Outcomes:*** *A learner will be able to:* 1.3 *Create a professional and tailored resume, and portfolios highlighting skills and achievements. (P.I. 10.1.2, 10.1.3 (CO1)*
6.	Mini Project ***Learning Outcomes:*** *A learner will be able to:* *6.1 Generate original ideas and innovative solutions to problems. (P.I. – 10.1.2, 10.2.2 and 12.2.1, 12.2.2) (CO6)*
7.	Interpersonal Skills Presentation ***Learning Outcomes:*** *A learner will be able to:* *A learner will be able to:* *3.1 Demonstrate assertive communication, effective negotiation skills, and leadership qualities to influence and guide individuals and teams toward common goals. (P.I. –9.1.1, 9.2.1, 10.2.1) (CO3)*

Performance Indicators:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

P.I.- 1.1.1: **Remembering**: Students will gain knowledge to develop the traits of a suitable candidate with respect to resume writing, participating in group discussions, and facing interviews
P.I.- 1.2.2: **Understanding**: Students will understand the techniques to analyse problem statements and formulate solutions of problems using surveys and project work
P.I.- 1.3.1: **Remembering**: Students can demonstrate the key skills required to face GDs, interviews, and resume writing as an individual or a team member
P.I.- 1.3.2: **Understanding**: Students can exhibit professional presentation skills both individually or in a team
P.I.- 1.4.2: **Understanding**: Students can prepare themselves as an individual or as a part of a team for various corporate ethics and etiquettes
P.I.- 2.1.2: **Understanding**: Student will inculcate professional ethics to build stronger relationships in professional practices
P.I.- 2.1.3: **Applying**: Students will apply the skills of communicating effectively to deliver the right employment skills
P.I.- 2.1.4: **Analyzing**: Students will critically analyse the insights about communicating effectively during campus placements and competitive examinations
P.I.- 2.2.3: **Applying**: Students will develop effective communication strategies to build their inter-personal skills.
P.I.- 3.2.1: **Remembering**: Students will inculcate knowledge by communicating about contemporary issues and demonstrate the ethical code of conduct.
P.I.- 3.2.2: **Understanding**: Students will learn to communicate effectively to deliver the right employment skills
P.I.- 3.2.3: **Applying**: Students can apply their skills to prepare themselves as an individual or as a part of a team for various corporate ethics and etiquettes
P.I.- 3.3.1: **Remembering**: Students will gain fundamental knowledge of various inter-personal skills like team building, motivation, assertiveness, conflict resolution etc., to progress professionally
P.I.- 3.3.2: **Understanding**: Students will explain and demonstrate the formal presentations using modern ICT tools for a successful career that meets the global corporate world virtual requirements.

Mapping of Course Outcomes with Learning Outcomes:

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

Mapping of Course Outcomes with Programme Outcomes:

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

Assessment Criteria of Learning Outcomes:

Learning Outcomes: *The Learner will:*	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1: Students will be able to demonstrate essential employment skills by effectively participating in group discussions, preparing professional resumes, and performing confidently in job interviews.	1.1 Participate in Group Discussions and evaluate cases of group discussions	ISA LAB, MSE, ESE
	1.2 Group Discussion Do's and Don'ts, Selection Criteria	ISA TH
	1.2 Draft a professional beginner level resume	ESE LAB
	1.3 Participate in Mock interviews and write appropriate responses to HR and Technical Interview Questions	ISA LAB
	1.4 Prepare professional e-Portfolios	ESE LAB
	1.5 Prepare video resumes	ESE LAB
LO2: Students will be able to demonstrate appropriate professional etiquette in	2.1 Perform role play on different scenarios pertaining to professional etiquettes	ISA LAB

academic and workplace environments by practicing respectful communication, maintaining decorum in formal interactions, and following accepted norms of behavior during meetings, emails, and networking events.	2.2 Identify 4 Etiquettes which you feel matter a lot in the professional world. Write down tips to develop those etiquettes	ISA TH
LO3: Students will be able to develop effective interpersonal communication skills by engaging in active listening, expressing ideas clearly, providing constructive feedback, and collaborating productively in diverse teams and professional environments.	3.1 Design presentations on Interpersonal Skills and present in the class as a flipped activity	ISA
	3.2 Mini Project Report and Presentation	ESE (P)
LO4: Students will be able to analyze and apply ethical principles in engineering practices by recognizing moral dilemmas, evaluating consequences, and making decisions that reflect integrity, responsibility, and social accountability.	4.1 Analyze case studies based on Ethics	ISA LAB
	4.2 A. Select any one research paper from the AAP, read it and paraphrase the same. B. Submit a plagiarism check report of your paraphrase.	ISA TH
LO5: Students will be able to enhance their personal and professional identity by developing self-awareness, confidence, emotional intelligence, and a positive mindset that supports personal growth, stress management, and career readiness.	5.1 Personality MBTI Test and Psychometric Test. Submit screenshot of results.	ISA LAB
	5.3 Identify the major stressors in your life. Make a mind map on Stress Management.	ISA TH
	5.12 Prepare a comprehensive Time Management Matrix and design a productive schedule for yourself.	ISA TH
	5.13 What is SWOT analysis and what is its use? Prepare your SWOT Analysis	ISA TH
	5.14 What is Johari Window and how is it useful? Prepare your Johari Window.	ISA TH
	5.6 Complete MOOC course and get certified	ISA LAB

	5.7 Prepare a visual representation of your Vision Chart and Short-Term Goals and Long Term Goals.	ISA TH
LO6: Enable students to apply creative and critical thinking, analyze and solve problems collaboratively, and communicate ideas effectively in diverse professional and social contexts.(	6.1 Design a Poster and write-up on any one of the following 21st century skills	ISA TH

Reference Books:

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

Related/ Equivalent MOOC and Associated Certification:

1. LinkedIn Mastery: Creating an awesome profile - https://www.udemy.com/course/linkedinmastery-creating-an-awesome-profile/
2. Soft Skills: The 11 Essential Career Soft Skills - https://www.udemy.com/course/soft-skills-the11-essential-career-soft-skills/
3. Understanding Personality Types at Work - https://www.udemy.com/course/understandingpersonality-types-at-work/
4. Speak English Professionally: In Person, Online & On the Phone - https://www.coursera.org/learn/speak-english-professionally
5. How to Write a Resume (Project Centered Course) https://www.coursera.org/learn/how-to-write-aresume
6. Interviewing and Resume Writing in English Specialization https://www.coursera.org/specializations/english-interview-resume
7. Build Your Professional ePortfolio in English - https://www.coursera.org/learn/eportfolio-english

Indian Knowledge System Courses

Course Name: Indian Traditional Knowledge System

Course Code: IKS01

Vertical/ Sub-Vertical: HSSM_IKS

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: Introduction to Indian History and Culture, Sanskrit Basics (Optional but beneficial), Introduction to Agricultural Science, Animal Science and Veterinary Basics, Fundamentals of Astronomy

Recommended Semester: 2

Course Scheme:

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

Assessment guidelines:

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

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

Preamble:

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

Course Objectives:

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

Course Outcomes:

Learner will be able to:

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

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Review of Scientific Literature in Sanskrit:	***Learning Objective:*** *To critically analyze and evaluate classical Sanskrit texts for their contributions to traditional scientific knowledge systems, such as Ayurveda, astronomy, mathematics, and linguistics, and to develop the ability to contextualize these contributions within both historical and contemporary frameworks. (CO1, CO2)* **Contents:** References of sciences /scientific knowledge through different textual sources. ***Self-Learning Topics***: *Nil* ***Learning Outcomes:*** *A learner will be able to:* *1.8 Gain an overview of the vast repository of scientific knowledge preserved in Sanskrit texts (P.I. 10.1.1) CO1* *1.9 Familiarize with specific works like Aryabhatiya (astronomy), Charaka Samhita (medicine), and Sulbasutras (geometry) (P.I.12.1.1) CO2* *1.10 Learn how ancient principles from Sanskrit texts can be applied to modern sciences like astronomy, medicine, and environmental studies (P.I.12.1.2) CO2*	6
2	Chemistry and Mathematics:	***Learning Objective:*** *To explore and interpret key concepts, techniques, and contributions of ancient Indian scholars in the fields of chemistry (Rasashastra) and mathematics (Ganitashastra), and to understand their relevance and application in the evolution of scientific thought and practices (CO2, CO3).* **Contents:** Various treatises on Chemistry, Use of Chemistry in Medicines, Metallurgy, Use of Chemistry for occult practices,	6

		Mathematical concepts through Shulbasutras, Development of different types of mathematical branches and treatises based on that, Development of Astronomy etc. ***Learning Outcomes:*** *A learner will be able to:* *2.1 Learn about the use of alchemy in Ayurveda and traditional medicine, including processes like purification and transformation of metals (P.I. 12.2.1)CO2* *2.2 Learn about ancient Indian metallurgical techniques, including the extraction, alloying, and casting of metals as described in texts like Krishi-Parashara and Brihatsamhita (P.I. 12.2.2) CO2* *2.3 Understand the contributions of mathematicians like Aryabhata, Bhaskara, and Brahmagupta to global mathematical advancements (P.I. 12.2.1) CO2* *2.4 Learn about the Indian contributions to astronomy, including planetary motion, eclipses, and time calculation, as described in Surya Siddhanta and Aryabhatiya (P.I. 12.3.1) CO3*	
3	Dietetics:	***Learning Objective:*** *To examine the principles of ancient Indian dietetics as outlined in classical texts such as Ayurveda, focusing on the relationship between food, health, and seasonal/regional variations, and to assess their applicability in promoting holistic well-being today. (CO1, CO2, CO3).* **Content:** Study of different texts based on culinary art Nalapakadarpana, Bhojanakuthuhalam, Supashastra, Modes of preservation of food, Dietary guidelines through branches of Ayurveda, Food and Diseases, etc. ***Learning Outcomes:*** *A learner will be able to:* *3.1 Learn traditional methods of food preservation such as fermentation, pickling, drying, and smoking (P.I2.2.1) CO1* *3.2 Study the dietary principles and guidelines described in Ayurvedic texts, emphasizing balance (Tridosha), seasonal eating, and personalized nutrition (P.I. 12.3.1) CO1* *3.3 Explore the role of food as medicine in Ayurveda, focusing on how specific dietary practices can prevent and manage diseases (P.I. 12.1.2) CO2*	7

		3.4 Study ancient practices of food presentation, garnishing, and plating as described in culinary texts (P.I. 12.2.1. 12.2.2) CO3 *3.5 Study ancient practices of food presentation, garnishing, and plating as described in culinary texts (P.I. 12.3.1) CO2*	
4	Agriculture, Astronomy, and Zoology	***Learning Objective:*** *To investigate the foundational knowledge and practices in agriculture, astronomy, and zoology as reflected in ancient Indian texts, and to appreciate their scientific insights, innovations, and environmental harmony in the context of traditional knowledge systems.(CO2, CO3).* **Content:** Study of Krishisuktas, Krishiparashara, Brihatsamhita, Types of crops, Manures, Types of land- Devamatruka, Nadimatruka, Indian Astronomy, Use of animals in warfare, Animal husbandry, Animals for medicine. ***Learning Outcomes:*** *A learner will be able to:* *5.15 Learn about the types of crops, their cultivation cycles, and their significance in ancient Indian agronomy (P.I0. 2.1) CO2* *5.16 Understand the classification of land types like Devamatruka and Nadimatruka based on fertility, water retention, and suitability for specific crops (P.I2.1.2) CO2* *5.17 Explore the role of Indian astronomy in agricultural practices, including the timing of sowing, harvesting, and irrigation (P.I2.2.1) CO3* *5.18 Learn about the historical use of animals like horses, elephants, and others in warfare strategies and their impact(P.I.12.3.1) CO3* *5.19 Study ancient practices of animal husbandry, focusing on their role in supporting agriculture and society(P.I. 12.3.2) CO3* *5.20 Understand the medicinal uses of animals and animal-derived products as described in ancient texts (P.I.12.3.1) CO2*	6
Total			**30**

Suggested List of Practicals:

Sr No.	Suggested Topic(s)
1.	Poster Presentation ***Learning Outcomes:***

	A learner will be able to: *1.1 Gain an overview of the vast repository of scientific knowledge preserved in Sanskrit texts (P.I. 10.1.1) (CO1)*
2.	Blog Writing ***Learning Outcomes:*** *A learner will be able to:* *2.4 Learn about the Indian contributions to astronomy, including planetary motion, eclipses, and time calculation, as described in Surya Siddhanta and Aryabhatiya (P.I. 12.3.1) CO2*
3.	Book Review ***Learning Outcomes:*** *A learner will be able to:* *3.4 Study ancient practices of food presentation, garnishing, and plating as described in culinary texts . (P.I. – 12..2.1) (CO3).*
4.	Question and Answers ***Learning Outcomes:*** *A learner will be able to:* *3.1 Learn traditional methods of food preservation such as fermentation, pickling, drying, and smoking (P.I2.2.1) (CO2)*
5.	Essay Writing ***Learning Outcomes:*** *A learner will be able to:* *5.1 Learn about the types of crops, their cultivation cycles, and their significance in ancient Indian agronomy (P.I. I0. 2.1) (CO3)*
6.	Infographics ***Learning Outcomes:*** *A learner will be able to:* *5.3Explore the role of Indian astronomy in agricultural practices, including the timing of sowing, harvesting, and irrigation (P.I2.2.1, 12.3.2 (CO3)*

Performance Indicators:

P.I.- 10.1.1 **Remembering:** Read, understand and interpret technical and non-technical information
P.I.- 10.2.1 **Understanding**: Listen to and comprehend information, instructions, and viewpoints of others
P.I.- 12.2.1 Remembering: Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current
P.I.- 12.3.1 **Understanding**: Source and comprehend technical literature and other credible sources of information
P.I.-12.3.2 **Analyzing**: Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.
P.I.-12.2.2 **Understanding:** Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field

Mapping of Course Outcomes with Learning Outcomes:

	Mapped to Learning Outcomes
CO1	1.1. 3.1, 3.2
CO2	1.2, 1.3, 2.1, 2.2, 2.3, 3.3, 3.5, 5.1,5.2, 5.6
CO3	2.4, 3.4, 5.3, 5.4, 5.5

Mapping of Course Outcomes with Programme Outcomes:

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

Assessment Criteria of Learning Outcomes:

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

outlined in classical texts such as Ayurveda, focusing on the relationship between food, health, and seasonal/regional variations, and to assess their applicability in promoting holistic well-being today. (CO1, CO2, CO3).	• The student can justify their applicability in promoting holistic well-being today.	ISA
LO4: *Students will be able to investigate the foundational knowledge and practices in agriculture, astronomy, and zoology as reflected in ancient Indian texts, and to appreciate their scientific insights, innovations, and environmental harmony in the context of traditional knowledge systems.(CO2)*	• The student can investigate the foundational knowledge and practices in agriculture, astronomy, and zoology • The student is able to appreciate their scientific insights, innovations, and environmental harmony in the context of traditional knowledge systems.	ISA ISA

Reference Books:

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

Related/ Equivalent MOOC and Associated Certification:

1. Introduction to Indian Knowledge System – IGNOU (SWAYAM) Offered by: IGNOU | Language: English | Duration: 12 weeks, Starts: 15 Jul 2025 | Enroll by: 15 Sep 2025
   Enroll here: https://onlinecourses.swayam2.ac.in/nou25_ge95/preview

2. Indian Knowledge System (IKS): Concepts & Applications in Science – IIM Bangalore & Chanakya University (SWAYAM) Offered by: IIMB & Chanakya Univ. Duration: 10 weeks
   Enroll here: https://onlinecourses.swayam2.ac.in/imb23_mg54/preview

3. Indian Knowledge System (IKS): Humanities & Social Sciences – IIM Bangalore & Chanakya University (SWAYAM) Offered by: IIMB & Chanakya Univ. Duration: 10 weeks
   Enroll here: https://onlinecourses.swayam2.ac.in/imb23_mg55/preview

4. Indian Knowledge System – Dr Roli Pradhan (NITTTR, Bhopal) (SWAYAM) Offered by: NITTTR Bhopal Duration: 8 weeks
   Enroll here: https://onlinecourses.swayam2.ac.in/ntr24_ed78/preview

Course Name: Indian Constitution

Course Code: IKS02

Vertical/ Sub-Vertical: HSSM_IKS

K-S-A Mapping: Knowledge & Skill

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Practical	Theory	Practical
IKS02	2	-	2	-
-	-	-	-	

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (IKS02)	75	-	-	75 (100%)
	-	-	-	-

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

Preamble:

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

Course Objectives:

- To understand the concept and necessity of a Constitution.
- To interpret the ideals enshrined in the Constitution.
- To comprehend the significance of Fundamental Rights and Duties.
- To gain knowledge of the Indian parliamentary and judicial systems.

Course Outcomes:

Learner will be able to:

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

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction to Indian Constitution	***Learning Objective:*** *Understand the historical context and philosophy behind the Constitution.* **Contents:** *Historical background, Constitutional philosophy.* ***Self-Learning Topics***: *Constituent Assembly Debates, Role of Dr. B.R. Ambedkar.* ***Learning Outcomes:*** *A learner will be able to:* 1.11 LO1.1: Recall historical origins and key objectives of the Indian Constitution (CO1) P.I. – 1.1.1, *1.12* LO1.2: Explain preamble values and their relevance (CO3) P.I. – 1.3.1	3
2	Citizenship & Fundamental Duties	***Learning Objective:*** *Understand who is an Indian citizen and the constitutional duties.* **Contents:** *Citizenship at commencement, Rights of overseas Indians, Duties of citizens.* ***Self Learning topics:*** *NRC, CAA provisions (non-political lens).* ***Learning Outcomes:*** *A learner will be able to:* *2.10 Explain constitutional provisions regarding acquisition/loss of citizenship. (PI: 1.3.2, CO2)* *2.11 Relate duties to everyday civic behaviour. (PI: 1.4.2, CO2)*	3
3	Fundamental Rights	***Learning Objective:*** *Comprehend and evaluate the scope of rights and freedoms in the Constitution.* **Contents:**	4

		Right to Equality, Freedom, Religion, Education, Remedies; UCC, Article 370, Reservations. ***Self Learning:*** *PIL, RTI Act basics.* ***Learning Outcomes:*** *A learner will be able to:* *3.13 Analyze the limitations and significance of each fundamental right. (PI: 2.1.4, CO3)* *3.14 Evaluate constitutional debates like UCC and reservations. (PI: 3.2.1, CO3)*	
4	Directive Principles of State Policy (DPSP)	***Learning Objective:*** *Analyze socio-economic principles for governance and their constitutional directives.* **Content:** Justice, legal aid, Panchayati Raj, education, environment, UCC. **Self Learning Topics:** Sustainable Development Goals (SDGs) vs. DPSP. ***Learning Outcomes:*** *A learner will be able to:* *4.9 Identify key social and economic DPSPs and their impact. (PI: 3.3.1, CO3)* *4.10 Compare DPSPs with Fundamental Rights. (PI: 3.2.1, CO3)*	4
5	The Parliament	***Learning Objective:*** *Understand the structure and functioning of legislative bodies.* **Content:** Lok Sabha, Rajya Sabha, powers, law-making, amendment process. ***Self-Learning Topics:*** *Budget session, Parliamentary privileges.* ***Learning Outcomes:*** *A learner will be able to:* *5.21 Describe how laws are introduced and passed. (PI: 1.3.2, CO4)* *5.22 Explain the amendment process and bicameral structure. (PI: 1.4.2, CO4)*	4
6	Judiciary	***Learning Objective:*** *Understand the structure and jurisdiction of Indian courts.* **Contents:** Supreme Court, High Courts, Subordinate courts, Quasi-judicial bodies **Self-Learning Topics:** Judicial review, Contempt of court. ***Learning Outcomes:***	4

		A learner will be able to: *6.13 Describe functions of Supreme and High Courts. (PI: 1.3.1, CO5)* *6.14 Explain the scope of judicial independence. (PI: 1.4.2, CO5)*	
7	Elections	***Learning Objective:*** *Understand the electoral process and related constitutional provisions.* **Content:** Election Commission, Legislative elections, Court restrictions. ***Self-Learning Topics:*** *Model Code of Conduct, NOTA.* ***Learning Outcomes:*** *A learner will be able to:* *5.23 Explain the powers and functions of the Election Commission. (PI: 2.1.2, CO6)* *5.24 Describe the legislative role in elections. (PI: 1.4.2, CO6)*	4
8	Landmark Cases	***Learning Objective:*** *Evaluate the constitutional impact of key judicial verdicts.* **Content:** Nanavati, Shah Bano, Kesavananda Bharati, Vishakha. ***Self-Learning Topics:*** *Maneka Gandhi, Golaknath, ADM Jabalpur.* ***Learning Outcomes:*** *A learner will be able to:* *5.25 Analyze the legal and social implications of landmark cases. (PI: 3.2.3, CO7)* *5.26 Justify the evolving nature of constitutional interpretation. (PI: 3.3.2, CO7)*	4
Total			**30**

Suggested List of Practicals: NA

Performance Indicators:

P.I.- 1.1.1: **Remembering**: Recall key mathematical formulas and concepts relevant to engineering problems.
P.I.- 1.2.2: **Understanding**: Describe how basic science concepts apply to material behavior and engineering systems.
P.I.- 1.3.1: **Remembering**: List fundamental engineering principles (e.g., Ohm's law, Bernoulli's equation) and their applications.
P.I.- 1.3.2: **Understanding**: Explain the relevance of basic engineering principles to real-world problems.
P.I.- 1.4.2: **Understanding**: Explain the functions of specialized engineering systems in the computer engineering domain.
P.I.- 2.1.2: **Understanding**: Explain the key features and scope of a complex engineering problem.

P.I.- 2.1.3: **Applying**: Use standard problem-identification techniques (e.g., root cause analysis) to define an engineering challenge.
P.I.- 2.1.4: **Analyzing**: Decompose a complex engineering problem into its constituent parts to identify critical aspects.
P.I.- 2.2.3: **Applying**: Develop a basic solution plan using a systematic approach to solve an identified problem.
P.I.- 3.2.1: **Remembering**: List potential design approaches and tools relevant to solving the problem.
P.I.- 3.2.2: **Understanding**: Describe the principles and methodologies used to generate alternative design solutions.
P.I.- 3.2.3: **Applying**: Propose multiple design concepts addressing the problem's constraints and requirements.
P.I.- 3.3.1: **Remembering**: Identify evaluation criteria (e.g., cost, safety, sustainability) for comparing design solutions.
P.I.- 3.3.2: **Understanding**: Explain the trade-offs involved in selecting a particular design solution.

Mapping of Course Outcomes with Learning Outcomes:

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

Mapping of Course Outcomes with Programme Outcomes:

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

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO1.1: Recall historical origins and key objectives of the Indian Constitution (CO1) P.I. – 1.1.1,	• Identify key events in India's constitutional development. • List the objectives stated in the Constitution's Preamble. • Match key dates with associated constitutional milestones.	ISA

	• Recognize contributions of major figures in constitution-making.	
LO1.2: Explain preamble values and their relevance (CO3) P.I. – 1.3.1	• Define each value stated in the Preamble. • Explain how values like justice and equality are reflected in policies. • Relate Preamble values to recent Supreme Court judgments. • Analyze contemporary relevance of the term "Secular" or "Republic.".	ISA
LO2.1 *Explain constitutional provisions regarding acquisition/loss of citizenship. (PI: 1.3.2, CO2)*	• Outline methods of acquiring Indian citizenship. • Explain circumstances under which citizenship is lost. • Differentiate between constitutional and statutory provisions. • Apply rules to hypothetical citizenship scenarios.	ISA
LO 2.2*Relate duties to everyday civic behaviour. (PI: 1.4.2, CO2)*	• List the fundamental duties in the Constitution. • Connect duties to real-life civic activities (e.g., voting, cleanliness). • Evaluate consequences of ignoring civic duties. • Suggest ways to promote civic sense among citizens..	ISA
LO3.1 *Analyze the limitations and significance of each fundamental right. (PI: 2.1.4, CO3)*	• Explain scope and limits of each right (e.g., Article 19). • Compare rights with international human rights. • Interpret case law related to right restrictions. • Evaluate situations where rights clash with national interest.	ISA
LO3.2 *Evaluate constitutional debates like UCC and reservations. (PI: 3.2.1, CO3)*	• Summarize key arguments for/against UCC. • Analyze the evolution of reservation policy. • Discuss legal challenges to reservation or UCC. • Debate on future trajectories using recent case law or reports.	ISA
LO 4.1 *Identify key social and economic DPSPs and their impact. (PI: 3.3.1, CO3)*	• List important DPSPs (Articles 36–51). • Match articles with real-world policies (e.g., MGNREGA). • Identify differences between enforceable rights and guidelines. • Assess how DPSPs shape legislative priorities.	ISA
LO4.2 *Compare DPSPs with Fundamental Rights. (PI: 3.2.1, CO3)*	• Create a comparison table of DPSPs vs Fundamental Rights.	ISA

	• Discuss conflicts in implementation (e.g., Keshavananda Bharati case). • Explain prioritization in court verdicts. • Analyze implications of non-enforceability.	
LO 5.1*Describe how laws are introduced and passed. (PI: 1.3.2, CO4)*	• List stages in the legislative process. • Identify roles of both Houses during lawmaking. • Trace the journey of a recent bill. • Compare legislative procedures in different countries.	ISA
LO5.2Explain the amendment process and bicameral structure. (PI: 1.4.2, CO4)	• Distinguish between types of amendments (simple, special). • Identify Articles involved in amendment process (e.g., Art. 368). • Diagram the structure of Lok Sabha and Rajya Sabha. • Analyze a major constitutional amendment (e.g., 42nd or 44th).	ISA ISA
LO 6.1*Describe functions of Supreme and High Courts. (PI: 1.3.1, CO5)*	• List jurisdiction types: original, appellate, advisory. • Compare SC and HC functions. • Identify constitutional articles relevant to judiciary (e.g., Art. 124). • Give examples of landmark judgments.	ISA
LO 6.2 *Explain the scope of judicial independence. (PI: 1.4.2, CO5*	• Define "judicial independence." • Discuss appointment and removal of judges. • Examine NJAC and collegium debate. • Explain separation of powers using real cases.	ISA
LO7.1 *Explain the powers and functions of the Election Commission. (PI: 2.1.2, CO6)*	• List constitutional provisions (e.g., Art. 324). • Identify roles during pre, mid, and post-election. • Evaluate EC's role in ensuring free and fair elections. • Refer to cases where EC's role was questioned.	ISA
LO 7.2 *Describe the legislative role in elections. (PI: 1.4.2, CO6)*	• Explain laws governing elections (RPA 1951). • Identify Parliament's role in electoral reforms. • Discuss model code of conduct and its implementation. • Compare role of legislature vs Election Commission.	ISA
LO8.1 Analyze the legal and social implications of		ISA

landmark cases. (PI: 3.2.3, CO7)	• Summarize major rulings (e.g., Kesavananda Bharati, S.R. Bommai). • Analyze how each case shaped constitutional interpretation. • Discuss long-term social effects. • Connect with public or media response.	ISA
LO 8.2*Justify the evolving nature of constitutional interpretation. (PI: 3.3.2, CO7)*	• Explain doctrines like basic structure, harmonious construction. • Discuss the role of judicial activism. • Analyze how SC has reinterpreted the Constitution over decades. • Use case law to support dynamic interpretation..	ISA

Reference Books:

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

Related/ Equivalent MOOC and Associated Certification:

- NPTEL: Constitutional Studies
- Udemy: Constitution of India

Course Name: Exploring Indian Arts

Course Code: IKS03

Vertical/ Sub-Vertical: HSSM/AEC

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

Pre-requisite required: NIL

Pre-requisite for: NIL

Recommended Semester: 2

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
IKS03	Theory	Practical	Theory	Practical
	2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (IKS03)	25	-	50	075

Preamble:

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

Course Objectives:

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

Course Outcomes:

Learner will be able to:

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

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	**Introduction to Indian Art**	***Learning Objective:*** *To understand the diversity, forms, and geographical scope of Indian art in both traditional and modern contexts. (CO1)* ***Contents:*** Indian art consists of a variety of art forms, including painting, sculpture, pottery, and textile arts such as woven silk. Geographically, it spans the entire Indian Subcontinent, including what is now India, Pakistan, Bangladesh, Sri Lanka, Nepal, and at times Eastern Afghanistan. A strong sense of design is characteristic of Indian Art and can be observed in its modern and traditional forms. Discussing different types and forms in Indian Art, like Drawing, Painting, Handicraft performing art, and the performing arts. ***Learning Outcomes:*** *A learner will be able to:* *1.1 Learners will be able to describe the cultural, religious, and socio-political contexts that shaped various art traditions in India. (CO1) (P.I.* 10.1.1, 10.1.2, 12.1.2, 12.3.1) *1.2 Learners will be able to differentiate between classical, folk, tribal, and modern Indian art forms. (CO1) (P.I.* 10.1.1, 10.1.2, 12.1.2, 12.3.1) *1.3 Learners will be able to analyze visual and performing arts using appropriate terminology and critical frameworks. (CO1) (P.I.* 10.1.3, 10.3.1, 12.3.2, 12.1.2) *1.4 Learners will be able to appreciate the diversity and symbolism in Indian sculpture, painting, architecture, music, dance, and crafts. (CO1) (P.I.* 10.2.1, 10.2.2, 12.3.2) *1.5 Learners will be able to trace the regional variations and*	2

		continuity of artistic practices across India. (CO1) (P.I. 10.1.1, 10.1.3, 12.2.1, 12.3.1)	
2	**Indian Architecture**	***Learning Objective:*** *To identify and analyze the distinctive features, historical development, and cultural significance of major architectural styles in India—from ancient to contemporary periods—while understanding their influence on society, religion, and regional identity.* (CO2) **Contents:** Photos and Videos of Indian structure will be shown. Students will share their views on the same. The session starts with students will get one topic, which they must discuss with their teammates and present in front of the class. Assignments will be on architectural sites. They will choose their own topic and will present in limited time span. ***Learning Outcomes:*** *A learner will be able to:* *2.1 The Learners will be able to identify key architectural styles and monuments across different periods of Indian history (e.g., Buddhist, Hindu, Jain, Islamic, Colonial, and Modern). (CO 2) (P.I.* 10.1.1, 10.1.2, 12.3.1) *2.2 The Learners will be able to describe the historical, religious, and cultural contexts that shaped the evolution of Indian architecture. (CO2) (P.I.* 10.1.1, 10.1.2, 12.1.2, 12.3.1) *2.3 The Learners will be able to differentiate between regional architectural features and materials used across various parts of India. (CO2) (P.I.* 10.1.1, 10.1.2, 12.3.1) *2.4 The Learners will be able to analyze the structural elements, aesthetics, and symbolism in prominent Indian architectural works. (CO2) (P.I.* 10.1.3, 10.3.1, 12.3.2, 12.1.2) *2.5 The Learners will be able to trace the development of temple, stupa, mosque, palace, and fort architecture in India. (CO2) (P.I.* 10.1.1, 10.1.3, 12.2.1, 12.3.1)	7
3	**Indian music and Performing Arts**	***Learning Objective:*** *To enable students to understand and appreciate the fundamental concepts, historical evolution, and cultural significance of Indian music and performing arts, while developing the ability to critically engage with various classical, folk, and contemporary forms. (CO1)* **Contents:** What is Performing Arts? 4 major streams of dance music, theatre and film. Languages, Rulers and Kings as depicted in the paintings. Students will share their native experiences and will perform for their class.	7

		Learning Outcomes: *A learner will be able to:* *3.1 The Learners will be able to identify the major forms of Indian music (classical, folk, devotional) and performing arts (dance, theatre, puppetry). (CO1) (P.I.* 10.1.1, 10.1.2) *3.2 The Learners will be able to understand the theoretical foundations of Indian classical music and dance, including ragas, talas, and natya shastra principles. (CO1) (P.I.* 10.1.1, 10.1.2, 12.1.2) *3.3 The Learners will be able to differentiate between Hindustani and Carnatic music traditions and their regional and stylistic variations. (CO1) (P.I.* 10.1.1, 10.1.2) *3.4 The Learners will be able to describe the key elements, techniques, and expressions used in major Indian classical dance forms (e.g., Bharatanatyam, Kathak, Odissi, Kathakali). (CO1) (P.I.* 10.1.3, 10.2.2, 12.3.2) 3.5 *The Learners will be able to trace the historical development and cultural significance of Indian performing arts across periods. (CO1) (P.I.* 10.1.1, 10.1.3, 12.2.1)	
4	**Painting Styles and Handicrafts**	***Learning Objective:*** *To develop an understanding of the Directive Principles as guiding values for governance, and to critically assess their role in shaping social and economic policies aimed at achieving a just and equitable society. (CO3)* **Contents:** Warli Painting is a Tribal Art mostly created by the tribal people from the North Sahyadri Range in Maharashtra, India. This range encompasses cities such as Dahanu, Talasari, Jawahar, Palghar, Mokhada, and Vikramgad of Palghar district. This tribal art originated in Maharashtra, where it is still practiced today. ***Learning Outcomes:*** *A learner will be able to:* *4.1 The Learners will be able to identify major traditional and regional painting styles of India, such as Madhubani, Warli, Pattachitra, Kalamkari, Tanjore, and Miniature painting. (CO3) (P.I.* 10.1.1, 10.1.2, 12.3.1) *4.2 The Learners will be able to recognize key Indian handicraft traditions, including textiles, pottery, woodwork, metalwork, and jewelry-making. (CO3) (P.I.* 10.1.1, 10.1.2, 12.3.1) *4.3 The Learners will be able to Describe the historical and cultural context in which various painting styles and handicrafts developed. (CO3) (P.I.* 10.1.1, 10.1.2, 12.1.2, 12.3.1) *4.4 The Learners will be able to Differentiate between folk, tribal, and classical painting forms and their thematic and stylistic*	7

		features. (CO3) (P.I. 10.1.1, 10.1.2, 12.3.1) *4.5 The Learners will be able to Analyze the materials, techniques, and symbolism used in traditional Indian art and craft practices. (CO3) (P.I.* 10.1.3, 10.3.1, 12.3.2, 12.1.2)	
5	**Madhubani Painting**	***Learning Objective**: To enable students to understand the origin, techniques, themes, and cultural significance of Madhubani painting, and to develop basic skills in creating artworks using its traditional motifs and styles. (CO2)* **Contents:** Madhubani Painting is a style of painting practiced in the Mithila region of India and Nepal. It is named after the Madhubani district of Bihar, India (the place of its origin). Artists create this painting by using a variety of mediums, including their own fingers, twigs, brushes, nib-pens, and matchsticks. The paint is created using natural dyes and pigments. The paintings are characterized by their eye-catching geometrical patterns. There is a ritual content for particular occasions, such as birth or marriage, and festivals such as Holi, Surya Shasti, Kali Puja, Upanayana, and Durga Puja. ***Learning Outcomes:*** *A learner will be able to:* *5.1 The Learners will be able to understand the historical and cultural origins of Madhubani painting and its connection to the Mithila region of Bihar. (CO2) (P.I.* 10.1.1, 10.1.2, 12.1.2, 12.3.1) *5.2 The Learners will be able to identify key themes and symbols traditionally used in Madhubani art, such as mythology, nature, and rituals. (CO2) (P.I.* 10.1.1, 10.1.2, 12.3.1) *5.3 The Learners will be able to recognize different styles within Madhubani painting (e.g., Bharni, Kachni, Tantrik, Godna, and Kohbar). (CO2) (P.I.* 10.1.1, 10.1.2, 12.3.1) *5.4 The Learners will be able to describe the traditional tools and materials used, including natural dyes, handmade paper, and bamboo pens.(CO2) (P.I.* 10.1.1, 10.1.2, 12.3.1) *5.5 The Learners will be able to demonstrate basic techniques of line drawing, border making, and motif repetition typical of Madhubani. (CO2) (P.I.* 10.3.1, 10.3.2, 12.3.2)	5
Total			**30**

Suggested List of Practical:

Sr No.	Suggested Topic(s)
1.	Various Quizzes (as mentioned in the syllabus copy)

	Learning Outcomes: *A learner will be able to:* *1.5Learners will be able to trace the regional variations and continuity of artistic practices across India. (CO1) (P.I.* 10.1.1, 10.1.3, 12.2.1, 12.3.1) *2.5The Learners will be able to trace the development of temple, stupa, mosque, palace, and fort architecture in India. (CO2) (P.I.* 10.1.1, 10.1.3, 12.2.1, 12.3.1) *3.5The Learners will be able to trace the historical development and cultural significance of Indian performing arts across periods. (CO1) (P.I.* 10.1.1, 10.1.3, 12.2.1, 12.3.1) *4.5The Learners will be able to analyze the materials, techniques, and symbolism used in traditional Indian art and craft practices. (CO3) (P.I.* 10.1.3, 10.3.1, 12.3.2, 12.1.2) *5.5The Learners will be able to demonstrate basic techniques of line drawing, border making, and motif repetition typical of Madhubani. (CO2) (P.I.* 10.3.1, 10.3.2, 12.3.2)

Performance Indicators:

P.I. 10.1.1 Understanding: Read, understand and interpret technical and non-technical information
P.I. 10.1.2 Create: Produce clear, well-constructed, and well-supported written engineering
P.I. 10.1.3 Create/Analyze: Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
P.I. 10.2.1 Understand: Listen to and comprehend information, instructions, and viewpoints of others
P.I. 10.2.2 Apply/Create: Deliver effective oral presentations to technical and non-technical audiences
P.I. 10.3.1 Create: Create engineering-standard figures, reports and drawings to complement writing and presentations
P.I. 10.3.2 Apply/Create: Use a variety of media effectively to convey a message in a document or a presentation
P.I. 12.1.1 Understand: Describe the rationale for the requirement for continuing professional development
P.I. 12.1.2 Analyse: Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
P.I. 12.2.1 Remember: Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current
P.I. 12.2.2 Understand: Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
P.I. 12.3.1 Understand: Source and comprehend technical literature and other credible sources of information
P.I. 12.3.2 Analyze: Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

Mapping of Course Outcomes with Learning Outcomes:

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

Mapping of Course Outcomes with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO7	PO8	PO9	P010	PO11	PO12
CO1	-	-	-	-	-	-	-	-	6/25	-	4/25
CO2	-	-	-	-	-	-	-	-	5/25	-	4/25
CO3	-	-	-	-	-	-	-	-	4/25	-	2/25

Assessment Criteria of Learning Outcomes:

Learning Outcomes: The Learner will:	**Assessment Criteria:** The Learner can:	**Evaluated under ISA/MSE/ESE/LAB**
LO 1.1: Learners will be able to describe the cultural, religious, and socio-political contexts that shaped various art traditions in India. (CO1) (P.I. 10.1.1, 10.1.2, 12.1.2, 12.3.1)	Learners will identify and explain key regional art forms across India, highlighting their unique features, cultural contexts, and historical roots through a painting/ a song/ a folkdance.	ESE
LO 1.2: Learners will be able to differentiate between classical, folk, tribal, and modern Indian art forms. (CO1) (P.I. 10.1.1, 10.1.2, 12.1.2, 12.3.1)		
LO 1.3: Learners will be able to analyze visual and performing arts using appropriate terminology and critical frameworks. (CO1) (P.I. 10.1.3, 10.3.1, 12.3.2, 12.1.2)	Learners will attempt a quiz on an artwork inspired by a regional Indian art form, demonstrating understanding of its visual style and traditional techniques.	ISA QUIZ
LO 1.4: Learners will be able to appreciate the diversity and symbolism in Indian sculpture, painting, architecture, music, dance, and crafts. (CO1) (P.I. 10.2.1, 10.2.2, 12.3.2)		
LO 1.5: Learners will be able to trace the regional variations and continuity of artistic practices across India. (CO1) (P.I. 10.1.1, 10.1.3, 12.2.1, 12.3.1)		
LO 2.1: The Learners will be able to identify key architectural styles and monuments across different periods of Indian history (e.g., Buddhist, Hindu, Jain, Islamic, Colonial, and Modern). (CO 2) (P.I. 10.1.1,	Learners will describe the historical development, key features, and regional styles of temple, stupa, mosque, palace, and fort architecture in India. They will analyze how these structures reflect cultural,	ESE

10.1.2, 12.3.1)	religious, and political influences over time through paintings.	
LO 2.2: The Learners will be able to describe the historical, religious, and cultural contexts that shaped the evolution of Indian architecture. (CO2) (P.I. 10.1.1, 10.1.2, 12.1.2, 12.3.1)	Learners will attempt a quiz on one architectural form (e.g., stupa, temple, mosque, fort, or palace), showcasing its key structural and decorative elements.	ISA QUIZ
LO 2.3: The Learners will be able to differentiate between regional architectural features and materials used across various parts of India. (CO2) (P.I. 10.1.1, 10.1.2, 12.3.1)		
LO2.4: The Learners will be able to analyze the structural elements, aesthetics, and symbolism in prominent Indian architectural works. (CO2) (P.I. 10.1.3, 10.3.1, 12.3.2, 12.1.2)		
LO 2.5: The Learners will be able to trace the development of temple, stupa, mosque, palace, and fort architecture in India. (CO2) (P.I. 10.1.1, 10.1.3, 12.2.1, 12.3.1)		
LO 3.1: The Learners will be able to identify the major forms of Indian music (classical, folk, devotional) and performing arts (dance, theatre, puppetry). (CO1) (P.I. 10.1.1, 10.1.2)	Learners will explain the evolution of key Indian performing arts (such as classical dance, music, and theater) across different historical periods through dance.	ESE
LO 3.2: The Learners will be able to understand the theoretical foundations of Indian classical music and dance, including ragas, talas, and natya shastra principles. (CO1) (P.I. 10.1.1, 10.1.2, 12.1.2)		
LO 3.3: The Learners will be able to differentiate between Hindustani and Carnatic music traditions and their regional and stylistic variations. (CO1) (P.I. 10.1.1, 10.1.2)	Learners will attempt a quiz on an element of a traditional Indian performing art, reflecting its style and historical context.	ISA QUIZ

LO 3.4: The Learners will be able to describe the key elements, techniques, and expressions used in major Indian classical dance forms (e.g., Bharatanatyam, Kathak, Odissi, Kathakali). (CO1) (P.I. 10.1.3, 10.2.2, 12.3.2)		
LO 3.5: The Learners will be able to trace the historical development and cultural significance of Indian performing arts across periods. (CO1) (P.I. 10.1.1, 10.1.3, 12.2.1)		
LO 4.1: The Learners will be able to identify major traditional and regional painting styles of India, such as Madhubani, Warli, Pattachitra, Kalamkari, Tanjore, and Miniature painting. (CO3) (P.I. 10.1.1, 10.1.2, 12.3.1)	Learners will identify and explain various materials and techniques used in traditional Indian art and craft, along with the symbolic meanings behind common motifs and designs through singing/ painting.	ESE
LO 4.2: The Learners will be able to recognize key Indian handicraft traditions, including textiles, pottery, woodwork, metalwork, and jewelry-making. (CO3) (P.I. 10.1.1, 10.1.2, 12.3.1)	Learners will attempt a quiz on a craft or artwork based on traditional materials and techniques, demonstrating their understanding of the symbolic elements involved.	ISA QUIZ
LO 4.3: The Learners will be able to Describe the historical and cultural context in which various painting styles and handicrafts developed. (CO3) (P.I. 10.1.1, 10.1.2, 12.1.2, 12.3.1)		
LO 4.4: The Learners will be able to Differentiate between folk, tribal, and classical painting forms and their thematic and stylistic features. (CO3) (P.I. 10.1.1, 10.1.2, 12.3.1)		
LO 4.5: The Learners will be able to Analyze the materials, techniques, and symbolism used in traditional Indian art and craft practices. (CO3) (P.I. 10.1.3, 10.3.1, 12.3.2, 12.1.2		
LO 5.1: The Learners will be able to understand the historical and cultural origins of Madhubani	Learners will describe the fundamental techniques used in	

painting and its connection to the Mithila region of Bihar. (CO2) (P.I. 10.1.1, 10.1.2, 12.1.2, 12.3.1)	Madhubani art, including line drawing, border design, and motif repetition through Madhubani paintings.	ESE
LO 5.2: The Learners will be able to identify key themes and symbols traditionally used in Madhubani art, such as mythology, nature, and rituals. (CO2) (P.I. 10.1.1, 10.1.2, 12.3.1)	Learners will attempt a quiz on Madhubani-style artwork that includes skillful use of line drawing, border making, and repeated motifs.	ISA QUIZ
LO 5.3: The Learners will be able to recognize different styles within Madhubani painting (e.g., Bharni, Kachni, Tantrik, Godna, and Kohbar). (CO2) (P.I. 10.1.1, 10.1.2, 12.3.1)		
LO 5.4: The Learners will be able to describe the traditional tools and materials used, including natural dyes, handmade paper, and bamboo pens. (CO2) (P.I. 10.1.1, 10.1.2, 12.3.1)		
LO 5.5: The Learners will be able to demonstrate basic techniques of line drawing, border making, and motif repetition typical of Madhubani. (CO2) (P.I. 10.3.1, 10.3.2, 12.3.2)		

Reference Books:

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

14. Devi, R. (1990). *Mudras in Bharata Natyam*. D. K. Printworld.
15. Singh, K. (1994). *Himalayan art*. Roli Books.
16. Craven, R. C. (1976). *Indian art: A concise history*. Thames and Hudson.
17. Das, S. K. (2005). *A history of Indian literature: 500–1399 AD*. Sahitya Akademi.
18. Goswamy, B. N. (2010). *Indian paintings in the Punjab hills*. Niyogi Books.
19. Michell, G. (2005). *Hindu art and architecture*. Thames & Hudson.
20. Lal, A. (2004). *The Oxford companion to Indian theatre*. Oxford University Press.

Related/ Equivalent MOOC and Associated Certification:

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

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

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

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

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

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

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

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

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

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

Liberal Learning/ Co-curricular Courses

Course Name: Various dance forms

Course Code: CC01

NEP Vertical _Basket: 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	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

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: Corporate and Social Etiquettes

Course Code: CC02

Category: General Education

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	-	25	050

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 • Conflict of interest and workplace compliance • Handling ethical dilemmas and reporting concerns • Diversity, equity, and inclusion in behavior • Course wrap-up, capstone presentations, and reflection	5
Total			**30**

Reference Books / Resources:

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

Course Name: Global Citizenship Education

Course Code: CC03

NEP Vertical _Basket: HSSM_VEC

Preamble:

In an increasingly interconnected world, students must be prepared not only as professionals but also as informed and responsible global citizens. This course aims to develop an awareness of global interdependence, foster respect for cultural diversity, and encourage civic engagement in addressing complex global challenges such as inequality, climate change, conflict, and social justice. Through interdisciplinary and experiential learning, learners will critically reflect on their roles in shaping a more inclusive, peaceful, and sustainable future.

Prerequisite:

Open to all undergraduate students with an interest in societal issues, global affairs, and personal development. No prior experience in international studies is required.

Course Objectives:

7. Understand the foundational concepts and principles of global citizenship.
8. Examine global challenges including poverty, inequality, climate change, and conflict.
9. Foster respect for cultural diversity and promote intercultural communication skills.
10. Promote ethical reasoning, human rights awareness, and civic responsibility.
11. Encourage active engagement in sustainable practices and social justice initiatives.
12. Develop critical thinking, media literacy, and digital citizenship skills.CO1: Define and explain the principles of global citizenship.

Course Outcomes:

CO1: Define and explain the meaning, relevance, and scope of global citizenship.

CO2: Analyze the causes and effects of key global challenges and development goals.

CO3: Demonstrate intercultural sensitivity and communicate across diverse backgrounds.

CO4: Apply principles of human rights and ethics in real-world decision-making.

CO5: Propose or participate in local actions with global impact.

CO6: Critically evaluate media, technology, and social narratives influencing global understanding.

Course Scheme:

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

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	75	-	-	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.

Suggested Assessment & Evaluation:

5. Assignments: Reflective essay on the benefits of natural farming (20%).
6. Quizzes: On core principles and environmental impact (20%).
7. Case Study Analysis: Evaluate a case study on chemical farming's impact vs. natural farming's benefits (30%).
8. Group Presentation: Develop a plan to implement natural farming in a chosen area (30%).

Detailed Syllabus:

Module No.	Module Name	Content
1	Foundations of Global Citizenship	• Definition, scope, and importance of global citizenship. • The interconnected world: globalization, global systems, and responsibilities. • Overview of global issues: poverty, inequality, environment, migration. • Opportunities and roles of youth in global problem-solving. • Introduction to SDGs and their global significance.
2	Culture, Diversity, and Communication	• Understanding cultural identity, norms, and differences. • Developing cultural awareness and reducing stereotypes. • Skills for effective intercultural communication. • Diversity and inclusion in the global context. • Gender, LGBTQ, and social equity in cultural narratives.
3	Human Rights, Social Justice, and Peace	• Historical evolution and significance of human rights. • Universal Declaration of Human Rights and related frameworks. • Social justice movements (civil rights, women's rights, LGBTQ). • Conflict and peace: understanding root causes and resolution strategies. • Building inclusive, peaceful societies through civic engagement.

4	Environment, Sustainability, and Global Health	• Climate change causes, global impacts, and policy responses. • Conservation of biodiversity and ecosystems. • Individual actions for sustainability and responsible consumption. • Global health disparities and healthcare access. • Importance of mental health and well-being in the global agenda.
5	Economy, Technology, and Media Literacy	• Impact of globalization on economies and societies. • Fair trade principles and ethical consumer choices. • Role of technology in solving global challenges. • Digital divide, access, and digital citizenship. • Media's influence on shaping global narratives and critical media evaluation.
6	Action, Reflection, and Global Engagement	• Civic responsibility and youth-led advocacy and activism. • Ethical frameworks for decision-making in global contexts. • Sustainable living: practical steps to apply global citizenship daily. • Integrating global citizenship in education and experiential learning. • Final project: student-led presentations and action plans.

Reference Books:

5. Learning to Live Together: UNESCO Global Citizenship Education Guide
6. Pedagogy of the Oppressed by Paulo Freire
7. Educating for Global Citizenship by Lloyd Kornelsen
8. Factfulness: Ten Reasons We're Wrong About the World – and Why Things Are Better Than You Think by Hans Rosling

Course Name: Wellness: Body, Mind and Spirit

Course Code: CC04

Category: General Education

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
Total Hours		**30**

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: IQ vs EQ

Course Code: CC05

NEP Vertical _Basket: 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

NEP Vertical _Basket: 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

NEP Vertical _Basket: 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 the 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

NEP Vertical _Basket: 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. IndianRailways,Landandbridges,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

NEP Vertical _Basket:

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:

7. Introduce students to fundamental financial concepts, including budgeting, saving, and investing, tailored for engineering professionals.
8. Equip students with tools to analyze costs, returns, and economic feasibility in engineering projects.
9. Teach students effective strategies for managing personal finances, including debt management and tax planning.
10. Familiarize students with investment options, portfolio diversification, and strategies for long-term wealth generation.
11. Train students to make informed financial decisions by analyzing risks, benefits, and ethical considerations.
12. 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	75	-	-	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:

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

Course Name: Mastering Advanced Excel

Course Code: CC10

NEP Vertical _Basket: 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:

7. Enable students to effectively use advanced Excel functions and formulas, including logical, statistical, and lookup functions, for complex data manipulation and problem-solving.
8. Teach students to organize, filter, and analyze large datasets using tools like PivotTables, Power Query, and advanced sorting techniques.
9. Equip students with the ability to create dynamic and visually impactful charts, dashboards, and reports for data-driven decision-making.
10. Introduce students to Excel automation using Macros and VBA (Visual Basic for Applications) to improve productivity and efficiency.
11. Familiarize students with tools such as Solver, Data Tables, Scenario Manager, and advanced conditional formatting to solve real-world business problems.
12. 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	75	-	-	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:

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

Course Name: Personal Grooming Essentials

Course Code: CC11

NEP Vertical _Basket: 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:

7. Introduce the importance of personal grooming and its impact on self-confidence and professional image.
8. Teach effective personal hygiene practices and skincare routines tailored to different skin types and needs.
9. Provide basic knowledge and techniques for maintaining hair and applying makeup for various occasions.
10. Educate students on choosing appropriate attire for professional, casual, and formal settings.
11. Train students to project confidence through effective verbal and nonverbal communication.
12. 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 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	75	-	-	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:

5. The Beauty Book by Ritu Kalra.
6. The Grooming Guide by Malini Singh.
7. The Essential Guide to Grooming by Kate Smith.
8. The Science of Personal Grooming by John Taylor.

Course Name: Various Music Forms

Course Code: CC12

NEP Vertical _Basket: 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:

7. Explore the historical and cultural development of various music forms across the globe.
8. Familiarize students with the key features, instruments, and structures of various music genres.
9. Enhance students' understanding of diverse musical traditions and their cultural significance.
10. Train students to identify and interpret rhythm, melody, harmony, and texture in different music forms.
11. Inspire students to explore their musical preferences and express themselves creatively.
12. 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	75	-	-	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:

5. My Music, My Life by Ravi Shankar
6. The Music of India by Raghunath Panigrahi
7. Indian Classical Music and Gharana Tradition by Shubha Mudgal
8. The Oxford Encyclopaedia of the Music of India by Ashok Ranade