



CURRICULUM STRUCTURE

FIRST YEAR UG: B.TECH

ELECTRONICS AND COMPUTER SCIENCE

REVISION: FRCRCE-3-26

Effective from Academic Year 2026-27

Board of Studies Approval: 05/03/2026

Academic Council Approval: 27/03/2026, 05/04/2026

Dr. Deepak Bhoir
Dean Academics

HOD (Department)

Dr. Sapna Prabhu
Principal



Society of St. Francis Xavier, Pilar's
Fr. Conceicao Rodrigues College of Engineering
Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai – 400 050
(Autonomous College affiliated to University of Mumbai)

Preamble:

Fr Conceicao Rodrigues College of Engineering an autonomous institute from the year 2024-25. University Grant Commission vide letter No. F. 2-10/2023(AC-Policy) dated 23rd Nov 2023 conferred the autonomous status to Fr. Conceicao Rodrigues College of Engineering, Fr. Agnel Ashram, Bandstand, Bandra (West), Mumbai 400050 affiliated to University of Mumbai for a period of 10 years from the academic year 2024-2025 to 2033-2034 as per clause 7.5 of the UGC (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations, 2023. We look towards autonomy as a great opportunity to design and implement curriculum sensitive to needs of Learner, Indian Society, and Industries. We commit to ourselves to the effective implementation of UGC Regulations and NEP 2020 in its spirit. Government of Maharashtra has directed Autonomous Colleges to revise their curriculum in line with National Education Policy (NEP) 2020 through Government Resolution dated 4th July 2023. Accordingly, degree options are given to the students admitted from academic year 2024-25 based on UGC circulars and DTE guidelines ref no. 17/DTE/NEP-2020/2024/111 dated 4th June 2024 related to implementation of NEP.

Based on recent recommendations of the GR, we are pleased to offer our holistic curriculum, a “H-Tree Model” of Engineering Education. A unique “H-Tree Model” of Engineering Education Curriculum is carefully designed to systematically develop IQ (Intelligence Quotient), PQ (Physical Quotient), EQ (Emotional Quotient) and SQ (Spiritual Quotient) of a learner. This curriculum aims at the development of an all-rounded personality with holistic approach to education in which learner receives 25% teacher-led learning, 25% peer learning, 25% self-learning and 25% experiential learning. The curriculum model is outcome based that focuses on learning by doing. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. It ensures multiple choices to learner acquiring skills through systematic planning. It has 7 verticals aligned to GR recommendations with strong science, and mathematics foundation and program core, sequel of electives, Multidisciplinary Minor courses, humanities & management courses and sufficient experiential learning through projects and semester-long industry / research internship along with employable skill-based courses. Learner gets an opportunity to acquire skills through NSDC aligned courses during summer vacations. Learner also gets additional option to choose the kind of degree i.e. **Built in Multidisciplinary minor or Double Minor in emerging field or Honors with Research.**

The curriculum is designed to give a glimpse of trends in the industry under vocational and enhanced skill practices, the pool is offered to nurture and develop creative skills in contemporary industrial practices. Criteria met in the structure is the opportunity for learners to choose the course of their interest in all disciplines. Program Core Course Cover Electronics and Computer Engineering based core courses. (Department Specific)

Various steps are taken to transform teaching learning process to make learning a joyful experience for students. We believe that this curriculum will raise the bar of academic standards with the active involvement and cooperation from students, academic and administrative units.



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Curriculum Structure for UG Programs at Fr CRCE w.e.f. A.Y. 2026-27:

Nomenclature of the courses in the Curriculum

BSESC -Basic Science & Engineering Science Courses

PCPEC- Program Core and Program Elective Courses

MDC -Multidisciplinary Courses

SC- Skill Courses

HSSM- Humanities, Social Sciences and Management

EL -Experiential Learning

LLC- Liberal Learning Courses

BSC -Basic Science Courses

ESC -Engineering Science Courses

PCC- Program Core Courses

PEC -Program Elective Courses

MDM -Multidisciplinary Minor

OE Open Elective

VSEC -Vocational and Skill Enhancement Course

VSC -Vocational Skill Courses

SEC -Skill Enhancement Courses

AEC -Ability Enhancement Course

EEMC -Entrepreneurship, Economics and Management Course

IKS -Indian Knowledge System

VEC -Value Education Course

RM -Research Methodologies

CEFP -Community Engagement or Field Project

ELC -Experiential Learning Courses

PRJ- Project

INT -Internship

CC -Cocurricular Courses

DM -Double Minor

HR- Honors with Research



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Credit Specification:

- ❖ Theory: 1 credit=13 to 15 hrs of teaching
- ❖ Lab: 1 Credit=26 to 30 hrs of lab work
- ❖ Studio Activities: 1 Credit= 26 to 30 hrs of creative activities
- ❖ Workshop Based Activities: 1 Credit=26 to 30 hrs of hands-on activities related to vocation/professional practice/skill based
- ❖ Seminar/Group Discussion: 1 Credit=13 to 15 hrs of participation
- ❖ Internship: 1 Credit=Per 2 weeks OR 36 to 40 hrs of engagement
- ❖ Field Based Learning/Practices: 1 Credit=26 to 30 hrs of learning activities
- ❖ Community Engagement Projects: 1 Credit=26 to 30 hrs of contact time along with 13 to 15 hrs of activities preparation, report writing, independent reading etc.
- ❖ Notional hours include Theory, practical, tutorials and self-learning for each students per week.

Degree/SEM	I	II	III	IV	V	VI	VII	VIII	Total
B.Tech (Multidisciplinary Minor)	20	20	22	22	22	22	20	20	168
B.Tech with Double Minor (Multidisciplinary & Specialization Minor)	20	20	22 +4 *	22 +4*	22 +4*	22 +4*	20 +2\$	20	186
B.Tech with Honors with Research (Multidisciplinary Minor)	20	20	22 +4 *	22 +4*	22 +4*	22 +4*	20 +2\$	20	186

*Optional Credits \$ optional 2 credits can be earned either in VII or VIII Semester

1. Learners who earn a minimum of total 168 credits will be awarded “B.Tech in Engg. /Tech. with Multidisciplinary Minor (MDM)” degree.

2. Learners will have the following options to earn B. Tech. in Engg. /Tech. degree in

a. Major Engg./Tech Discipline with Double Minor (Multidisciplinary and Specialization Minor)

b. Honors with Research and Multidisciplinary Minor

a) Major Engg./Tech Discipline with Double Minor (Multidisciplinary and Specialization Minor)

(additional 18 credits): 168 +18 =186 Min Credits.

There will be four courses (4 credits each), one in each semester starting from the 3rd semester which will be from emerging areas of specialisation. In 7 th or 8 th semester students will complete 2 credits semi3nar/project.

Admission eligibility min CGPA=7.5 after First year

b) B.Tech in Engg./ Tech.- Honors with Research and Multidisciplinary Minor (additional 18 credits by research): 168 +18 =186 Min Credits. (Admission eligibility min CGPA=7.5 after First and should maintain CGPA=7.5 after Third year)



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3. Learner can earn the certificate/Diploma/Degree based on his/her exit from the program as follows. College shall explore feasibility to offer NSDC aligned skill-based courses to the learners:

- a. UG Certificate: After a one-year (40 credits to be earned) and 8-credits summer workshop/vocational courses/internship
- b. UG Diploma: After two-years (80 credits to be earned) and 8-credits summer workshop/vocational courses/internship/Project
- c. B. Voc.: After three-years (120 credits to be earned) and 8-credits summer workshop/vocational courses/internship/Project

Salient Features of Curriculum:

- Framed as per Government Resolution dated 4 th July 2023 in line with National Education Policy (NEP) 2020.
- Minimum 168 choice-based credit structure with options of Degrees earning additional credits
- Unique 'H-Tree' Model of Curriculum: Hybrid model for holistic development with happy learning environment having bridge connecting verticals providing unique path for each learner for 3-dimensional growth, Life Long Learning, multiple entry-exit, inclusive model indicating equal distribution of central resources
- More emphasis on laboratory based and experiential learning
- More weightage to continuous assessment to reduce examination stress
- Mandatory Semester-long internship, courses with emotional & spiritual learning and skill-based learning aligned with NSDC framework
- Well balanced curriculum to attain Program Outcomes and skills of 21st century learner

	Course Verticals																	Total Credits
	BSESC		PCPEC		MDC		S C	HSSM				EL				LLC	BC	
SEM	BSC	ES C	PC C	PE C	MDM	OE	V S E C	AE C	EEM C	IK S	VE C	R M	CEF P	PR J	INT	CC	BC	
I	6	7	4				1									2	--	20
II	6	4	1				1	4		2						2	--	20
III	3		11		3	2					2		1					22
IV	3		11		3	2	2				1						2*	22
V			12	3	3	2	2											22
VI			14	3	3	2												22
VII & VIII				15	3							4		6	12		--	40
Total Credits as per Fr CRCE	18	11	53	21	15	8	6	4		2	3	4	1	6	12	4	2*	168
Total Credits as per GR	14	12	44	20	14	8	8	4	4	2	4	4	2	4	12	4		160

- Bridge course is only for second year direct admission students.



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SEMESTERWISE CURRICULUM STRUCTURE

UG Electronics and Computer Science Programme: 2026-27 Scheme

SEM-I												
Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE	MSE	ESE		Total	Points	Total
								Min	Max			
26BSC11EC01	BSESC	BSC	Matrices and Differential Calculus	TH	2	20	30	20	50	100	2	3
				TU	1	50	-	-	-	50	1	
				SL	3							
26BSC11EC04	BSESC	BSC	Engineering Physics	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SL	2							
26PCC11EC01	PCPEC	PCC	Programming Fundamentals (C)	TH	2	20	30	20	50	100	2	4
				PR	2	50	-	-	-	50	1	
				TU	1	50	-	-	-	50	1	
				SL	3							
26ESC11EC03	BSESC	ESC	Basic Electrical and Electronics Engineering	TH	2	20	30	20	50	100	2	4
				PR	2	50	-	-	-	50	1	
				TU	1	50	-	-	-	50	1	
				SL	3							
26ESC11EC02	BSESC	ESC	Engineering Graphics	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SL	2							
26VSE11EC02	SC	VSEC	Skill Laboratory – 2	PR	2	50	-	-	-	50	1	1
26LLC1X	LLC	CC	One Course from CC	PR	2	100	-	-	-	100	2	2
				SL	2	-	-	-	-	-	-	
Total					TH:TU:PR:SL 10:3:12:15=40					1000	-	20
SEM-II												
Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE	MSE	ESE		Total	Points	Total
								Min	Max			
26BSC11EC03	BSESC	BSC	Integral Calculus and Probability Theory	TH	2	20	30	20	50	100	2	3
				TU	1	50	-	-	-	50	1	
				SL	3							
26BSC11EC02	BSESC	BSC	Engineering Chemistry	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SL	2							
26PCC11EC02	PCPEC	PCC	Innovation and Design Thinking	PR	2	50	-	-	-	50	1	1
26IKS11EC01	HSSM	IKS	Indian Knowledge System	TH	2	100	-	-	-	100	2	2
				SL	2	-	-	-	-	-	-	
26ESC11EC01	BSESC	ESC	Digital Electronics	TH	2	20	30	20	50	150	2	4
				PR	2	50	-	-	-	50	1	
				TU	1	50	-	-	-	50	1	
				SL	3							
26AEC11EC01	HSSM	AEC	Object Oriented Programming with JAVA	PR	4	100	-	-	-	100	2	2
26VSE11EC01	SC	VSEC	Skill Laboratory -1	PR	2	50	-	-	-	50	1	1
26AEC11EC02	HSSM	AEC	Art of Communication	TH	1	100	-	-	-	100	1	2
				PR	2		-	-	-		1	
				SL	1							
26LLC2X	LLC	CC	One Course From CC	PR	2	100	-	-	-	100	2	2
				SL	2							
Total					TH:TU:PR:SL 9:2:16:13=40			-	-	1000	-	20

Notional hours = Contact hours + Self-learning

Skill Lab -1		Skill Lab -2	
A	Measuring and Testing Tools	A	PC and Networking
B	Soldering and PCB Assembly	B	Linux Operating System
C	Mini-project (Hardware)	C	Data analysis using spreadsheets



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NOTE:

1. Colour rows are going to be swapped in SEM I and SEM II for two Groups.

Group I: 3 Computer Engineering Divisions and 1-Mechanical Engineering Class.

Group II: 3 Computer Science and Engineering Divisions and 1- Electronics and Computer Science class.

2. 'Manual for Degree Options' for List of Courses offered under MDM and DM Degree options.



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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
26BSC11EC01	Matrices and Differential Calculus	2	1	-	3	2	1	-	3
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
		Tutorial		50	-	-	-	50	
		Lab		-	-	-	-	-	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	CO1	Apply eigenvalue and eigenvector techniques to diagonalize a given square matrix.
	CO2	Apply differentiation techniques to evaluate higher-order derivatives of functions.
	CO3	Apply partial differentiation technique to obtain the extremum of the given function.
	CO4	Apply the concepts of analytic functions to solve well-defined engineering problems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Matrices Types of Matrices (symmetric, skew- symmetric, Hermitian, Skew Hermitian, Unitary, Orthogonal Matrices and their properties). Rank of a Matrix using Echelon forms, reduction to normal form.	1,2,3,4	02
	1.2	System of Linear equations, their consistency and solutions.	1,2,3,4	02
	1.3	Eigenvalues and Eigenvectors of a square matrix and their Properties (without proof)	1,2,3,4	02
	1.4	Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials	1,2,3,4	02
	1.5	Similarity of matrices, diagonalizable and non-diagonalizable matrices	1,2,3,4	01
2	2.1	Successive Differentiation Successive differentiation: nth derivative of standard functions.	1,2,3,4	02
	2.2	Leibnitz's Theorem (without proof) and problems	1,2,3,4	01
3	3.1	Partial Differentiation Partial Differentiation: Function of several variables, Partial derivatives of first and higher order. Differentiation of composite function.	1,2,3,4	03
	3.2	Euler's Theorem on Homogeneous functions with two independent variables (with proof). Deductions from Euler's Theorem. Maxima and Minima of a function of two independent variables,	1,2,3,4	03



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4	4.1	Analytic Functions Function $f(z)$ of complex variable, Limit, Continuity and Differentiability of $f(z)$, Analytic function: Necessary and sufficient conditions for $f(z)$ to be analytic (without proof).	1,2,3,4	02
	4.2	Cauchy-Riemann equations in Cartesian coordinates (without proof).	1,2,3,4	02
	4.3	Milne-Thomson method: Determine analytic function $f(z)$ when real part (u), imaginary part (v) or its combination $au + bv$ is given.	1,2,3,4	02
	4.4	Harmonic function, Harmonic conjugate and Orthogonal trajectories.	1,2,3,4	02
Total				26

Self-learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial:

Assessment shall be based on minimum 8 tutorials/activities evaluated through continuous assessment of analytical thinking, problem-solving skills, logical circuit design, and accuracy of solutions.

Tutorials: Assignments to be completed on Journal Paper			
	Topics	Ref.	Hrs
1	Matrices: Diagonalisation of matrix, System of linear Equations Problem solving include types of matrices, solving system of linear equations using rank of a matrix, reduction of higher degree matrix polynomial using Cayley-Hamilton theorem, finding diagonal form of a matrix using eigen values and eigen vectors	1,2,3,4	1
2	Successive Differentiation: Problem solving include finding n th order derivative of a function, and n th derivative of a product of two functions using Leibnitz Rule	1,2,3,4	1
3	Partial Differentiation: Problem solving include finding partial derivatives of a function, partial derivative of composite functions using Chain rule and finding extremum of a given function	1,2,3,4	1
4	Analytic Functions: Problem solving include determining derivative of a function in complex sense using first-order method and using Cauchy-Riemann Equations. Extend harmonic function to analytic function by using Milne Thomson Method	1,2,3,4	1



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Activities to be Completed			
5	SCILAB Practical: Algebra of Matrices Write code in SCILAB that perform algebraic operations on matrices, computing inverse, transpose, determinant and solving system of linear equation.	5	1
6	SCILAB Practical: Complex Numbers Write code in SCILAB for representing a complex number in cartesian form as well as geometrically locating it using Argand diagram.	5	1
7	SCILAB Practical: Numerical Methods in solving system of equations Write code in SCILAB for finding root of algebraic and transcendental equations using Newton-Raphson method, Regula-Falsi method	5	1
8	SCILAB Practical: Applications of Partial Differentiation Write code in SCILAB for computing extremum points of a given function.	5	1
Total			08

Recommended Books:

- [1] Dr B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publications, 4nd Edition.
- [2] H. K. Das, “Advanced Engineering Mathematics”, S. Chand, 28th Edition.
- [3] Erwin Kreysizg, “Advanced Engineering Mathematics”, John Wiley & Sons, 10th Edition.
- [4] Jain and Iyengar, “Advanced Engineering Mathematics”, Narosa Publications, 4th Edition.
- [5] Rajan Goyal, Mansi Dhingra, “Programming in SCILAB”, Narosa Publication.

Useful Video Links:

- [1] <https://www.youtube.com/watch?v=OtnSenweGFw>
- [2] <https://www.youtube.com/watch?v=vFj4DNRsF9Q>
- [3] https://www.youtube.com/watch?v=FK8yUzr_YuI
- [4] <https://www.youtube.com/watch?v=8jPr6rGstYk>

SUGGESTED CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
C01	3	1			2									
C02	3	1			2									
C03	3	1			2									
C04	3				2									

Legends: - High: 03, Medium: 02, Low: 01, No Mapping:

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
26BSC11EC04	Engineering Physics	2	-	2	2	2	-	1	3
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
		Tutorial		-	-	-	-	-	
		Lab		50	-	-	-	50	

Pre-requisite Course Codes		None
After the successful completion students should be able to:		
Course Outcomes	CO1	Derive the conditions for intensity maximum and minimum in interference and diffraction of light and solve numerical problems.
	CO2	Develop Schrodinger equation in time dependent and independent form and application of it to solve particle in a box problem.
	CO3	Explain the working of lasers and optical fiber and explain their applications.
	CO4	Explain Fermi level and its variations in semiconductors and derive expression for Hall Voltage.
	CO5	Explain the Physical principles of sensors and their applications.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Theory of interference of light - Thin films- wedge shaped film, Newton's rings, Applications of interference in thin films.	1-3	4
	1.2	Fraunhofer diffraction at single slit – diffraction due to 'n' slits- plane transmission grating. Applications of diffraction grating.	1-3	4
2	2.1	Wave – particle duality-de Broglie matter waves – Concept of wave function and its physical significance – Heisenberg's Uncertainty Principle – Schrodinger's wave equation – Time independent and Time dependent equations – Particle in a one-dimensional rigid box.	4-7	6
3	3.1	Spontaneous and stimulated emission, Einstein's A and B coefficients; Properties of laser- amplification of light by population inversion, different types of lasers: solid-state lasers (Nd-YAG), gas lasers (He-Ne, CO ₂), applications.	8-10	4
	3.2	Optical fiber- principle-types-material, mode, refractive index- Expression for acceptance angle and numerical aperture. Application- Communication, sensors.	8-10	3
4	4.1	Energy bands in extrinsic semiconductors, Fermi -Dirac Distribution Law, Fermi Level in intrinsic & Extrinsic semiconductors, Variation of Fermi level with doping and temperature. P-N Junction, Fermi Level in P-N Junction in biased and unbiased conditions. Hall Effect and its applications.	8-11	4



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5	5.1	Physics of Sensors: Temperature sensors-RTD, Thermocouples, Humidity sensors Pressure sensors: Bellows, Diaphragm, capacitive, inductive and Piezoelectric pressure sensors. Displacement (LVDT), Velocity (Ultrasonic) and acceleration (piezoelectric) sensors. Optical Sensors: Photo diode, LDR	12-14	5
Total				30

Self-learning:

2. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
3. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment: -

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Suggested list of activities:

1. Quiz/ crossword
2. Open book test
3. Case Studies
4. Model making
5. Presentation

Exp. No.	Experiment Details
1	P-N Junction: Forward & Reverse bias characteristics
2	Determination of Plank's constant by Photo electric cell method
3	Determination of wavelength of Laser by diffraction grating
4	Determination of Numerical aperture & acceptance angle of optical fiber
5	Determination of Radius of curvature of lens by Newton's rings
6	Determination of thickness using air wedge apparatus
7	Determination of grating constant
8	Experimental verification of Hall effect
9	Experiments on Sensors – LVDT, UDM, Strain gauge, pressure sensors



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Recommended Books:

TEXT BOOKS

- [1] Engineering Physics – B. K. Pandey & S. Chaturvedi, Second Edition, Cengage.
- [2] Physics for Scientists and Engineers with Modern Physics, Serway and Jew, Cengage Publications

REFERENCE BOOKS

- [1] Optics by Subramaniam N & Brij Lal, S Chand & Co. Pvt. Ltd., New Delhi,
- [2] Optics by R. Agarwal, S. Chand publishers.
- [3] Fundamentals of Optics by Jenkins A Francis and White E Harvey, McGraw Hill Inc., New Delhi,
- [4] Concepts of Modern Physics by Arthur Beisser, McGraw Hill, 7th edition.
- [5] Modern Physics by R Murugesan, Kiruthiga, Sivaprasath S Chand
- [6] Quantum Mechanics by Sathyaprakash, Pragati Prakashan, Meerut.
- [7] Quantum Mechanics by V. Devanathan, Narosa, Chennai.
- [8] Applied Engineering Physics – Rajendran & Marikani (Tata McGraw Hill)
- [9] Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications
- [10] Engineering Physics by M.N. Avadhanulu, S. Chand & Company Ltd.
- [11] Solid State Electronic Devices- B. G. Streetman, Prentice Hall Publisher
- [12] Handbook of Modern Sensors Physics design and application- Jacob Fraden, Springer, AIP press.
- [13] Electronic Instrumentation –H.S. Kalsi, Tata Mc Graw-Hill Education
- [14] Instrumentation & Measurement Techniques by Albert D. Helfrick & William D. Cooper (PHI) Edition
- [15] Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York.

Suggested CO-PO matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	1	-	-	-	-	-	1	-	-	-
CO2	3	-	-	-	1	-	-	-	-	-	1	-	-	-
CO3	3	-	-	-	1	-	-	-	-	-	1	-	-	-
CO4	3	-	-	-	1	-	-	-	-	-	1	-	-	-
CO5	3	-	-	-	1	-	-	-	-	-	1	-	-	-

Legends- High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
26PCC11EC01	Programming Fundamentals (C)	2	1	2	3	2	1	1	4
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
		Tutorial		50	-	-	-	50	
		Lab		50	-	-	-	50	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	CO1	Formulate simple algorithms for arithmetic, logical problems and translate them to programs in C language
	CO2	Illustrate programming principles, decision making statements, looping constructs.
	CO3	Demonstrate modular programming using functions.
	CO4	Demonstrate the applications of derived data types such as arrays, strings and structures.
	CO5	Implement Programs based on pointers in C.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		C Programming Fundamentals	1,4	8
	1.1	The von Neumann Architecture, Introduction to operating system and system programs, Structured programming Approaches.		
	1.2	Steps for Problem Solving: Algorithm and Flowchart.		
	1.3	Variables, keywords, Data types, Operators: Arithmetic, Relational and Logical, Assignment, Unary, Conditional, Bitwise, Expression, Statements. Operator Precedence and Expression evaluation, formatted input and output		
2		Control Flow Statements	2,3	6
	2.1	If statement, if-else statement, multi-way decision, switch statement		
	2.2	while, do-while, for, nested loops, Jump control statements. continue statement, break statement		
3		Functions	2,3,4	6
	3.1	Defining a Function, accessing a Function, Function Prototype		
	3.2	Passing Arguments to a Function, call by value, call by reference, Recursion.		
4		Arrays and Strings	1,4	6
	4.1	Introduction to Arrays, Declaration, initialization and accessing elements of one dimensional and two-dimensional arrays, Passing one-dimensional array to functions		
	4.2	Basics of strings in C, String operations and functions, Passing strings to functions		



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5		Structure	1,2,4	6
	5.1	Concept of Structure, Declaration and Initialization of structure, Nested structures, Array of Structures		
6		Pointers	3,4	7
	6.1	Fundamentals of pointers, Declaration, initialization and de-referencing of pointers, Void and Null Pointers, Pointer Arithmetic		
	6.2	Concept of dynamic memory allocation, DMA functions – Malloc(), Calloc(), Realloc(), Free().		
Total				39

Self-learning:

4. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
5. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment: -

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial:

Assessment shall be based on minimum 8 tutorials/activities evaluated through continuous assessment of analytical thinking, problem-solving skills, logical circuit design, and accuracy of solutions.

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Suggested list of activities:

1. Quiz/ crossword
2. Open book test
3. Case Studies
4. Model making
5. Presentation

To be Taught in laboratory			
	Topics	Ref.	Hrs.
1	Learning Basic Unix Commands (mkdir, rmdir, gedit, cp, mv, rm, cd, cd..) Operator: a) Gross salary b) Largest of three nos. Using ternary operator	1,4	2
2	Control Flow statements :	1,4	2



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	a) Roots of Quadratic equation b) Grades using if else if ladder		
3	Switch statements: a) Calculator using switch b) Design a menu-driven program for unit conversions.(nested switch)	1,4	2
4	Understanding loop structure – while loop: a) GCD using Euclid's algorithm using do...while loops b) Print all the Armstrong numbers from 100 to 500 c) Sum of the first 50 natural numbers.	1,4	2
5	Pattern and Series: a) Write a program to display the patterns b) Calculate Cosine of An Angle	1,4	3
6	Function: a) nPr and nCr using functions b) Swapping two nos	1,4	2
7	Recursion: a) Fibonacci using recursion b) X ^Y using recursion	1,4	2
8	Single Dimensional Array: a) Bubble sort b) Merge two array into a single array c) Calculate Sum and Average(Passing one-dimensional arrays to functions)	1,4	3
9	String: a) Implement user defined string handling functions b) String is Palindrome or not	1,4	2
10	Structure: a) Sorting an array of employees using structures.	1,4	3
11	Pointer: a) Reversing an array using pointers b) Count the number of character and words in the text using Pointers.	1,4	3
	Total		26

Recommended Books:

- [1] Yashavant Kanetkar, "Let Us C", BPB publication, Sixteenth Edition
- [2] E. Balaguruswamy, Programming in ANSI C, McGraw-Hill
- [3] Kernighan, Ritchie, —The C programming Language, Prentice Hall of India
- [4] Pradeep Day and Manas Gosh, —Programming in C, Oxford University Press

SUGGESTED CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3										
CO2	3	2	2								
CO3	3	2	2								
CO4	3	2	2								
CO5	3	2	2								

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -



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Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
26ESC11EC03	Basic Electrical and Electronics Engineering	L	T	P	SL	L	T	P	Total
		2	1	2	3	2	1	1	4
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
		Tutorial		50	-	-	-	50	
		Lab		50	-	-	-	50	

Pre-requisite Course Codes		
Course Outcomes	CO1	Apply various network theorems to analyze DC circuits.
	CO2	Analyze single phase and three phase AC circuits.
	CO3	Describe the constructional features and operation of single phase Transformer.
	CO4	Illustrate the working principle and applications of DC machines.
	CO5	Explain the applications of P-N junction diode in rectifiers and filters for converting AC to DC.

Module No.	Unit No.	Topics	Ref.	Hours
1		DC Circuits		
	1.1	Basic electrical quantities -: charge, current, voltage, power, and energy. Types of circuit elements: resistors, capacitors, and inductors. Ohm's Law and Kirchhoff's Laws. Types of sources	1,4	10
	1.2	D.C. circuits and network simplification: series and parallel circuits, star-delta transformation, Mesh and Nodal Analysis, Source transformation.	1,4	
	1.3	DC Network Theorems: Superposition Theorem, Thevenin's Theorem, Maximum Power Transfer Theorem	1,4	
2		AC Circuits		
	2.1	Generation of alternating voltage & current (AC), fundamentals of AC - waveforms, Phasor representation of AC quantities, definitions of time period, amplitude, frequency, phase, RMS value and average value, Peak factor and Form Factor.	1,3	9
	2.2	R, L, C in AC circuits, Series RL, RC and RLC circuits- phase difference and power factor, phasor diagram, series-parallel circuits, active, reactive, apparent power, series resonance.	1,3	
3		Three phase circuits		
	3.1	Three phase circuits: voltage and current generation, advantages and applications, voltages, currents and power in Star connected and delta connected balanced circuits.	2,3	4
	3.2	Relationship between phase and line currents and voltages in Star and Delta connected systems, Phasor diagrams	2,3	
4		Single phase transformer		
	4.1	Construction, principle of operation, types of transformer, induced emf equation and transformation ratio.	2,4	7



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	4.2	Transformer at No load and Full load condition, phasor diagrams, equivalent circuit, Losses in transformer, Regulation and Efficiency (<i>Numerical are not expected on Regulation and efficiency</i>).	2,4	
5		DC machines		
	5.1	Construction, principle of operation, classification of DC machines, applications of DC generator, DC motor, equation of generated emf/back emf.	3	5
6		Semiconductor Diodes (Numerical are not expected)		
	6.1	Working of P-N junction Diode, I-V characteristic, application as a rectifier, and introduction to filters.	6,7	4
			Total	39

Self-learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment: -

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial:

Assessment shall be based on minimum 8 tutorials/activities evaluated through continuous assessment of analytical thinking, problem-solving skills, logical circuit design, and accuracy of solutions.

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Suggested list of activities:

1. Quiz/ crossword
2. Open book test
3. Case Studies
4. Model making
5. Presentation

Proposed List of Laboratory Experiments: -

1. Verification of Mesh and Nodal analysis.
2. Verification of Superposition Theorem.
3. Verification of Thevenin's Theorem.



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4. Verification Maximum Power Transfer Theorem.
5. Measurement of electrical parameters for alternating sinusoidal voltage (AC)
6. To find resonance conditions in a R-L-C series resonance circuit
7. To measure relationship between phase and line, currents and voltages in three phase system
8. Study of single phase Transformer.
9. Forward & reverse bias characteristics of PN junction diode
10. Application of PN junction diode – rectifiers (full-wave)

Recommended Books:

- [1] V. N. Mittal and Arvind Mittal – Basic Electrical Engineering, Tata McGraw Hill
- [2] B. L. Theraja – Textbook of Electrical Technology, Prentice Hall of India (PHI)
- [3] Kothari & Nagrath – Theory and Problems of Basic Electrical Engineering, PHI (13th edition)
- [4] B.R Patil – Basic Electrical Engineering, Oxford Higher Education
- [5] Principles of Electrical Engineering – Vincent Del Toro, Prentice Hall of India (PHI)
- [6] V. K. Mehta – Principles of Electronics, S. Chand Publishing, New Delhi
- [7] R. S. Sedha – A Textbook of Applied Electronics, S. Chand Publishing, New Delhi

SUGGESTED CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3									2	2		
CO2	3	3			2						2	2		
CO3	3	2				2					2	2		
CO4	3	2				2					2	2		
CO5	3	2			2	2					2	2		

Legends: - High: 03, Medium: 02, Low: 01, No Mapping:

Blooms Level

Remember ✓	Understand ✓	Apply ✓	Analyse ✓	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
26ESC11EC02	Engineering Graphics	2	-	2	2	2	-	1	3
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
		Tutorial		-	-	-	-	-	
		Lab		50	-	-	-	50	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	CO1	To draw Engineering Curves
	CO2	To draw projections of Points, Lines, Planes and Solids
	CO3	To draw sectional views in Section of solids and draw the development of lateral surfaces of solids with sections
	CO4	To apply the basic principles of projections in converting 3D view to 2D drawing.
	CO5	To visualize an object from the given two views
	CO6	To use Computer Aided Drafting tools for drawing various views including Isometric Views

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction to Engineering Graphics Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of Lines, Dimensioning Systems as per IS conventions. Introduction to plain and diagonal scales.	1,4	1
	1.2	Engineering Curves Basic construction of Cycloid, Involute and Helix (of cylinder) only.	1,4	2
2	2.1	Projection of Points and Lines Lines inclined to either HP or VP Reference Plane (Excluding Traces of lines) and simple application-based problems on Projection of lines.	1,4	2
	2.2	Projection of Planes Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to either HP or VP only. (Exclude composite planes).	1,4	1
	2.3	Projection of Solids (Prism, Pyramid, Cylinder, Cone only) Solid projection with the axis inclined to HP and VP. (Exclude Spheres, Composite, Hollow solids and frustum of solids). Use change of position or Auxiliary plane method	1,4	2
	2.4	Section of Solids Section of Prism, Pyramid, Cylinder, & Cone cut by plane perpendicular to at least one reference plane (Exclude Curved Section Plane). Use change of position or Auxiliary plane method.	1,4	3



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3	3.1	Orthographic: Fundamentals of orthographic projections. Different views of a simple machine part as per the first angle projection method recommended by I.S. Full or Half Sectional views of the Simple Machine parts	2,4	3
	3.2	Sectional Orthographic Projections Full or Half Sectional views of the Simple Machine parts	2,4	3
4	4.1	Isometric Views:- Principles of Isometric projection – Isometric Scale, Isometric Views, Conversion of Orthographic Views to Isometric Views (Excluding Sphere).	1,2,4	3
	4.2	Missing Views: The identification of missing views from the given views. Create the third view from the two available views so that all the details of the object are obtained	1,2,4	3
5	5.1	Development of Lateral Surfaces Lateral surface development of Prism, Pyramid, Tetrahedron, Hexahedron, Cylinder, Cone with section plane inclined to HP or VP only. (Exclude DLS of a solid with a hole in it and Reverse Development)	1,4	3
Total				26

Self-learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment: -

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Suggested list of activities:

1. Quiz/ crossword
2. Open book test
3. Case Studies
4. Model making
5. Presentation



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To be Taught in laboratory			
	Topics	Ref.	Hrs.
1	Overview of Computer Graphics Covering: Listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.	3	3
2	Customization & CAD Drawing: Consisting of set up of the drawing page and the printer including scale settings, Setting up of units and drawing limits, ISO and ANSI standards for coordinate dimensioning.	3	3
3	Annotations, layering & other Functions Covering: Applying dimensions to objects, applying annotations to drawings, Setting up and use of layers, layers to create drawings, Create, edit and use customized layers, Changing line lengths through modifying existing lines (extend/lengthen), Printing documents to paper using the print command, orthographic projection techniques, Drawing sectional views of objects (simple machine parts).	3	3
Activities to be Completed in CAD Lab			
A1	Orthographic Projection (1 Problem)	3	4
A2	Sectional Orthographic Projection (1 Problem)	3	4
A3	Reading of Orthographic Projections (1 Problem)	3	3
A4	Isometric Views (2 Problems)	3	3
Activities to be completed on A3 Size Sketchbook using Conventional Tools			
A5	Projection of Solids (1 Problem)	1,4	2
A6	Sections of Solids and Development of Lateral Surfaces (2 Problems)	1,4	2
A7	Sectional Orthographic Views (1 Problem)	1,4	2
	Total		26

Recommended Books:

- [1] N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd
- [2] N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.
- [3] Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "(CAD Soft Technologies): Auto CAD 2012 (For engineers and Designers)", Dreamtech Press New Delhi
- [4] Dhananjay A Jolhe, Engineering Drawing, Tata McGraw Hill.



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SUGGESTED CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	
CO2	-	-	-	-	-	-	-	-	2	-	-	-	-	
CO3	-	-	-	-	-	-	-	-	2	-	-	--	-	
CO4	-	-	-	-	-	-	-	-	2	-	-	-	-	
CO5	-	-	-	-		--		--	2	-	-	-	-	
CO6	-	-	-	-	2	-	-	-	2	-	-	1	-	

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
26VSE11EC02	Skill Lab-2 A-PC and Networking B – Introduction to Linux operating System C –Data analysis using spreadsheet	-	-	2	-	-	-	1	1
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		-	-	-	-	-	
		Tutorial		-	-	-	-	-	
		Lab		50	-	-	-	50	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	CO1	Identify and rectify computer hardware and networking related issues.
	CO2	Use Linux commands to perform file operations.
	CO3	Perform data analysis using spreadsheet.

Module-1		PC and Networking	Ref.	COs
	1.1	Computer Assembly & Hardware Troubleshooting Identify internal components: Motherboard, CPU, RAM, HDD/SSD, SMPS, NIC. Assemble a desktop system step-by-step. Perform BIOS check. Simulate hardware faults: Loose RAM, SATA cable disconnected, CMOS battery issue	1,2	CO1
	1.2	Basic Networking and IP Address Configuration Check current IP configuration: Windows: ipconfig, Linux: ifconfig / ip addr. Assign static IP address. Verify connectivity using: ping 127.0.0.1, ping own IP. Reset to dynamic (DHCP) configuration	1,2	CO1
	1.3	Basic Networking Commands Execute and interpret: ping, netstat, traceroute / tracert Identify: Packet loss, Open ports, Route hops	1,2	CO1
	1.4	LAN design & deployment Physical LAN setup, Subnet understanding, Switch functionality	1,2	CO1
Module-2		Demonstration of installation of Linux Operating System		2
	2.1	Linux command prompt usage, Use of man command, Linux directory structure, finding present working directory in Linux, listing files and directories with different options, changing the directory, creating files and directories using Linux commands	3	CO2
	2.2	Deleting files with rm, deleting folder with -d & -r, moving files and folders with mv, renaming with mv, copying with cp, use of cat command, the wc command, the sort command, Redirection in Linux, Introduction to piping, use of nano and/or vi editor	3	CO2
	2.3	Use of locate and find commands, Use of Grep in Linux, use of chmod and chown for giving permissions in Linux	3	CO2



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Module-3		Data analysis using spreadsheet		
	3.1	Introduction to Microsoft Excel/Open office Calc/Google Sheets, functionality using ranges, use of formulae for basic data analysis (sum, average, if, count, min, max, proper, upper, lower, autosum), sorting, filter, text to column, data validation	4	CO3
	3.2	Use of advance formulae for data analysis (concatenate, vlookup, hlookup, match, countif, text, trim)	4	CO3
	3.3	Creating pivot tables, manipulating pivot table, usage of pivot table tool bar, changing data field properties, displaying a pivot chart, setting pivot table options, adding subtotals to pivot tables	4	CO3
	3.4	Data visualization- creating 2D and 3D plots	4	CO3
	3.5	Data visualization using conditional formatting- creating formula-based rules	4	CO3

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Suggested list of activities:

1. Quiz/ crossword
2. Open book test
3. Case Studies
4. Model making
5. Presentation

Recommended Books:

1. Exploring Computer Hardware - 2024 Edition: The Illustrated Guide to Understanding Computer Hardware, Components, Peripherals & Networks (Exploring Tech)- by Kevin Wilson
2. PC Hardware: The Complete Reference - by Craig Zacker and John Rourke
3. <https://ubuntu.com/tutorials?topic=desktop>
4. <https://support.microsoft.com/en-us/office/excel-video-training-9bc05390-e94c-46afa5b3-d7c22f6990bb>

SUGGESTED CO - PO articulation Matrix

Laboratory Outcomes	Programme Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3		2							2		
CO2	3	3		2							2		
CO3	3	3		2							2		

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
26BSC11EC03	Integral Calculus and Probability Theory	2	1	-	3	2	1	-	3
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
		Tutorial		50	-	-	-	50	
		Lab		-	-	-	-	-	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	CO1	Apply the integrating factor method to solve first-order linear differential equations and related initial value problems.
	CO2	Solve higher-order linear differential equations with constant coefficients using appropriate (auxiliary equation, complementary function, particular integral) methods.
	CO3	Apply change of order of integration and transformation of variables (Cartesian to polar coordinates) to simplify double integrals.
	CO4	Apply concepts of probability and mathematical expectation to compute probability distributions and measures of dispersion.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Linear Differential Equations of first order and first degree		
1	1.1	Exact Differential Equations, integrating Factor, Differential Equations reducible to exact form.	1,2,3,4,5	3
	1.2	Linear differential equations (Definition), Differential Equations reducible to linear form, Bernoulli's differential equation	1,2,3,4,5	3
2		Linear differential equation of higher order		
	2.1	Complementary function, Particular Integral of differential equations of the type: $f(D)y = X$ where X is e^{ax} , $\sin(ax + b)$, $\cos(ax + b)$, x^m , $e^{ax} V$, xV , where V is a function of x . Method of variation of parameters for second order.	1,2,3,4,5	6
	2.2	Cauchy's homogeneous linear differential equation.	1,2,3,4,5	1
3		Integral Calculus		
	3.1	Properties of gamma functions, Integrals reducible to gamma functions.	1,2,3,4,5	1
	3.2	Properties, relation between Beta and Gamma functions, Integrals reducible to Beta functions, Duplication formula.	1,2,3,4,5	2
	3.3	(Standard curves, Cardioide, Lemniscate, Spheres, Ellipsoids, Cylinders, Cones, Tetrahedrons, Planes)	1,2,3,4,5	1
	3.4	Definition and evaluation of a double integral. Evaluate by changing the order of integration and by changing to polar form.	1,2,3,4,5	3



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4		Probability Theory		
	4.1	Definition and basics of probability, Conditional probability, Total Probability theorem and Bayes' theorem.	1,2,3,4,6	2
	4.2	Discrete random variable, Continuous random variable, Probability distribution, Probability density function.	1,2,3,4,6	2
	4.3	Expectation, Variance, Moment generating function, Raw and Central moments up to 4 th order.	1,2,3,4,6	2
Total				26

Self-learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial:

Assessment shall be based on minimum 8 tutorials/activities evaluated through continuous assessment of analytical thinking, problem-solving skills, logical circuit design, and accuracy of solutions.

Tutorials: Assignments to be completed on Journal Paper			
	Topics	Ref.	Hrs.
1	Linear Differential Equations of first order: Problem solving include finding general solution of: Exact differential equations, Equations reducible to exact differential equation, Linear differential equations, Equations reducible to linear differential equation.	1,2,3,4,5	1
2	Linear Differential Equations of higher order Problem solving include computing: Complementary function, and particular integral of a higher order linear differential equation with constant coefficient. Cauchy's homogeneous linear differential equation and Method of variation of parameters for second order.	1,2,3,4,5	1
3	Integral Calculus Problem solving include evaluating integrals using: Gamma and Beta functions. Evaluate double integration: change the order of integration, change to polar co-ordinates and evaluate.	1,2,3,4,5	1
4	Probability Problem solving include: Total Probability theorem, Bayes' theorem, Probability distribution and probability density function, Expectation, Variance, Moment Generating Function, Raw and Central moments up to 4 th order	1,2,3,4,6	1



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Activities to be Completed			
5	SCILAB Practical Solving linear differential equations of first order and first degree: Write code in SCILAB that computes complementary function, integrating factor, and general solution of first order, first-degree differential equation.	7	1
6	SCILAB Practical Solving linear differential equations of higher orders. Write code in SCILAB that computes general solution of higher order linear differential equation.	7	1
7	SCILAB Practical Tracing of curves Write code in SCILAB for tracing Curves and their intersection. Curves: Circle, Loop Curve, Parabola, Cardioide, Astroid, Cycloid.	7	1
8	SCILAB Practical Tracing of surfaces Write code in SCILAB for tracing Surfaces and their intersection. Surfaces: Paraboloid, Sphere, Plane, Cylinder, Cone.	7	1
Total			8

Recommended Books:

- [1] Dr B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publications, 4nd Edition.
- [2] H. K. Das, “Advanced Engineering Mathematics”, S. Chand, 28th Edition.
- [3] Erwin Kreysizg, “Advanced Engineering Mathematics”, John Wiley & Sons, 10th Edition.
- [4] Jain and Iyengar, “Advanced Engineering Mathematics”, Narosa Publications, 4th Edition.
- [5] Ravish R Singh and Mukul Bhatt, “Engineering Mathematics”, Tata McGraw Hill.
- [6] S.C. Gupta & V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
- [7] Rajan Goyal, Mansi Dhingra, “Programming in SCILAB”, Narosa Publication.

Useful Video Links:

- [1] https://onlinecourses.swayam2.ac.in/e-learning/preview/cec22_ma10
- [2] <https://www.youtube.com/watch?v=S4Xmb32s138>
- [3] <https://www.youtube.com/watch?v=btOCUmJkrrg>
- [4] https://www.youtube.com/watch?v=gQ-u_HISKNNk
- [5] https://www.youtube.com/watch?v=w_KiHgultbM
- [6] https://www.youtube.com/watch?v=POv_YgCqAv8&list=PLbMVogVj5nJQWowhOG0-K-yI-bwRRmm3C&index=2

SUGGESTED CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2			2						
CO2	3	2			2						
CO3	3	2			2						
CO4	3	2			2						

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
26BSC11EC02	Engineering Chemistry	L	T	P	SL	L	T	P	Total
		2	-	2	2	2	-	1	3
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
		Tutorial		-	-	-	-	-	
		Lab		50	-	-	-	50	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	CO1	Calculate the efficiency of green and catalytic process compared to traditional industrial processes.
	CO2	Quantify the concentration of sample using instrumental analytical techniques
	CO3	Evaluate corrosion mechanisms and recommend prevention methods
	CO4	Interpret properties and applications of different types of smart materials
	CO5	Analyse fuel characterization and combustion calculations

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Catalysis and Green Chemistry	1,5	5
	1.1	Basic concept of homogenous and heterogeneous catalysis. Hydrogenation of alkenes using Wilkinson's catalyst. Carbonylation of alkanes using Vaska's complex.		
	1.2	Comparative study of synthesis of Indigo dye, Adipic acid, Ibuprofen by traditional and green route and explanation on Green chemistry principle satisfied.		
2		Instrumental Methods of Analysis	3,4,5	5
	2.1	Spectroscopic Techniques: Principle, Beer-Lambert's law Instrumentation and working of UV-Visible Spectroscopy and its applications		
	2.2	Conductometry & Potentiometry: Instrumentation, working and applications.		
3		Corrosion and its control	1,5,7	6
	3.1	Corrosion Definition, Mechanism of Corrosion (I) Dry or Chemical Corrosion-Due to oxygen (II)Wet or Electrochemical corrosion-Mechanism) (i) Evolution of hydrogen type ii) Absorption of oxygen. Types of Corrosion-Galvanic cell corrosion, Concentration cell corrosion (differential aeration principle)		
	3.2	Factors affecting the rate of corrosion (i) Nature of metal, (ii)Nature of corroding environment. Methods of corrosion control (I)Material selection and proper designing, (II) Cathodic protection i) Sacrificial anodic protection ii) Impressed current method.		



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4		Smart Materials	4,5,7	5
	4.1	Polymers Compounding of plastic, Fabrication of plastic by Compression, Injection, Transfer and Extrusion moulding. Glass transition temperature, Conducting polymers, Molecular weight (Number average and weight average), Numerical problems. Composite materials: Polymer reinforced composite materials and its applications		
	4.2	Nanomaterial: Introduction, Properties (size-dependent), Synthesis (Top-down, Bottom-up), Carbon Nanotubes (CNTs), Synthesis of CNT by Arc discharge, CVD, Laser ablation method.		
5		Fuels	4,6	5
	5.1	Definition, classification, characteristics of a good fuel, Calorific value -Definition, Gross or High calorific value & Net or lower calorific value only formula (no derivations) & numerical for calculations of Gross and Net calorific values.		
	5.2	Solid fuels Analysis of coal - Proximate and Ultimate Analysis - numerical problems and significance.		
	5.3	Combustion –Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid and gaseous fuel.		
		Total		26

Self-learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment: -

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Suggested list of activities:

1. Quiz/ crossword
2. Open book test
3. Case Studies
4. Model making
5. Presentation



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To be Taught in laboratory			
	Topics	CO	Ref.
1	To estimate of strength of a strong acid by pH titration	CO2	8
2	To determine of dissociation constant of a weak acid by conductometric method	CO2	8
3	To determine concentration of Cobalt ions from given sample by colorimetric method	CO2	8
4	To determine the EMF of Zn-Cu galvanic cell and verify the Nernst's equation potentiometrically	CO3	8
5	To determine of percentage of ash and moisture from given sample of coal	CO5	8
6	To synthesize p-bromoacetanilide from acetanilide by green method	CO1	8
7	To synthesize phenol-formaldehyde polymer or bio plastic from starch	CO4	8
8	To determine the Acid value of the given fuel sample	CO5	8
Simulation Based -- Virtual Lab			
A1	To determine the Nitrogen content by Kjeldhal's method https://aac-amrt.vlabs.ac.in/exp/nitrogen-content-kjeldahl/	CO5	
A2	To determine viscosity average molecular weight of a given polymer https://pcv-amrt.vlabs.ac.in/exp/average-molecular-weight-polymer/	CO4	
Activities to be completed in Lab/ Class session			
A1	Combustion numerical to calculate weight and volume of air required for complete combustion of given fuel sample	CO5	6
A2	Presentation on Composite materials/ polymer applications in the industry	CO4	6

Recommended Books:

- [1] Engineering Chemistry, Jain & Jain, Dhanpat Rai Publishing Co.
- [2] Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co.
- [3] Fundamental of Engineering Chemistry, S.S. Umare, S. Chand Publications.
- [4] Textbook of Engineering Chemistry by Shashi Chawla, Dhanpat Rai & Co.
- [5] Engineering Chemistry by Shikha Agarwal, Cambridge University Press
- [6] Engineering Chemistry by O.G. Palana, Tata McGraw Hill Education
- [7] Engineering Chemistry by N. Krishnamurthy, P. Vallinayagam, and D. Madhavan Prentice Hall India
- [8] A textbook of Quantitative Chemical Analysis, 5th Edition, A. I. Vogel, ELBS Longman Publication

CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2			2									
CO2	3	2			2									
CO3	3	2			2									
CO4	3	2			2									

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
26PCC11EC02	Innovation Design and Thinking	-	-	2	-	-	-	1	1
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		-	-	-	-	-	
		Tutorial		-	-	-	-	-	
		Lab		50	-	-	-	50	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	CO1	Discuss case studies of innovative products and services..
	CO2	Identify market needs and perform customer demand analysis.
	CO3	Generate ideas through brainstorming and frame product/service ideas.
	CO4	Empathize with the customer.
	CO5	Design and develop a prototype.
	CO6	Pitch their idea.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Problem Identification	1,2,4	
	1.1	Develop Macro Industry–Problem Perspective		1
	1.2	Assemble “Real-World” Problems		1
	1.3	Examine Chosen Problems		1
	1.4	Analyze Problems		1
2		Customer Identification & Needs Validation	1.3	
	2.1	Identify Customer Segments		1
	2.2	Assess Jobs-To-Be-Done (JTBD)		1
	2.3	Develop Customer Persona		1
	2.4	Understand Customer Validation		1
	2.5	Validate Customer–Problem Fit		1
	2.6	Pivot / Refine Customer–Problem Fit for Feasibility		1
3		Solution Idea Generation	1,2	
	3.1	Examine Ideation Techniques		1
	3.2	Generate Solution Ideas		1
4		Opportunity and Competition Mapping	3,4	
	4.1	Identify Global Competitors		1
	4.2	Review Industry Trends & Estimate Market Size (TAM)		1
5		Prototype Development and MVP	1,4,5	
	5.1	Overview of Prototypes & MVP		2
	5.2	Build an Initial Prototype		2
	5.3	Prototypes for Early Validation		1
6		Opportunity (Feasibility) Assessment	2,5	
	6.1	Map Your Relative Position in the Market		1
	6.2	Estimate Opportunity Size (TAM, SAM, SOM)		1



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7		Business Modelling	4,5	1
	7.1	Examine Revenue Models		
	7.2	Build Lean CANVAS		1
	7.3	Build Business Model Canvas		1
8		Venture Idea Feasibility	5,6	
	8.1	Financial Management for Profitability		1
	8.2	Pitch your Idea	1	1
			Total	26

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Suggested list of activities:

1. Quiz/ crossword
2. Open book test
3. Case Studies
4. Model making
5. Presentation

Recommended Books

1. Prof. Bala Ramadurai, *Karmic Design Thinking*, ISBN-13, January 2020.
2. Idris Mootee, *Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School*, Wiley Publications, 2013.
3. Christoph Meinel, Larry Leifer, Hasso Plattner, *Design Thinking: Understand – Improve – Apply*, Springer, 2011.
4. Roger Martin, *The Design of Business: Why Design Thinking is the Next Competitive Advantage*, Harvard Business Press, 2009.
5. <https://web.nen.wfglobal.org/en/home> (Wadhwani Portal)

Reference Books

- [1] Peter F. Drucker, *Innovation and Entrepreneurship*, Routledge.
- [2] Tim Brown, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*, HarperBusiness, 2009.
- [3] Blake Masters, Peter Thiel, *Zero to One: Notes on Startups, or How to Build the Future*.
- [4] Eric Ries, *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*, Penguin, 2011.
- [5] Andrew King, Jeanne Liedtka, Kevin Bennett, *Solving Problems with Design Thinking: Ten Stories of What Works*, Columbia Business School Publishing, 2013.
- [6] Mauricio Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena, Beatriz Russo, *Design Thinking: Business Innovation*, MJV Press, 2011.
- [7] Robert A. Burgelman, Clayton M. Christensen, Steven C. Wheelwright, *Strategic Management of Technology and Innovation*, McGraw-Hill, 5th Edition, 2017.



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SUGGESTED CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	1	2	1	1	–	2	1	–	2	–	2		
CO2	–	3	2	2	1	2	–	–	1	1	2		
CO3	–	2	3	1	1	1	–	2	2	–	2	2	1
CO4	–	2	2	–	–	3	2	2	2	–	1		
CO5	1	2	3	2	3	1	–	2	1	1	2	2	1
CO6	–	1	2	–	–	1	2	3	3	2	2	2	1

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
26IKS11EC01	Indian Knowledge System	L	T	P	SL	L	T	P	Total
		2	-	-	2	2	-	-	2
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		100	-	-	-	100	
		Tutorial		-	-	-	-	-	
		Lab		-	-	-	-	-	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	CO1	Explain the meaning, scope, characteristics, and philosophical foundations of Indian Knowledge Systems
	CO2	Identify and describe major Indian contributions to science, technology, engineering, and mathematics
	CO3	Understand Indian systems of health, wellness, and environmental sustainability
	CO4	Analyze key ideas from Indian philosophy, ethics, and governance traditions
	CO5	Apply concepts of Indian Knowledge Systems to contemporary contexts

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Introduction to Indian Knowledge Systems	1,2,3, 6,8	5
	1.1	Meaning, scope, and characteristics of Indian Knowledge Systems		
	1.2	Nature of knowledge in ancient India; Oral traditions and knowledge transmission		
	1.3	Guru-Shishya Parampara		
	1.4	Epics of India: Ramayana and Mahabharata Key Issues and messages		
2		Science and Technology	1,3,5, 8	5
	2.1	Mathematics: Zero, decimal system		
	2.2	Geometry and algebra in ancient India		
	2.3	Engineering and Technology		
	2.4	Contribution of Kings in Ancient India (<i>Examples: Shivaji Maharaj Ashoka, Raja Raja Chola, Krishnadevaraya etc.</i>)		
3		Indian Systems of Health, Wellness and Environment	1,3,7	4
	3.1	Yoga and integrated wellness		
	3.2	Preventive healthcare and lifestyle management		
	3.3	Traditional ecological knowledge and sustainability		
	3.4	Water management, agriculture, and biodiversity conservation		
4		Indian Philosophy, Ethics and Governance	2,4,6, 8	6



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	4.1	Overview of schools of Indian philosophy		
	4.2	Ethical values and duties in Indian traditions		
	4.3	Social responsibility and moral conduct		
	4.4	Leadership and governance ideas from Indian texts		
	4.5	Relevance to professional ethics and engineering practice		
5		Contemporary Applications and Case Studies	1,2,3	6
	5.1	Indian Knowledge Systems and innovation		
	5.2	Indigenous technologies and Indian startups		
	5.3	Integration of IKS with modern science and engineering		
	5.4	Case study: Yoga in global health		
	5.5	Case study: Sustainable architecture and traditional crafts		
			Total	26 hrs.

Self-learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment: -

Theory:

ISE: ISE activities carry 100 marks. These activities will be conducted throughout the semester.

Recommended Books:

- [1] B. Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R. N., Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning, 2022
- [2] Kapil Kapoor, Avadhesh K. Singh, "Indian Knowledge Systems, Volume 1", Indian Institute of Advanced Study, 2005
- [3] Bharatiya Vidya Bhavan – Indian Heritage and Culture
- [4] S. Radhakrishnan – Indian Philosophy (Vol. I & II)
- [5] S. Chandrasekhar – History of Indian Science and Technology
- [6] Frits Staal – Discovering the Vedas
- [7] David Frawley – Ayurveda and the Mind
- [8] A. L. Basham – The Wonder That Was India

SUGGESTED CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	2	-	1	-	1	-	3	1	-
CO2	-	-	-	-	-	2	1	-	-	1	-	3	-	1
CO3	-	-	-	-	-	2	3	-	-	-	-	2	3	-
CO4	-	-	-	-	-	3	-	3	1	1	-	1	3	1
CO5	-	-	-	-	-	3	2	2	2	2	-	2	2	3

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
26ESC11EC01	Digital Electronics	2	1	2	3	2	1	1	4
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
		Tutorial		50	-	-	-	50	
		Lab		50	-	-	-	50	

Pre-requisite Course		
After the successful completion students should be able to:		
Course Outcomes	CO1	Describe various number system, code conversion problems, logic gates, SOP and POS forms, and simplifications of logic functions.
	CO2	Compare TTL and CMOS families w.r.t. their characteristic parameters.
	CO3	Construct combinational circuits using given MSI devices.
	CO4	Apply the knowledge of flip-flops and MSI devices to design sequential circuits
	CO5	Analyze the given sequential circuits to identify the state transitions and race conditions.
	CO6	Implement the given logic function using programmable logic devices.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Implementation of Logic functions		
	1.1	Logic gates, Implementation of functions using basic gates and using Universal gates	1,2, 3,4	8
	1.2	Formulating a logic function, Sum of Products (SOP), Product of Sums (POS), Minimization using Boolean Algebra, De Morgan's Theorems, Minimization using Karnaugh map (upto 4 variables), Quine-McClusky Technique	1,2, 3,4	
2.		Logic Families		
	2.1	Characteristic parameters of logic families: Voltage and Current parameters, Fan in, Fan out, Noise margin, Power Dissipation, Propagation Delay	1,2, 3,4	4
	2.2	TTL NAND gate and its transfer characteristics, CMOS inverter and transfer characteristics, comparison of TTL and CMOS logic families	1,2, 3,4	



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3.		Combinational Circuit Design		
	3.1	Full adders, ripple carry adders, Carry Look ahead Adders, Binary Subtractors	1,2	8
	3.2	Multiplexer/ Demultiplexer, Encoders, Priority Encoders, Parity Generators, Code Converters, comparator, ALU	3,4	
	3.3	Static and dynamic hazards in combinational circuits		
4.		Elements of Sequential Circuit		
	4.1	Storage elements: Latches and Flip-flops (S-R, J-K, D, T Flipflop), Master Slave Flip-flop	1,2 , 3,4	8
	4.2	Synchronous and Asynchronous counters, Shift registers and their applications. Timing & Clocking Concepts–Propagation delay, Setup time, Hold time, Clock skew	1,2 3,4	
5.		Analysis of Sequential circuits		
	5.1	Analysis of Moore and Mealy type Finite State Machines (FSM), State Reduction	1,2 3,4	7
	5.2	Introduction to Asynchronous Sequential circuits, Essential hazards in asynchronous sequential circuits	1,2 3,4	
6.		Programmable devices		
	6.1	Structure of Programmable Logic Devices (PLDs), Function implementation with PAL and PLAs, Introduction to CPLD and FPGA	1,2 , 3,4	4
Total				39

Laboratory Learning			
	Suggested experiment list	Module	Ref.
1	To implement the combinational logic for a given function using basic gates and Universal gates.	1	1,2
2	To simulate a CMOS inverter and to plot the transfer characteristics (using SPICE)	2	1,2
3	a. To verify the function of 8 bit binary adder IC7483 b. To implement a BCD adder using IC7483	3	1,2
4.	a. To implement the function of 8 bit Multiplexer using IC74151 b. To implement a given 4 variable Boolean function using Multiplexer IC 74151	3	1,2
5.	To implement an 8 bit binary comparator using IC 7485	3	1,2
6.	a. To implement a Mod n asynchronous counter using flip-flops b. To implement a Mod n counter using IC 74163	3	7,8
7.	Implementation of a combinational circuit using reconfigurable devices a. To write an HDL code for the parity generator and simulate verify the operation by simulation. b. To implement the HDL code on FPGA and verify the operation.	3	7,8
8.	Implementation of a sequential circuit using reconfigurable devices a. To write an HDL code for a 4 bit shift register and verify the operation by simulation. b. To implement the HDL code on FPGA and verify the operation.	4	7,8



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Self-learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment: -

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial:

Assessment shall be based on minimum 8 tutorials/activities evaluated through continuous assessment of analytical thinking, problem-solving skills, logical circuit design, and accuracy of solutions.

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Suggested list of activities:

1. Quiz/ crossword
2. Open book test
3. Case Studies
4. Model making
5. Presentation

Recommended Books:

- [1] John F. Wakerly, "Digital Design Principles and Practice"- Pearson Publications, 4th edition
- [2] Morris Mano, Michael D. Ciletti, "Digital Design with introduction to Verilog HDL" Pearson, 5th edition
- [3] John M. Yarbrough, "Digital Logic Applications and Design" – Thomson Publications
- [4] Stephen Brown and Zvonko Vranesic, "Fundamentals of digital logic design with Verilog design", McGraw Hill, 3rd Edition
- [5] Roth and Kinney, "Fundamentals of Logic Design", Cengage learning, 7th edition
- [6] William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall of India
- [7] J. Bhaskar, A Verilog HDL Primer, Third Edition, Star Galaxy Publishing
- [8] Sameer Palnitkar, "Verilog HDL: A guide to digital design and synthesis"

Online References:

- [1] <https://archive.nptel.ac.in/content/storage2/courses/106108099//Digital%20Systems.pdf>
- [2] <https://www.electronicsforu.com/>



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[3] <https://circuitdigest.com/>

SUGGESTED CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	3	2	2	1	1	-	-	-	-	-	-	-	-
CO2	3	1	-	-	2	-	1	2	2	-	1	-	-
CO3	3	1	3	1	0	-	1	2	2	-	1	1	-
CO4	3	1	3	1	0	-	1	2	2	-	1	1	-
CO5	3	3	-	1	0	-	-	0	0	-	1	-	-
CO6	3	2	3	-	3	-	1	2	2	-	1	1	2

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyze ✓	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
26AEC11EC01	Object Oriented Programming with Java	-	-	4	-	-	-	2	2
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		-	-	-	-	-	
		Tutorial		-	-	-	-	-	
		Lab		100	-	-	-	100	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	LO1	Demonstrate Proficiency in Fundamentals of Java
	LO2	Apply Object-Oriented Programming Principles
	LO3	Explore multithreading, File I/O, and exception handling
	LO4	Develop Real world Java Applications

Suggested Experiment List			
Module 1	Introduction to Java Basics: Overview of Java programming language, setting up the development environment (IDE installation), Writing and executing your first Java program, Understanding variables and data types, Basic input/output operations, Control Structures and Functions.		Ref 1,2,3 LOs LO1
	1. Program to demonstrate input using Scanner and command line arguments.		
	2. Electricity Bill Generator: Electricity Bill Calculation using Java Design and develop a Java program to calculate the electricity bill of a household based on the number of electricity units consumed. The program must accept the total units consumed from the user and compute the bill according to the following slab rates: Units Consumed Rate per Unit 0 – 100 units ₹5 per unit 101 – 300 units ₹7 per unit Above 300 units ₹10 per unit After calculating the total energy charge, the program must add 18% GST to the bill and display a well-formatted electricity bill.		



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	3. Design and implement a Java program that simulates a Number Guessing Game between the computer and the user. The program should generate a random integer between 1 and 100. The user must repeatedly guess the number until the correct number is found. After each guess, the program must guide the user by displaying whether the guessed number is: Too High → if the guess is greater than the generated number Too Low → if the guess is smaller than the generated number Correct → when the guess matches the generated number The program must also keep track of the total number of attempts made by the user and display it when the user successfully guesses the number.		
	4. To write a Java program that determines whether a given number is a prime number using a user-defined function.		
Module 2	Introduction to object-oriented programming (OOP) concepts: Classes and objects in Java, Encapsulation, and polymorphism (method overloading), Access modifiers (public, private, protected, default)	1,2,3	LO2
	1. Create a Student class with private data members: Roll Number, name, marks. Provide public getter and setter methods to access and modify data. Display student details using a separate method.		
	2. Program to demonstrate constructor overloading		
	3. Program on passing and returning objects as argument.		
	4. Area Calculation using Overloading. Create overloaded methods: area(int side) → square area(int length, int breadth) → rectangle area(double radius) → circle		
Module 3	Inheritance: Types of Inheritance, Interface, Abstract class and methods, super and final keywords, Polymorphism (method overriding)	1,2,3	LO2
	1. Create a base class named Vehicle that represents general vehicle properties and behaviours. Then create a derived class named Car that inherits from the Vehicle class and adds specific features related to cars.		
	2. Write a Java program to demonstrate multilevel inheritance by creating three classes: Animal, Mammal, and Dog, where Mammal inherits from Animal and Dog inherits from Mammal. Implement methods in each class and create an object of Dog to access all inherited and own methods.		
	3. Create an abstract class Shape that contains an abstract method calculateArea(). Create subclasses Circle and Rectangle that extend the		



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	Shape class and implement the abstract method to calculate their respective areas.		
	4. Write a Java program to demonstrate multiple inheritance using interfaces by creating two interfaces, Engine and MusicSystem, each with different methods. Create a class Car that implements both interfaces and demonstrates all functionalities using an object in the main method.		
Module 4	Strings and Arrays: Introduction to strings and string manipulation. Introduction to arrays, Declaration and initialization of an array, Operations on Arrays, Array of objects, Passing array to methods, returning array from methods,	1,2,3	LO2
	1. Given a sentence containing leading/trailing spaces and multiple spaces between words, reverse the order of words while keeping each word's characters unchanged. Output must contain exactly one space between words and no leading/trailing spaces. Example: " Java is powerful " → "powerful is Java"		
	2. Implement string compression using run-length encoding: replace consecutive repeated characters with char + count. If the compressed string is not shorter than the original, return the original. Example: "aaabbc" → "a3b2c1", "abcd" → "abcd"		
	3. Develop a Java program to store marks of 10 students in an array and calculate average marks, highest and lowest marks and number of students scoring above average.		
	4. Write a Java program to develop a banking application. Store account balance of 20 customers. Write methods for the following: - to implement deposit and withdraw function. - To identify customers with balance below 1000 rs. - Calculate total banks holdings		
	POST MSE		
Module 5	Exception Handling(try-catch-throw-throws, finally). 1. Write a Java program to divide two numbers entered by the user. Handle the ArithmeticException if the denominator is zero. 2. Write a Java program that performs division and array access in the same program. Use multiple catch blocks to handle different exceptions.	1,2,3	LO2
Module 6	Multithreading: thread lifecycle and Thread Scheduling 1. Write a Java program that creates three threads with different priorities: • Low priority thread • Normal priority thread	1,2,3	LO3



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	High priority thread Each thread should print its name and a counter from 1 to 5. 2. Write a java program that runs 2 threads. First thread finds sum of each row and second thread finds sum of each column in a 2D array.		
Module 7	File Handling: File Input/output with Streams, Serialization and Deserialization, Random Access Files	1,2,3	LO3
	1. Design and implement a Student Record Management System using Java File Handling. The system must: - Store student details (Roll No, Name, Marks) in a text file. - Append new student records without overwriting existing data. - Read and display all student records. - Search and display a student record by Roll Number. - Handle file-related exceptions properly.		
Module 8	Front-End Development and Database Connectivity using N-Tier Architecture	1,4	LO4
	Front-end development using HTML -Designing user interfaces (UI), Handling user interactions, Sending/receiving data from backend Setting Up Database Environment (MySQL/PostgreSQL), Establishing Database Connection, Executing SQL Queries, basics of Exception Handling		
Module 9	Mini Project: Defining the problem statement and objectives. Implement the idea of Mini Project based on the content of the syllabus (Group of 2-3 students) . Consider user privacy (authentication) and data protection (encryption)	1,2,3,4	LO4
Total			

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 50 marks for submission of experiments and 50 marks for oral/practical evaluation.

Suggested list of activities:

- Quiz/ crossword
- Open book test
- Case Studies
- Model making
- Presentation



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Recommended Books:

- [1] Herbert Schildt, “Java: The Complete Reference”, Ninth edition, McGraw Hill Education Publication
- [2] E. Balaguruswamy, “Programming with JAVA”, Sixth edition, McGraw Hill Education Publication
- [3] Kathy Sierra and Bert Bates, “Head First Java: A Brain-Friendly Guide, 2Nd Edition”, O'REILLY publication
- [4] Head First HTML and CSS” by Elisabeth Robson and Eric Freeman, 2Nd Edition”, O'REILLY publication.

SUGGESTED CO - PO articulation Matrix

Laboratory Outcomes	Programme Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
CO1	3	1	1	-	2	-	-	-		-	2		
CO2	3	1	1	-	2	-	-	-		-	2		
CO3	3	1	1	-	2	-	-	-		-	2		
CO4	3	1	2	-	2	-	1	2	2	-	2		

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
26VSE11EC01	Skill Lab-I A-Measuring and Testing Tools B - Soldering and PCB Assembly C -Mini-project Hardware	-	-	2	-	-	-	1	1
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		-	-	-	-	-	
		Tutorial		-	-	-	-	-	
		Lab		50	-	-	-	50	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Learning Outcomes	LO1	Identify and select appropriate measuring instruments, soldering tools, and electronic components for engineering applications.
	LO2	Operate digital/analog instruments and perform proper soldering techniques following safety protocols.
	LO3	Design and develop basic electronic circuits including PCB layout using CAD tools.
	LO4	Perform accurate measurements, calibration, PCB fabrication, and circuit assembly.
	LO5	Analyze measurement data, troubleshoot circuits, and optimize hardware performance.
	LO6	Document experimental results and present a functional hardware mini-project prototype.

To be Taught in laboratory			
	Part A: Measurement & Testing Tools	Ref.	LOs
1	Introduction to Measuring Instruments and Safety Practices: Identify Multimeters, oscilloscopes, function generators, power supplies, and safety precautions.	[1], [3], [4],	LO1LO2
2	DC power supply: - Study of construction and working principles of Linear Power Supply and Switched Mode Power Supply (SMPS). Measurement of output voltage, ripple voltage, load regulation, and efficiency under different load conditions, followed by performance comparison.	[5]	LO2 LO3
3	Digital Multimeter: - Operations: Measurement of AC/DC voltage, current, resistance, continuity, and diode testing with proper range selection and safety precautions.		LO3
4	Observation and analysis of waveforms; measurement of frequency, amplitude, time period, and phase difference using oscilloscope and function generator.		LO4 LO5
	Part B: Soldering and PCB Assembly	[6],	
5	Introduction to Soldering Tools and Safety Practices: Identify soldering iron, solder wire, flux, desoldering pump, and safety equipment. Understanding workspace safety.	[7], [8], [1]	LO1, LO2
6	Basic Soldering Techniques: - Practice soldering on GPB boards, mastering proper heating techniques, and solder application. Practice of proper Through-Hole Component Soldering		LO2



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	technique for Soldering resistors, capacitors, LEDs, and ICs on general-purpose PCB, Soldering of SMD components and application of desoldering and rework techniques.		
7	Introduction to PCB Design Software: - Design of schematic and PCB layout using software (KiCad/EasyEDA), footprint assignment, and Gerber file generation.		LO3
8	PCB Fabrication & Inspection: - PCB etching, drilling, assembly, and inspection for soldering defects with corrective actions.		LO4, LO5
	Part C: Hardware Mini Project		
9	Problem Definition & Circuit Design Identification of real-world problem, block diagram preparation, component selection, and circuit simulation.	[1], [2], [3], [5]	LO1, LO3
10	Breadboard Prototyping Assembly of circuit on breadboard and functional verification using measuring instruments.		LO4
11	PCB Implementation & Testing Final PCB design, component assembly, soldering, and systematic testing of the hardware prototype.		LO4
12	Documentation & Demonstration Preparation of project report, result analysis, and presentation of working prototype with technical explanation.		LO6

Course Assessment: -

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Suggested list of activities:

1. Quiz/ crossword
2. Open book test
3. Case Studies
4. Model making
5. Presentation

Suggested some topic for projects

1. Regulated Power supply
2. Clock Generator using IC555
3. Decade counter
4. Automatic Night Lamp (LDR Based)
5. Clap Switch
6. Temperature Monitoring System
7. IR Obstacle Detector
8. Soil Moisture Indicator
9. Nurse calling system
10. SMPS
11. Power Amplifier
12. Modulator and Demodulator



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Recommended Books:

- [1] Paul Scherz and Simon Monk, *Practical Electronics for Inventors*, 4th Edition, McGraw-Hill Education.
- [2] Charles Platt, *Make: Electronics: Learning Through Discovery*, Maker Media, Inc.
- [3] Paul Horowitz and Winfield Hill, *The Art of Electronics*, 3rd Edition, Cambridge University Press.
- [4] Forrest M. Mims III, *Getting Started in Electronics*, Master Publishing.
- [5] R. P. Jain, *Modern Digital Electronics*, 4th Edition, Tata McGraw-Hill.
- [6] R. S. Khandpur, *Printed Circuit Boards: Design, Fabrication, Assembly and Testing*, Tata McGraw-Hill Education.
- [7] Clyde F. Coombs Jr., *Printed Circuits Handbook*, McGraw-Hill Professional.
- [8] IPC-A-610, *Acceptability of Electronic Assemblies*, IPC Standard.

SUGGESTED CO - PO articulation Matrix

Laboratory Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
LO1	3	-	-	-	2	1	-	-	-	-	-	2	-
LO2	1	-	-	2	-	-	-	-	-	-	2	-	-
LO3	-	-	-	3	-	1	-	-	-	-	3	-	1
LO4	2	3	-	3	-	-	-	-	-	-	2	3	-
LO5	2	2	2	2	-	-	-	-	-	-	3	2	-
LO6	3	-	2	-	-	-	-	-	-	-	2	-	-

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse ✓	Evaluate ✓	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
26AEC11EC02	Art of Communication (AoC)	L	T	P	SL	L	T	P	Total
		1	-	2	1	1	-	1	2
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory	100	-	-	-	100		
		Lab		-	-	-			
		Tutorial	-	-	-	-	-		

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	CO1	Understand the fundamentals, process, and importance of communication in personal, academic, and professional contexts.
	CO2	Apply appropriate verbal and non-verbal communication strategies in formal and informal situations.
	CO3	Demonstrate competence in Listening, Reading, Speaking, and Writing (LRSW) skills with confidence and clarity.
	CO4	Prepare effective professional correspondence such as emails, applications, and formal requests.
	CO5	Analyze and practice ethical, responsible, and professional communication in digital and online environments.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Foundations of Communication	1.2	3
	1.1	Meaning, process, and importance of communication		
	1.2	Communication cycle and elements		
	1.3	Indian perspectives on communication (brief overview)		
	1.4	Barriers to communication and strategies to overcome them		
2		Verbal and Non-Verbal Communication	1.2	4
	2.1	Verbal communication: clarity, tone, and articulation		
	2.2	Non-verbal communication: kinesics, proxemics, chronemics, haptics, oculesics, paralanguage		
	2.3	Public speaking fundamentals and stage confidence		
	2.4	Ethical and inclusive communication		
3		Communicative Competence (LRSW Skills)	5	3
	3.1	Listening skills: TED Talks / motivational speeches		
	3.2	Reading skills: academic, technical, and reflective reading (self-learning)		
	3.3	Speaking skills: discussions, group interaction, ethics-based conversations		
	3.4	Writing skills: reviews and short reports		



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4	4.1 4.2	Professional and Workplace Communication Principles of effective correspondence Email etiquette and formal letters Applications, requests, permissions, and internship-related communication	1,2	2
5	5.1 5.2 5.3 5.4	Digital Imprint & Online Communication Concept of digital imprint and digital footprint Professional identity on digital platforms (email, LinkedIn, academic platforms) Ethical, responsible, and safe digital communication Basics of online reputation management and cyber etiquette	1	1
Total				13

Self-learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment: -

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Suggested list of activities:

1. Quiz/ crossword
2. Open book test
3. Case Studies
4. Model making
5. Presentation

Sr. No.	Title of the assignments/Activities to be carried out in Class/Lab	Ref.	CO
1	Draft & Orally presenting Public speaking/ Extempore-ISE1(PR)	1	3
2	Foundations of Communication module assignment: Subjective-ISE1 (TH)	2	1
3	Writing a review any novel/ book or movie/ Research paper and mention the reflection- Self Learning -ISE1(PR)	1	3
4	Listening Skills: TED/Motivational Talks with Comprehension Test-ISE1 (TH)	3	3
	ISE1 Marks		



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5	Role Play activities on verbal and non-verbal ability- ISE2(PR)	5	2
6	Speaking skills: Panel Discussion on Ethics- ISE2(PR)	3	3
7	Effective Correspondence: Subjective (TH)	1	4
8	Digital Imprint & Online Communication: Case discussion on: Digital footprint, Cyber etiquette, Reflection on ethical digital presence (TH)	2	5
9	Presentation/ Poster Making: - Presentation on Indian thinkers, leaders, or contemporary communication models-ISE2(PR)	2	1
ISE2 Marks			
10	*Usage of Language Lab to improve English Language skills with the help of Wordsworth Software installed	5	5

Recommended Books:

- [1] Shirley Mathews – Communication Skills, Technical Publication, Pune 2022
- [2] Meenakshi Raman & Sangeeta Sharma – Professional Communication Oxford, India 2011
- [3] Michael McCarthy & Felicity O'Dell – English Vocabulary in Use Cambridge University Press, India 1999
- [4] Norman Lewis – Word Power Made Easy Anchor Books, New York 1978
- [5] Selected online resources and TED Talks

SUGGESTED CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1								-	-	2		3	-	3
CO2								-	1	3		3	-	1
CO3								-	2	3		2	3	-
CO4								-	-	3		1	3	1
CO5								2	2	2		2	2	3

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyse	Evaluate	Create
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