CURRICULUM STRUCTURE

FIRST YEAR UG: B.TECH

ELECTRONICS AND COMPUTER SCIENCE

REVISION: FRCRCE-2-25

Effective from Academic Year 2025-26
Board of Studies Approval: 28/02/2025
Academic Council Approval:14/02/2025 & 08/03/2025

Dr. DEEPAK BHOIR Dean Academics	Dr. SAPNA PRABHU HoD (ECS)	DR. SURENDRA RATHOD Principal

Preamble:

Greetings and congratulations to all the education partners Fr Conceicao Rodrigues College of Engineering for getting autonomous status to the college 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 leaner 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. Honors or Double Minor or Honors with Research.

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.

Curriculum Structure for UG Programs at Fr CRCE w.e.f. A.Y. 2025-26

Nomenclature of the courses in the curriculum	
Abbreviation	**Title**
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
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

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.

Credit requirements for different options of the Degrees:

Degree/SEM	I	II	III	IV	V	VI	VII	VIII	Total
B.Tech with Multidisciplinary Minor	20	20	22	22	22	22	20	20	168
B.Tech with Double Minor (Multidisciplinary & Specialisation Minor)	20	20 +2*	22 +4*	22 +4*	22 +4*	22 +4*	20 +2$	20 +2$	188
B.Tech with Research and Multidisciplinary Minor	20	20 +2*	22 +4*	22 +4*	22 +4*	22 +4*	20 +2$	20 +2$	188

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

There is 2 credit course 'Introduction to Emerging Technologies' in SEM-II introducing various emerging technologies along with basics of various tracks under multidisciplinary, minor and research domain helping student in decision making for further options of learning.

a) Major Engg./Tech Discipline with Double Minor (Multidisciplinary and Specialization Minor) (additional 20 credits): 168 +18+2 (SEM-II)=188 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 7th or 8th semester students will complete 2 credits seminar/project. **Admission eligibility min CGPA=7.5 after First year**

b) B.Tech in Engg./ Tech.- Honors with Research and Multidisciplinary Minor (additional 20 credits by research): 168 +18+2 (SEM-II)=188 Min Credits. (Admission eligibility min CGPA=7.5 after First and should maintain CGPA=7.5 after Third year)

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 4th July 2023 in line with National Education Policy (NEP) 2020.
- ✓ Minimum 165 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
- ✓ Curriculum is designed to create excitement among learners for education through stories, activities, collaboration, hackathon, contest, case studies, creative art etc.
- ✓ Curriculum is designed to make graduates responsible citizens of country with future ready skills to handle challenges of 21st Century

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)

SEMESTERWISE CURRICULUM STRUCTURE

UG Electronics and Computer Science Program:

SEM-I												
Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE1	MSE	ISE 2	ESE	Total	Points	Total
25BSC11EC01	BSESC	BSC	Matrices and Differential Calculus	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
25BSC11EC02	BSESC	BSC	Fundamentals of Electromagnetics & Semiconductor Devices	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25ESC11EC01	BSESC	ESC	Engineering Graphics	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25ESC11EC02	BSESC	ESC	Basic Electrical and Electronics Engineering	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25PCC11EC01	PCPEC	PCC	Innovation and Design Thinking	PR	2	20	-	30	-	50	1	1
25PCC11EC02	PCPEC	PCC	Essential Computing Skills for Engineers	PR	4	50	-	50	-	100	2	2
25VSE11EC01	SC	VSEC	Measuring Instruments and Testing Tools	PR	4	50	-	50	-	100	2	2
25AEC11EC01	HSSM	AEC	Art of Communication	TH	1	40	-	60	-	100	1	2
				PR	2						1	
25LLCXX	LLC	CC	One Course from CC	PR	2	-	-	50	-	50	2	1
				Total	**TH:TU:PR 9:1:20=30**					**1000**	**-**	**20**

SEM-II												
Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE1	MSE	ISE2	ESE	Total	Points	Total
25BSC11EC03	BSESC	BSC	Integral Calculus and Probability Theory	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
25BSC11EC04	BSESC	BSC	Engineering Chemistry	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25ESC11EC03	BSESC	ESC	Programming Fundamentals	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25ESC11EC04	BSESC	ESC	Human Health Systems	TH	1	50	-		-	50	1	1
25PCC11EC03	PCPEC	PCC	Digital Electronics	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25PCC11EC04	PCPEC	PCC	Essential Psychomotor Skills for Engineers	PR	4	50	-	50	-	100	2	2
25VSE11EC02	SC	VSEC	Creative Coding in Python	PR	4	50	-	50	-	100	2	2
25IKS11EC01	HSSM	IKS	Indian Knowledge System	TH	2	50	-	50	-	100	2	2
25LLCXX	LLC	CC	One Course from CC	PR	2	50	-		-	50	2	1
25DM01/25HR01	DM/HR	DM/HR	Introduction to Emerging Technologies	TH	2	50	-	50	-	100	2	2*
				Total	**TH:TU:PR 13:1:16=30**			**-**	**-**	**1100**	**-**	**20+2***

* Introduced as first course for DM/HR

NOTE: Kindly refer-

1. Separate Manual for List of **'Liberal Learning Courses (LLC)'**

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

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25BSC11EC01	Matrices and Differential Calculus	L	T	P	L	T	P	Total
		2	1	0	2	1	0	3
		Examination Scheme						
			ISE 1	MSE	ISE 2	ESE	Total	
		Theory	20	30	20	30	100	
		Tutorial	20	--	30	--	50	

Pre-requisite Course Codes	--	
After the successful completion students should be able to:		
Course Outcomes	CO1	Implement diagonalization of a given matrix using eigen values and eigen vectors.
	CO2	Execute Higher order derivatives of a given functions
	CO3	Apply partial differentiation technique to obtain the extremum of the given function.
	CO4	Demonstrate basic knowledge of analytic functions in solving engineering problems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Matrices**	1,2,3,4	09
	1.1	**Introduction:** 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	System of Linear equations, their consistency and solutions.		
	1.3	Eigenvalues and Eigenvectors of a square matrix and their properties(without proof)		
	1.4	Cayley-Hamilton Theorem (without proof), verification and reductionof higher degree polynomials		
	1.5	Similarity of matrices, diagonalizable and non-diagonalizable matrices		
2		**Successive Differentiation**	1,2,3,4	03
	2.1	Successive differentiation: nth derivative of standard functions.		
	2.2	Leibnitz's Theorem (without proof) and problems		
3		**Partial Differentiation**	1,2,3,4	06
	3.1	Partial Differentiation: Function of several variables, Partial derivatives of first and higher order. Differentiation of composite function.		

	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,		
4		**Analytic Functions**	1,2,3,4	**08**
	4.1	Function *f(z)*of complex variable, Limit, Continuity and Differentiability of*f(z),* Analytic function: Necessary and sufficientconditions for *f(z)* to be analytic (without proof).		
	4.2	Cauchy-Riemann equations in Cartesian coordinates (without proof).		
	4.3	Milne-Thomson method: Determine analytic function *f(z)*when realpart (u), imaginary part (v) or its combination au+bv is given.		
	4.4	Harmonic function, Harmonic conjugate and Orthogonal trajectories.		
			Total	**26**

Tutorial

Exp. No.	Tutorial Details
1	Matrices
2	Successive Differentiation
3	Partial Differentiation
4	Analytic Functions
5	Matlab / Scilab Practical
6	Matlab / Scilab Practical
7	Matlab / Scilab Practical
8	Matlab / Scilab Practical

Course Assessment:

Theory:

ISE-1: MCQ: 20 Marks
ISE-2: MCQ: 20 Marks
MSE: 90 minutes 30 Marks written examination based on 50% syllabus
ESE: 90 minutes 30 Marks written examination based on the syllabus after MSE

Tutorial:

1. ISE-1 will be conducted for the first two tutorials. (20 marks).
2. ISE-2 will be conducted for the remaining two tutorials (20 marks) and four Matlab / Scilab practical (10 marks).

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.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25BSC11EC02	Fundamentals of Electromagnetics and Semiconductor Devices	L	T	P	L	T	P	Total
		2	--	2	2	--	1	3
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab	20	--	30	--	50	

Pre-requisite Course Codes		--
Course Outcomes	CO1	Solve problems related to electrostatics, magnetostatics and semiconductors.
	CO2	Describe the Laws of Electromagnetism
	CO3	Explain the principles behind semiconductor materials, band theory, and carrier transport.
	CO4	Describe applications of semiconductors
	CO5	Demonstrate practical skills through laboratory experiments involving electromagnetism as well as semiconductor devices

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Vector Calculus** Scalar and Vector fields. Gradient, Divergence and Curl. Vector integration, Line, Surface and Volume integrals, Fundamental theorems of Gradient Divergence and Curl. Scalar and Vector potentials.	T1	4
2		**Electrostatics** Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential. Electrostatic field and potential of a dipole. Solving simple electrostatics problems.	T1	5
3		**Magnetostatics** Bio-Savart law, Divergence and curl of static magnetic field, Ampere's Law, vector potential and calculating it for a given magnetic field using Stokes' theorem	T1	4
4		**Electromagnetic Waves** Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law Maxwell's equations, The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave	T1	5
5		**Semiconductors** E-k diagram, Direct and indirect bandgap semiconductors, Density of states, Occupation probability, Fermi level and quasi-Fermi level (variation by carrier concentration and temperature), Conductivity & Mobility, carrier drift and Diffusion. Hall Effect.	T2	4
6		**Application of Semiconductors** PN Junction diode, Fermi Level in P-N Junction in biased and unbiased conditions, Metal-semiconductor junction (Ohmic and Schottky); LED: device structure, materials, characteristics, bandgap modification, heterostructures, Semiconductor materials of interest for optoelectronic devices, Light-semiconductor interaction.	T2	4

Course Assessment:

Theory:

ISE-1: 20 Marks
Activity: Tutorials/Assignments i.e. problem solving on Electromagnetics

ISE-2: 20 Marks
Activity: Article Discussion, Quiz and Assignments
Outcome: Reflective Journal

MSE: 90 minutes **30 Marks** written examination based on 50% syllabus
ESE: 90 minutes **30 Marks** written examination based on remaining syllabus after MSE

ISE:
1. ISE-1 will be conducted for four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
2. ISE-2
a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
b. Reflective journal analysis on the given problem statement for 10 marks

Guidelines for Laboratory Exercises:

1. Electromagnetics simulations using MATLAB/Virtual Labs
2. Semiconductor measurements: Hall Effect
3. Application of Semiconductor: PN Junction, Zener Diodes, LEDs, PV Cells.

Text Books:

1.Introduction to Electrodynamics: D J Griffiths, 4th Edition, Pearson.
2. Solid State Electronic Devices: Ben G. Streetman & Sanjay Kumar Banerjee, 7th Edition, Pearson.

Recommended Books:

1. Halliday and Resnick, Physics
2. Electromagnetics Vol-1: Steven W. Ellingson, VT Publishing, Virginia Tech(open Text-book)
3. Electricity, Magnetism & Electromagnetic Theory: S. R. Manohara & Shubha A, S. Chand Publications
4. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley, 2008
5. Solid State Devices: B. Somanathan Nair & S. R. Deepa, 2nd Edition, Prentice Hall
6. Solid State Devices & Technology: V. Suresh Babu, 4th Edition, Pearson
7. Electricity and Magnetism: E. M. Purcell and D. J. Morin
8. Classical Electricity and Magnetism: Panofsky and Phillips
9. NPTEL/SWAYAM Course

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25ESC11EC01	Engineering Graphics	L	T	P	L	T	P	Total
		2	--	2	2	--	1	3
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab	20	--	30	--	50	

Pre-requisite Course Codes		--
After the successful completion students should be able to:		
Course Outcomes	CO1	To draw Projection of Points, Lines and Planes
	CO2	To draw projections in Projection of 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, Involutes and Helix (of cylinder) only.	1,4	2
2	2.1	**Projection of Points and Lines** Lines inclined to both the Reference Planes (Excluding Traces of lines) and simple application based problems on Projection of lines.	1,4	3
	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	3
	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	1,4	3

		method.		
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	1,4	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	**28**

Course Assessment:

Theory:

ISE-1:

Team Activity: Two Hours Duration: 20 Marks

Making Models out of Card Boards/Clay for Basic Primitive solids. Solids will be cut by Section plane as per instructions provided Drawing Projections of Same as per instructions will be part of activity. Here Cut sections will also be developed using development principles. There will be small quiz or students will give a demonstration of Project or activity

Assessment will be done by two teachers in the department who are teaching engineering graphics

ISE-2: Two hours 20 Marks

Team Activity

Here One Simple component either machine component/Any simple component will be given to group of students in team. Students will measure dimensions and make working drawing of same showing all three views/sectional views including isometric view. At the end of activity Group will give presentation on same

MSE: 90 minutes **30 Marks** written examination based on 50% syllabus

ESE: 90 minutes **30 Marks** written examination based on remaining syllabus after MSE

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			
A6	Projection of Solids (1 Problem)	1,4	2
A7	Sections of Solids and Development of Lateral Surfaces (2 Problems)	1,4	2
A8	Sectional Orthographic Views (1 Problem)	1,4	2
	Total		29

Course Assesment:- (Lab)

1. ISE-1 will be conducted for four activities (A1, A2, A3, A4) Continuous pre-defined rubrics-based evaluation for 20 marks.

2. ISE-2 will be conducted for four activities (A5, A6, A7, A8) Continuous pre-defined rubrics-based evaluation for 30 marks.

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) &GauravVerma, "(CAD Soft Technologies) :Auto CAD 2012 (For engineers and Designers)", Dreamtech Press NewDelhi

[4] Dhananjay A Jolhe, Engineering Drawing, Tata McGraw Hill.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25ESC11EC02	Basic Electrical and Electronics Engineering	L	T	P	L	T	P	Total
		2	--	2	2	--	1	3
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab.	20	--	30	--	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	7
	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	6
	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**		5
	4.1	Construction, principle of operation, types of transformer, induced emf equation and transformation ratio.	2,4	
	4.2	Transformer at No load and Full load condition, phasor diagrams, equivalent circuit, Losses in transformer, Regulation and Efficiency.	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	2
6		**Semiconductor Diodes**		
	6.1	Working of P-N junction Diode, I-V characteristic, application as a rectifier, and introduction to filters.	6,7	2
			Total	26

Course Assessment:

(i) Theory:

ISE-1 for 20 Marks:

(a) Tutorial on independent solving of numerical examples (10 marks) - 2 hours

(b) Multiple choice questions (MCQ) - 10 marks (1 hour)

ISE-2 for 20 Marks:

(a) Multiple choice questions (MCQ) - 10 marks (1 hour)

(b) Circuit simulation for 10 marks

MSE: 90 minutes 30 Marks written examination based on 50% syllabus

ESE: 90 minutes 30 Marks written examination based on remaining syllabus after MSE

(ii) Lab: 40 Marks (08 experiments of 05 marks each) + 10 Marks (activity based) = 50 Marks ISE:

1. ISE-1 will be conducted for four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

2. ISE-2

a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

b. Activity: Oral examination / viva-voce (10 marks) ISE-1:

Proposed List of Laboratory Experiments:-

1. Verification of Mesh and Nodal analysis.
2. Verification of Superposition Theorem.
3. Verification Maximum Power Transfer Theorem.
4. Measurement of electrical parameters for alternating sinusoidal voltage (AC)
5. To find resonance conditions in a R-L-C series resonance circuit
6. To measure relationship between phase and line, currents and voltages in three phase system
7. Forward & reverse bias characteristics of PN junction diode
8. 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

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC11EC01	Innovation and Design Thinking	L	T	P	L	T	P	Total
		--	--	2	--	--	1	1
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	--	--	--	--	--	
		Lab	20	--	30	--	50	

Pre-requisite Course Codes		
At the end of the course the students will be able:		
Course Outcomes	CO1	To discuss case studies of innovative products and services.
	CO2	To identify the market needs and customer demand analysis.
	CO3	To generate ideas through brainstorming and frame product/service idea
	CO4	To empathize with the customer.
	CO5	To design and develop a prototype.
	CO6	To pitch their idea.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Innovation and Creativity:** **(Takeaway)** Innovation, Invention and Creativity. Mindset. Convergent and Divergent Thinking. Case Studies – levels and types of Innovations. Market Impact. Linear and Non-Linear Innovations. **(Key Exercises)** 1. Exercises/Games/Activities to boost creativity and Inspiration 2. Article/Case Studies Discussion 3. Digital Market Survey Report and Customer Demand Analysis, Preparing competencies report to identify desired level of innovation & domain definition.	1	04
2		**Introduction of Design Thinking:** **(Takeaway)** Five stage model of design thinking. Empathize, Define, Ideate, Prototype, Testing. Non-linearity of the Model. **(Key Exercises)** 1. Live examples and videos 2. Design Thinking Activity for given problem 3. Find the impact and value of Innovation	1,2	04
3	3.1	**Empathize:** **(Takeaway)** Empathize with users. Step into the customer's shoes. Ask right questions.What? Why? Empathy Map. Draw inference from research. **(Key Exercises)**	1,2	04

		1. Immersion Activity-Body Storming. 2. Finding the user needs in the market by using Social, Physical, Identity, Communication, Emotional (SPICE) Framework 3. Creation of Empathy Map, Affinity Map, Mind Map, Journey Map 4. Story Telling, K-Scripts for case study, Role Playing		
4	**4.1**	**Definition and Ideation:** **(Takeaway)** Idea Generation, Themes, Thinking for refinement, Storytelling and Tools for Innovation **(Key Exercises)** 1. Brainstorming, Sketch 2. Situation, Constraints, Objectives, People, Estimates and Scope (SCOPES) tool 3. Social. Technology, Economy, Environment and Political (STEEP) trend analysis for opportunity framing by using steep matrix template. 4. Defining the strategic priorities of customer demand and stakeholder mapping 5. Generating new ideas with Substitute, Combine, Adapt, Magnify/Minify, Reverse, Eliminate, put to other use (SCAMPER) tool.	3,4	04
5	**5.1**	**Prototyping:** Prototyping, Testing for Desirable, Feasible and viable solution, Product Market Fit, Business Model validation **(Takeaway)** **(Key Exercises)** 1. Value Proposition Canvas 2. Business Model canvas	3,4	06
6		**The Design Challenge:** **(Takeaway)** Define Design Challenge, Prototyping Iteration, Pitching, Media **(Key Exercises)** 1. Demo day	4	04
			Total	**26**

Course Assessment:

Lab:

ISE:

1. **ISE-1** will be conducted for first three experiments. (Article discussion, Design thinking workshop for a sample idea, Empathy Map)
   Continuous pre-defined rubrics-based evaluation for 20 marks.

2. ISE-2

a. Idea Competition. Continuous pre-defined rubrics-based evaluation for 10 marks.
b. Business Model Canvas for identified Idea for 10 marks
c. Demo Day – Prototype for 10 marks

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*", 2013, Wiley Publications.
3. Christoph Meinel, Larry Leifer, Hasso Plattner, "*Design Thinking: Understand – Improve – Apply",* Springer, 2011.
4. Roger Martin, "*The Design of Businesses: Why Design Thinking is the next Competitive Advantage*", Harward Business Press, 2009

Referenced Books:

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

Online Courses:

https://www.classcentral.com/course/youtube-design-thinking-transforming-teams-110078
https://www.coursera.org/learn/uva-darden-design-thinking-innovation
https://www.coursera.org/learn/creative-thinking-techniques-and-tools-for-success
https://www.coursera.org/specializations/uva-darden-design-thinking
learning.edx.org: Design Thinking and Creativity for Innovation

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC11EC02	Essential Computing skills for engineers	L	T	P	L	T	P	Total
		--	--	4	--	--	2	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	--	--	--	--	--	
		Lab	50	--	50	--	100	

Pre-requisite Course Codes		--
At the end of the course the students will be able :		
Course Outcomes	CO1	Use Linux commands to perform file operations.
	CO2	Use Matlab/ Scilab for scientific computing.
	CO3	Use web technology to design web pages.
	CO4	Perform CRUD operations using relational databases.
	CO5	Create scientific document using LaTeX.
	CO6	Perform data analysis using spreadsheet.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Linux Operating System**	[1]	**08**
	1.1	Demonstration of installation of Linux Operating System	[1]	
	1.2	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	[1]	
	1.3	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	[1]	
	1.4	Use of locate and find commands, Use of Grep in Linux, use of chmod and chown for giving permissions in Linux	[1]	
2		**Introduction to Scientific Computing using Matlab/ Scilab**	[2]	**10**
	2.1	Introduction to Matlab/Scilab, getting data into Matlab/Scilab, creating, concatenating and reshaping arrays, Accessing data in arrays, mathematical and statistical operations with arrays	[2]	
	2.2	Taking user input, control structures for making decisions and adapting to different situations, conditional data selection	[2]	
	2.3	Visualizing data using 2D and 3D plots, introduction to toolboxes for different scientific computing tasks, creating and calling functions	[2]	
	2.4	Introduction to tables of data, storing and sorting table data, extracting data from table, exporting tables, combining tables, [2]indexing into cell arrays, Working with date and time	[2]	

	2.5	Preprocessing data- normalizing data, working with missing data	[2]	
3		**Foundations of web technology**	[3]	**10**
	3.1	HTML Basics- HTML tags and attributes, Headings in HTML, creating paragraphs in HTML, Basic formatting tags of HTML, giving background and font colors using HTML, creating links using HTML, Adding images in HTML	[3]	
	3.2	Creating tables and lists using HTML, creating forms in HTML, Embedding videos on web page	[3]	
	3.3	CSS syntax, CSS selectors, background formatting using CSS, CSS box model, adding borders, margins and padding using CSS, adding styles to fonts using CSS, Positioning using CSS, Pseudo-classes in CSS, CSS navigation bar, creating image gallery using CSS, use of external CSS for creating website layout	[3]	
	3.4	Introduction to Javascript, basic Javascript syntax, Variables in Javascript, operators and control structures in Javascript, functions in Javascript, arrays and number handling in Javascript,	[3]	
	3.5	DOM manipulation in Javascript, Form validation using Javascript	[3]	
4		**Introduction to Database Technology**	[4]	**02**
	4.1	Installation of MySQL/Postgresql, creating database schema and tables, DML operations, conditional selection of records from the database tables, demonstration of PHP-MySQL/Postgresql database connectivity	[4]	
5		**Introduction to LaTeX**	[5]	**12**
	5.1	Demonstration of installation and usage of Texlive/MikeTex, formatting words, lines and paragraphs, font formatting, creating section and subsections, use of geometry package	[5]	
	5.2	Insertion of graphics and tables in document, creation of lists, mathematics environment, writing equations	[5]	
	5.3	Writing algorithms, inserting code in document, creating table of contents, creating hyperlinks	[5]	
	5.4	Bibliography management, citations, creating chapters using report class, inserting other .tex and .pdf files in document	[5]	
	5.5	Presentation in LaTeX using beamer class, creating overlay in beamer, blocks in beamer presentation, presentation themes	[5]	
	5.6	Usage of style files in a document	[5]	
6		**Data analysis using spreadsheet**	[6]	**10**
	6.1	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	[6]	
	6.2	Use of advance formulae for data analysis (concatenate, vlookup, hlookup, match, countif, text, trim)	[6]	

	6.3	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	[6]	
	6.4	Data visualization- creating 2D and 3D plots	[6]	
	6.5	Data visualization using conditional formatting- creating formula-based rules	[6]	
			Total	**52**

Course Assessment:

ISE:

1. **ISE-1**
   a. Quiz based on module 1 for 10 marks.
   b. Completion of any 4 courses from suggested list on module 2 for 20 marks. Suggested URL and course list: https://matlabacademy.mathworks.com/
      1. MATLAB Onramp
      2. Simulink Onramp
      3. App Building Onramp
      4. Object-Oriented Programming Onramp
      5. Simscape Onramp
      6. Circuit Simulation Onramp
   c. Quiz based on module 2 for 10 marks.
   d. Assignment (web page designing) based on module 3 for 10 marks.
2. **ISE-2**
   a. Quiz based on module 4 for 10 marks.
   b. Assignment (Scientific Document Preparation using LaTeX) based on module 5 for 20 marks.
   c. Assignment (data analysis using spreadsheet) based on module 6 for 20 marks.

Recommended References:

[1] https://ubuntu.com/tutorials?topic=desktop

[2] https://in.mathworks.com/support/learn-with-matlab-tutorials.html

[3] https://www.w3schools.com/

[4] https://www.mysql.com/

[5] https://en.wikibooks.org/wiki/LaTeX

[6] https://support.microsoft.com/en-us/office/excel-video-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25VSE11EC01	Measuring Instruments and Testing Tools	L	T	P	L	T	P	Total
		--	--	2	--	--	2	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	--	--	--	--		
		Lab	**50**	**--**	**50**	**--**	**100**	

Pre-requisite Course Codes	--	
After successful completion of the course, the student will be able to:		
Course Outcomes	CO1	Have a working knowledge about the measurement process, units of measurements, static and dynamic characteristics of instrument.
	CO2	Identify and classify types of test & measuring instruments that are available in the laboratory
	CO3	Find out and verify the manufacturers, make, models, market cost and specifications of the given instrument
	CO4	Select a suitable test & measuring instrument for any given system, application or a process
	CO5	Understand the importance & significance of calibration of measuring instrument
	CO6	Study various quality standards for Measurement, Inspection and Testing

Teaching Learning Methodology: Role Play Model

a. Instructor
Responsibilities: Explain theoretical background, provide required sample formats, guide students in identification of appropriate online material, supervision and assessment of overall activity, summarize the activity

b. First Group of Students: Customer
Responsibilities: To finalize specifications of instrument to be purchased prepare request for quotations, prepare comparative statement, preparation for purchase order (PO)

c. Second Group of Students: Manufacturer / Vendor
Responsibilities: To maintain the specifications of manufactured instruments, to submit quotations including all applicable taxes, to prepare invoice as per purchase order (PO)

d. Third Group of Students: Sales/Service Engineer
Responsibilities: To demonstrate capabilities of various instruments and convince customer to purchase a particular instrument, to prepare Delivery Challan, Install the instrument and prepare Installation report, Demonstrate all the functions and uses of the instrument

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Basic Concepts of Measurements**	T1, T2, T3, R3, R4	
	1.1	Introduction to the measurement process & its aim, functional elements of an instrumentation system, Need of Inspection, Go-NoGo Gauges. Difference between measuring instrument and Comparator.		4
	1.2	Introduction to Standards such as IS/ BIS, NABL standards. Errors inmeasurement, types, classification, Calibration & its importance, Calibration method.		4
	1.3	Difference between sensor and transducer, classification of Types ofelectrical, electronic and mechanical sensors		4
2		**Units, Standards & Characteristics**	T1, T2, T3, R3, R4	
	2.1	Unit systems – MKS, CGS & SI for electrical & mechanical quantities		4
	2.2	Performance characteristics of instruments – static characteristics & dynamic characteristics, List of Manufacturers/ vendors dealing withsale, service and repair of measuring and test instruments.		4
3		**Mechanical Test & Measuring Instruments**	T1, T2, T3, R3, R4	
	3.1	Measurement of linear dimensions using Vernier caliper.		2
	3.2	Measurement of gauge thickness using Screw Thread micrometer.		2
	3.3	Measurement & Marking dimensions using Vernier height gauge		2
	3.4	Measurement of small dimensions by Optical Profile Projector Setting of dimensions using precision gauge blocks (slip gauges) by		2
	3.5	Wringing process. Identification of surface flatness defects using principle of interferometryby optical flats and monochromatic light.		2
	3.6	Measurement of components deviations w.r.t. standard using mechanicalcomparator		2
	3.7	Spirit Level for Alignment test		2
	3.8	Feeler Gauges for Gap measurement		2
	3.9	Thread Gauges for thread measurement		2
4		**Electronic Test & Measuring Instruments**	T4, R1, R2	
	4.1	Digital Multimeter		2
	4.2	DC Power Supply		2
	4.3	Function Generator		2
	4.4	Digital Storage Oscilloscope (DSO)		2
5		**Sensors & Transducers**	T3, T5	
	5.1	Proximity Sensors – Capactive, Inductance, Optical sensorsMechanical Limit Switch.		2
	5.2 **5.3** **5.4**	Piezo-Transducers for Pressure measurement,Strain Gauge Load cell Linear Variable Differential Transducer (LVDT)		4
			Total	**52**

Course Assessment:

Laboratory work: (ISE)

1. ISE-1 **Total Marks: 50**

A) After completion of Module 1 and Module 2, **Online Quiz / Q/A Asignment of 30 marks** to be conducted to check theoretical knowledge of measuring instruments and testing tools.
B) To conduct Minimum 4 experiment from the module 3 (Total marks = 4 x 5 = **20 marks**)

2. ISE-2 **Total Marks: 50**

A) To perform role play (Group Activity of 4 students each) (20 marks)
B) To conduct Minimum 6 experiment from the module 3, 4, 5 (Total marks = 6 x 5 = **30 marks**)

Text Books:

1. Engineering. Metrology, I.C. GUPTA, Dhanpat Rai Publications.
2. Engineering. Metrology, R. K. Jain, Khanna Publisher.
3. Engineering Metrology and Measurements, Raghavendra, Krishnamurthy, OUP India, 2013
4. Fundamentals of Micro-electronics, Behzad Razavi, Wiley Publications, 2008
5. Sensors and Transducers, Second Edition, D.Patranabis, PHI publications, 2003

Reference Books:

1. J. Millman and A. Grabel, "*Microelectronics*", Tata McGraw Hill, 2nd Edition.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "*Digital IntegratedCircuits:A Design Perspective*", Pearson Education, 2nd Edition.
3. Engineering Metrology, K. J. Hume, Kalyani publication
4. Engineering. Metrology, Hume K.G., M C Donald, Technical &Scientific, London.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25AEC11EC01	Art of Communication (AoC)	1	--	2	1	--	1	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Lab	40	--	60	--	100	

Pre-requisite Course Codes		Basic Language Skills
After successful completion of the course, the student will be able to:		
Course Outcomes	CO1	Understand the roots and fundamentals of communication.
	CO2	Apply Strategies to develop vocabulary and grammar skills for competitive exams
	CO3	Develop Listening, Reading, Speaking and Writing skills
	CO4	Acquire effective correspondence skills
	CO5	Relate Communication to Management Information Systems in the corporate sector

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Communication**	1,2,3, 7	
	1.1	**Ancient India and Communication:** Roots of Communication skills in Indian Tradition, Importance of Communication, Cycle.		4
	1.2	**Strengths and Weaknesses of Oral and Non-verbal Communication** (Kinesics, Proxemics, Chronemics, Haptics, Oculesics, Olfactics, Paralanguage) **Steps to Public Speaking:** Planning your speech, Delivery of Speech, Dealing with stage fear		
	1.3	**Barriers and Gateways in Communication:** Types of barriers: Physical, Mechanical, Psychological, Semantic and Cross-cultural		
2	2.1	**Verbal Ability in Competitive exams:** English grammar and Strategies for **UPSC/GATE/GRE/IELTS/TOEFL/CAT**	4,5	2
3		**Communicative Competence**	Videos, research papers	4
	3.1	Listening : Listening to two talks/lectures by specialists on selected subject		
	3.2	Specific topics -(TED Talks) and answering comprehension exercises (inferential questions)		
	3.3	Speaking: Small group discussions (the discussions could be		
	3.4	based on the listening and reading passages- open ended questions		

		Reading: Two subject-based reading texts followed by comprehension activities/exercises Writing: Summary writing based on the reading passages. Listening: Listening to two talks/lectures by specialists on selected subject specific topics -(TED Talks) and answering comprehension exercises (inferential questions) Speaking : Small group discussions (the discussions could be based on the listening and reading passages- open ended questions Reading :Two subject-based reading texts followed by comprehension activities/exercises Writing: Summary writing based on the reading passages. **Listening**: Motivational Talks or TED TALKS **Reading** : Self-learning (Reading of Literary piece or Research paper (Environment, Sustainability and Social aspects) **Speaking**: Discussion on Ethics and on self-learning tasks **Writing**: Review writing or writeup for public speaking		
4	**4.1** **4.2**	**Effective Correspondence** **Introduction, Do's and Don'ts, Format and Types** Application for internship Request/Permission	1,2,3	2
5	**5.1**	**Management Information System** Introduction, Purpose, Structure, Characteristics, Limitation	8	1
			Total	**13**

Sr. No.	Title of the assignments/Activities to be carried out in the Lab	Marks
1	Draft and Orally presenting Public speaking/ Extempore	**10**
2	Presentation/Poster Making - Modern times learning from Vedas/Upanishads/ Bhagvad gita/ Mahabharata	**20**
3	Aptitude Test on verbal ability	**10**
4	Listening skills: Quiz/ Subjective type questions	10
5	Reading& Writing skills: Reviewing a book/ Research paper	10
6	Speaking skills: Panel Discussion	10
7	Correspondence	10
8	Management Information system assignment	10
9	Communication module assignment	10
	Total	**100**

ISE1: 3 Activities
Public Speaking, Extempore, Aptitude test, presenting through Power point or Poster Making
Marks: 40
Learning outcome: Acquiring public Speaking skills for formal events and improving verbal ability
PO10: Communication, PO9: Individual and Team Work, P12: Long Life Learning

ISE: 2 Activities, 4 assignments
Marks: 60 Marks
Learning outcome: Efficiently developing listening, reading and writing skills
P10: Communication, PO8: Ethics, PO9: Individual and Team Work, P12: Long Life Learning

Reference Books:

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Communication Skills	2013	Shirley Mathews	Technical Publication, Pune	2022
2	English Vocabulary in Use	1999	Michael McCarthy, Felicity O'Dell	Cambridge University Press, India	1999
3	Oxford Practice Grammar	1999	John Eastwood	Oxford, India	1999
4	Communication Skills	2011	Meenakshi Raman, Sangeeta Sharma	Oxford, India	2011
5	English Grammar for Today	2005	Geoffrey Leech	Palgrave, UK	2005
6	Word Power Made Easy	1978	Norman Lewis	Anchor Books, New York	1978

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25BSC11EC03	Integral Calculus and Probability Theory	L	T	P	L	T	P	Total
		2	1	0	2	1	0	3
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Tutorial	20	--	30	--	50	

Pre-requisite Course Codes		
Course Outcomes	CO1	Execute first order linear differential equation.
	CO2	Execute higher order linear differential equation.
	CO3	Interpret the region of integration in solving double integrals.
	CO4	Apply concepts of probability and expectation for getting spread of the data and probability distributions.

Theory:

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Linear Differential Equations of first order**	1,2,3,4	06
	1.1	Exact Differential Equations, Integrating Factors, equations reducible to exact form.		
	1.2	Linear differential equations (Definition), equations reducible to linear form, Bernoulli's equation		
2	Title	**Linear Differential Equations of higher order**	1,2,3,4	07
	2.1	Linear differential equation with constant coefficient-complementary function, particular integrals of differential equation 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.		
	2.2	Cauchy's homogeneous linear differential equation and Method of variation of parameters for second order.		
3	Title	**Integral Calculus**	1,2,3,4	07
	3.1	Gamma functions: properties of gamma functions and integrals reducible to gamma functions.		
	3.2	Beta functions: properties, relation between Beta and Gamma functions, integrals reducible to Beta functions, Duplication formula.		
	3.3	Tracing of curves (Standard curves, Cardioide, Lemniscate, Spheres, Ellipsoids, Cylinders, Cones, Tetrahedrons, planes)		
	3.4	Double Integration: definition and evaluation. Evaluate by changing the order of integration and by changing to polar form.		
4	Title	**Probability**	1,2,3,4	06

	4.1	Definition and basics of probability, conditional probability.		
	4.2	Total Probability theorem and Bayes' theorem.		
	4.3	Discrete and continuous random variable with probability distributionand probability density function.		
	4.4	Expectation, Variance, Moment generating function, Raw and central moments up to 4^{th} order.		
			Total	**26**

Tutorial:

Exp. No.	Tutorial Details
1	Linear Differential Equations of First Order
2	Linear Differential Equations of Higher Order
3	Integral Calculus
4	Probability
5	Matlab / Scilab Practical
6	Matlab / Scilab Practical
7	Matlab / Scilab Practical
8	Matlab / Scilab Practical

Course Assessment:

Theory:

ISE-1: MCQ: 20 Marks
ISE-2: MCQ: 20 Marks
MSE: 90 minutes 30 Marks written examination based on 50% syllabus
ESE: 90 minutes 30 Marks written examination based on the syllabus after MSE

Tutorial:

1. ISE-1 will be conducted for the first two tutorials. (20 marks).
2. ISE-2 will be conducted for the remaining two tutorials (20 marks) and four Matlab / Scilab practical (10 marks).

Recommended Books:

[1] Dr B.S. Grewal, "*Higher Engineering Mathematics*", Khanna Publications, 4^{nd} Edition.

[2] H. K. Das, "*Advanced Engineering Mathematics*", S. Chand, 28^{th} Edition.

[3] Erwin Kreysizg, "*Advanced Engineering Mathematics*", John Wiley & Sons, 10^{th} Edition.

[4] Jain and Iyengar, "*Advanced Engineering Mathematics*", Narosa Publications, 4^{th} Edition.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25BSC11EC04	Engineering Chemistry	L	T	P	L	T	P	Total
		2	--	2	2	--	1	3
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab	20	--	30	--	50	

Pre-requisite Course Codes		--
Course Outcomes	CO1	To evaluate the activity and selectivity of the catalyst
	CO2	To compare the different types renewable sources of energy
	CO3	To compare the different types of corrosion and control measures in industries.
	CO4	To determine the quality of fuel and quantify the oxygen required for combustion of fuel.
	CO5	To evaluate the different types of fabrication methods, conducting polymers in various industrial fields

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Catalysis**	1,2,4	5
		Basic concepts of catalysis (Homogeneous and Heterogeneous catalysis), Industrial applications of Catalysis-Oxidation-Hydroformylation, Reduction-Hardening of vegetable oils, Wilkinson`s catalyst-Hydrogenation, Vaska`s complex – Carbonylation, Commercial catalytic reactors (fixed bed, fluidized bed).		
2	Title	**Energy resources (Solar, Hydel, Thermal etc.)** Introduction to Energy Sources, Solar Energy Basics, Solar Thermal Systems, Wind Energy, Geothermal Energy, Energy from Ocean: Principle of tidal power, components of Tidal Power Plant (TPP), classification, advantages and limitations of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, types of OTEC power generation, block diagram, applications, advantages and limitations.	1,2,4	5
3	Title	**Corrosion** Definition, Mechanism of Corrosion – (I) Dry or Chemical Corrosion - i) Due to oxygen ii) Due to other gases. (II) Wet or Electrochemical corrosion - Mechanism i) Evolution of hydrogen type ii)Absorption of oxygen. Types of Corrosion - Galvanic cell corrosion, Concentration cell corrosion (differentialaeration principle), 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, (III) Metallic coatings -only Cathodic coating (tinning) and anodic coatings (Galvanising)	1,2,4	5

4	**Title**	**Fuels and combustion** Definition, classification, characteristics of a good fuel, units of heat (no conversions). Calorific value - Definition, Gross or Higher calorific value & Net or lower calorific value, Dulong's formula & numerical for calculations of Gross and Net calorific values. Solid fuels - Analysis of coal - Proximate and Ultimate Analysis - numerical problems and significance. Combustion - Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels.	1,2,4	**6**
5	**Title**	**Polymers** Molecular weight (Number average and weight average), Numericals problems on molecular weight, Effect of heat on the polymers (Glass transition temperatures), Viscoelasticity, Conducting polymers, Classification-Thermoplastic and Thermosetting polymers, Compounding of plastic, Fabrication of plastic by Compression, Injection,Transfer and Extrusion molding, Preparation, properties and uses of PMMA, Butyl Rubber, PTFE and Kevlar	1,2,4	**5**

Exp. No.	List of Experiments
1	To determine the emf of a given cell potentiometrically.
2	To determine the moisture and Ash content in the given fuel sample.
3	To determine the percentage of volatile matter of a given sample by steam distillation method.
4	To determine the COD value of a given sample.
5	To determine the pH value of a given sample.
6	To Remove hardness of water by ion-exchange method.
7	To determine the cobalt ion concentration by colorimetry method.
8	To determine the conductance of a given sample

Course Assessment:

Theory:

ISE-1:
Activity: Quiz and assignments 20 Marks
ISE-2: Two hours 20 Marks
Activity: Article Discussion, Quiz and Assignments
Outcome: Reflective Journal

MSE: 90 minutes **30 Marks** written examination based on 50% syllabus
ESE: 90 minutes **30 Marks** written examination based on remaining syllabus after MSE

Lab:

ISE:
1. ISE-1 will be conducted for four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
2. ISE-2
a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
b. Reflective journal analysis on the given problem statement for 10 marks

Recommended Books:

1. Engineering Chemistry - Jain & Jain, Dhanpat Rai
2. Engineering Chemistry – Dara & Dara, S Chand
3. Green Chemistry: A textbook – V.K.Ahluwalia, Alpha Science International
4. A Text Book of Engineering Chemistry – Shashi Chawla, DhanpatRai
5. Textbook of Qualitative Inorganic Analysis: A. I. Vogel

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25ESC11EC03	Programming Fundamentals	2	--	2	2	--	1	3
		Examination Scheme						
			ISE1	MSE	ISE 2	ESE		Total
		Theory	20	30	20	30		100
		Lab	20	--	30	--		50

Pre-requisite Course Codes		
Course Outcomes	CO1	Explain the problem solving aspects using various programming paradigms.
	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, pointers, strings and functions.
	CO5	Apply various C++ constructs such as classes, objects, static members, access specifiers
	CO6	Apply the concept of inheritance to achieve code reusability and virtual functions for run time polymorphism

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Problem Solving**	1-2	2
	1.1	Steps for Problem Solving. Algorithm and FlowChart. Flow of Control.		
	1.2	Imperative and Declarative Programming Paradigm.		
2		**C Programming Fundamentals**	1,2	4
	2.1	Variables, keywords, Data types, Operators: Arithmetic, Relational and Logical, Assignment, Unary, Conditional, Bitwise, Expression, Statements. Operator Precedence and Expression evaluation.		
	2.2	Branching Structures: if statement, if-else statement, multi-way decision, switch statement, continue statement, break statement		
	2.3	Iterative Structures: while, do-while, for, nested loops, Jump control statements.		
3		**Arrays**	1,2	5
	3.1	Declaration, Definition, accessing array elements, one-dimensional array, two-dimensional array, array of characters, standard String handling functions.		
4		**Functions and Pointer**	1,2	5
	4.1	Defining a Function, accessing a Function, Function Prototype, Passing Arguments to a Function, call by value, call by reference, Recursion		
	4.2	Declaration and Access of Pointer variables, Pointer arithmetic, Pointer and Arrays.		
5		**Fundamentals of Object Oriented Programming**	3,4	04
	5.1	Declaration, Initialization, Array of Structure, pointer to structure.		

	5.2	Features of OOP, Classes and Objects, "this" pointer, Constructor and Destructors, static members.		
	5.3	Inline functions, Passing parameters to functions, Functions with default arguments		
	5.4	Access Specifiers, Friend Function and Friend Classes		
6		**Inheritance and Polymorphism**	3,4	06
	6.1	Types of Inheritance: Single Inheritance, Multiple Inheritance, Multi-level Inheritance, Hierarchical Inheritance, Inheritance and Constructors		
	6.2	Function Overloading, Operator Overloading.		
	6.3	Polymorphism, Virtual Functions, Pure Virtual Functions, Abstract Classes.		
			Total	**26**

	Indicative Experiments
1	Programs using Basic Control Structures, branching and looping.
2	Programs for the use of 1-D, 2-D arrays and String.
3	Demonstrate the use of Functions with different types of parameter passing mechanisms.
4	Demonstrate the use of Pointers
5	Program on Structures and pointer to Structure.
6	Programs on basics of Object Oriented Programming Construct,
7	Program to demonstrate various categories Inheritance.
8	Program to apply kinds of Polymorphism.

Course Assessment:

Theory:

1. ISE-1: Quiz: 10 marks.
Assignments: 10 marks
2. ISE-2: Mini-Project: 20 marks
MSE: 90 minutes **30 Marks** written examination based on 50% syllabus
ESE: 90 minutes **30 Marks** written examination based on remaining syllabus after MSE

Lab:

1. ISE-1 Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
2. ISE-2
a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
b. Practical Exam: 10 marks

Recommended Books:

[1] Yashavant Kanetkar, "*Let Us C"*, BPB publication, Sixteenth Edition
[2] V. Rajaraman & Neeharika Adabala, "*Computer Programming in C*" PHI Learning, Eastern Economy Edition, Second Edition.
[3] K.R. Venugopal, Rajkumar, T. Ravishankar, "*Mastering C++*" ,Tata McGraw Hill, Second Edition.
[4] Herbert Schildt, *" C++:Complete Reference"*, Tata McGraw Hill, Fourth Edition,

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25ESC11EC04	Human Health Systems	L	T	P	L	T	P	Total
		1	--	--	1	--	--	1
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	--	30	--	50	
		Lab	--	--	--	--	--	

Pre-requisite Course Codes		Basic Science
Course Outcomes	CO1	Familiarize the students with the basic biological concepts and their engineering applications.
	CO2	Understand bio-design principles to create novel devices and structures in the future
	CO3	Develop the interdisciplinary vision of biological engineering

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Significance of Biology in Engineering**	2,3,5	2
	1.1	Introduction, Aspects of Biology as an Independent scientific discipline		
	1.2	Biological observations of the 18th Century that led to major discoveries, Brownian motion, Origin of Thermodynamics concerning original observations of Robert Brown and Julius Mayor		
	1.3	Fundamental importance of observation in any scientific inquiry		
2		**Human Organ Systems and Bio Designs – 1**	1,4	4
	2.1	Brain as a CPU System, Architecture of the human brain as a CPU system- Comparison between Brains Computing System with Conventional Von Neumann Computing System		
	2.2	Central Nervous System (CNS) and Peripheral Nervous System (PNS)-2 types: Somatic and Autonomic, Signal Transmission		
		EEG (Electroencephalography- Applications, EEG Signals and Types of Brain Activity)		
	2.3	Robotic Arms for Prosthetics- Robotic Arm Prosthetic Direct Control through Muscle Signals (myoelectric control), Robotic Arm Prosthetic by Brain-Machine Interfaces		
	2.4	Parkinson's disease Engineering Solutions for Parkinson's Disease		
	2.5	Artificial Brain		
	2.6	Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye)		
	2.7	Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart-related issues, reasons for blockages of blood vessels, design of stents, pacemakers, defibrillators)		

3		**Human Organ Systems and Bio Designs – 2**	1,4	3
	3.1	Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology – COPD(Chronic obstructive pulmonary disease), Ventilators, Heart-lung machine)		
	3.2	Kidney as a filtration system (architecture, mechanism of filtration, Chronic Kidney Disease, dialysis systems)		
	3.3	Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis)		
4		**Nature-Bioinspired Materials And Mechanisms**	6-7	2
	4.1	Echolocation (ultrasonography, sonars),		
	4.2	Photosynthesis (photovoltaic cells, bionic leaf).		
	4.3	Lotus leaf effect (Super hydrophobic and self-cleaning surfaces),		
	4.4	Plant burrs (Velcro)		
	4.5	Kingfisher beak (Bullet train)		
	4.6	Shark skin (Friction reducing swimsuits)		
	4.7	Human Blood substitutes - hemoglobin-based oxygen		
		carriers (HBOCs) and Perfluorocarbons (PFCs)		
5		**Trends in Bioengineering**	8-11	2
	5.1	Bioprinting techniques and materials,		
	5.2	3D printing of ear, bone, and skin. 3D printed foods,		
		Electrical tongue, and electrical nose in food science,		
	5.3	DNA origami and Biocomputing,		
	5.4	Bioimaging and Artificial Intelligence for disease diagnosis.		
	5.5	Self-healing Bio concrete (based on bacillus spores, calcium		
		lactate nutrients, and biomineralization processes)		
	5.6	Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, and Arsenic)		
Total				**13**

ISE Marks

1. ISE1-1 Quiz/ Assignment = 20 Marks
2. ISE2-1 Quiz/ Assignment = 10 Marks
3. Presentation / Poster Making = 20 Marks

Suggested Learning Resources:

1. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., andJaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
3. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
4. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
5. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
6. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
7. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press,2008.
8. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
9. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
10. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016
11. Blood Substitutes, Robert Winslow, Elsevier, 2005

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/121106008
2. https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
3. https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
4. https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
5. https://www.coursera.org/courses?query=biology
6. https://www.classcentral.com/subject/biology
7. https://www.futurelearn.com/courses/biology-basic-concepts

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC11EC03	Digital Electronics	L	T	P	L	T	P	Total
		2	--	2	2	--	1	3
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab	20	–	30	–	50	

Pre-requisite Course Codes		Binary number system and codes, binary arithmetic
Course Outcomes	After the successful completion students should be able to	
	CO1	Compare TTL and CMOS families w.r.t. their characteristic parameters
	CO2	Construct combinational circuits using given MSI devices.
	CO3	Apply the knowledge of flip-flops and MSI devices to design sequential circuits.
	CO4	Analyze the given sequential circuits to identify the state transitions and race conditions.
	CO5	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	4
	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	3
	2.2	TTL NAND gate and its transfer characteristics, CMOS inverter and transfer characteristics, comparison of TTL and CMOS logic families		
3.		**Combinational Circuit Design**		
	3.1	Full adders, ripple carry adders, Carry Look ahead Adders, Binary Subtractors	1,2, 3,4	5
	3.2	Multiplexer/ Demultiplexer, Encoders, Priority Encoders, Parity Generators, Code Converters, comparator, ALU		
	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 Flip-flop), Master Slave Flip-flop	1,2, 3,4	5
	4.2	Synchronous and Asynchronous counters, Shift registers and their applications	1,2, 3,4	
5.		**Analysis of Sequential circuits**		
	5.1	Analysis of Moore and Mealy type Finite State Machines (FSM),	1,2,	5

		State Reduction	3,4	
	5.2	Introduction to Asynchronous Sequential circuits, Essential hazards in asynchronous sequential circuits	1,2, 3,4	
6.		**Programmable devices**		
		Structure of Programmable Logic Devices (PLDs), Function implementation with PAL and PLAs, Introduction to CPLD and FPGA	1,2, 3,4	4
			Total	**26**

Laboratory Experiments:

Sr. No.	**Title of experiment**	**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	**4**	**1,2**
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.	**6**	**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.	**6**	**7.8**

Course Assessment:

Theory:

ISE-1: 20 marks

1. Quiz/ crossword -10 Marks
2. Open book test -10 marks

ISE-2: 2**0 Marks**

1. Case study -10 Marks
2. Oral examination -10 marks

MSE: 90 minutes **30 Marks** written examination based on 50% syllabus
ESE: 90 minutes **30 Marks** written examination based on remaining syllabus after MSE

Laboratory Assessment:

40 Marks (08 experiments of 05 marks each) + 10 Marks (activity based) = 50 Marks

ISE:

1. **ISE-1** will be conducted for four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

2. **ISE-2**
   a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
   b. Activity based: Testing and debugging activity for 10 marks

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 ZvonkoVranesic, "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", PrenticeHall 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:

https://archive.nptel.ac.in/content/storage2/courses/106108099//Digital%20Systems.pdf

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC11EC04	Essential Psychomotor skills for engineers	L	T	P	L	T	P	Total
		--	--	4	--	--	2	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	--	--	--	--	--	
		Lab	50	--	50	--	100	

Pre-requisite Course Codes	--	
After the successful completion students should be able to:		
Course Outcomes	CO1	Use skill of writing texts, labels, drawing perspective images and creating 3D objects with technical drawing fundamentals.
	CO2	Build solid model of a given object using 3D modeling software.
	CO3	Identify and rectify computer hardware and networking related issues
	CO4	Perform soldering and de-soldering of discrete components on Universal PCB
	CO5	Install, configure and operate system admin servers.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Creative Art**		**8**
	1.1	Art of writing Cursive, Bold, Italic, Block (3D) lettering, Creating Designer Name-Plates, Labels, Visiting Cards	[1]	4
	1.2	Introduction to Perspective Views, Iso-Scale and True Scale Isometrics, Construction of 3D regular blocks like Prism, Cylinder, Cut sections, Frustum (Card Paper model) using Development of Surface method.	[1]	4
2		**Introduction to solid modeling**		**12**
	2.1	Solid Modeling 3D Geometric modeling of an Engineering component, demonstrating modeling skills using commands like Extrude, Revolve, Sweep, Blend, Loft etc.	[2,3]	12
3		**Computer hardware, networking and troubleshooting**		**10**
	3.1	Computer assembly and troubleshooting	[4]	2
	3.2	IP address configuration, basic networking commands such as ping, netstat, traceroute, understand functionality of a network switch	[5,6]	2
	3.3	Implementation of LAN (2-3 computers) using network switch	[7]	2
	3.4	Identify and troubleshoot basic network problems using networking commands such as ping, netstat and traceroute	[8,9]	4
4		**PCB making and soldering**		**12**
	4.1	Soldering and de-soldering practice on Universal PCB using discrete components.	[10,11]	4
	4.2	Implementation of a 3V power supply circuit (using transistors and Zener diode) on Universal PCB	[12]	8

5		**Types of servers and their usage**		**10**
	5.1	Configuration and working of web server, FTP server	[13,14]	4
	5.2	Configuration and working of NFS server, SSH server	[15,16]	4
	5.3	Configuration and working of a wireless access point	[17]	2
			Total	**52**

Course Assessment:

Lab:

ISE:

1. **ISE-1**
   a. Assignment on Module 1 for 20 marks
   b. Assignment on Module 2 for 20 marks
   c. Group activity on (network troubleshooting) Module 3 for 10 marks

2. **ISE-2**
   a. Quiz on Module 4 for 10 marks
   b. Assignment (PCB implementation) on Module 4 for 30 marks
   c. Group activity on Module 5 for 10 marks

Recommended References

[1] https://mixeeva-design.ru/media/content/the-art-of-calligraphy.pdf

[2] N.D. Bhatt, *Machine Drawing*, Chartor Publishing

[3] Alexander Bordino, *Autodesk Inventor 2023 cookbook*, Packt publishing

[4] https://bskillforum.bharatskills.gov.in/DashBoadUpload/Others-EBOOK-28Oct2022131021.pdf

[5] https://rsydigitalworld.com/15-useful-linux-networking-commands/

[6] https://www.pearsonhighered.com/assets/samplechapter/0/7/8/9/0789732548.pdf

[7] https://www.youtube.com/watch?v=CGeAauny2fc

[8] https://pcpl21.org/wp-content/uploads/2020/09/10-Troubleshooting-Tips-If-Your-Internet-Is-Connected-But-Not-Working.pdf

[9] https://www.youtube.com/watch?v=AimCNTzDlVo

[10] Schwartz, Mel, ed. *Soldering: Understanding the basics*. ASM International, 2014.

[11] Hamilton, Charles. *A guide to printed circuit board design*. Elsevier, 2013.

[12] https://www.circuits-diy.com/3v-1a-dc-supply-using-bd135-139-npn-transistor/

[13] https://www.digitalocean.com/community/tutorials/how-to-install-the-apache-web-server-on-ubuntu-20-04

[14] https://itslinuxfoss.com/how-to-install-an-ftp-server-on-ubuntu-22-04/

[15] https://ubuntu.com/server/docs/service-nfs

[16] https://www.cyberciti.biz/faq/ubuntu-linux-install-openssh-server/

[17] https://www.youtube.com/watch?v=CEfUsyc2lwg

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25VSE11EC02	Creative Coding in Python	L	T	P	L	T	P	Total
		--	--	4	--	--	2	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Lab	50	--	50	--	100	

Pre-requisite Course Codes		
After the successful completion students should be able to :		
Course Outcomes	CO1	Demonstrate awareness of skills of 21st century engineer
	CO2	Demonstrate basic concepts of python programming.
	CO3	Identify, install and utilize python packages.
	CO4	Illustration of data analytics and data visualization using Python libraries
	CO5	Create GUI Applications using Python.
	CO6	Demonstrate creativity while implementing solution for a given problem using python

Module No.	Unit No.	Topics
1		**21st century skills**
	1.1	Introduction and Importance of 21st Century skills, case studies of creativity in engineering, Creator Tool PictoBlox, Github
2		**Python Fundamentals:**
	2.1	***Basic Data Types:*** Letter Counter App, Right Triangle Solver App, Multiplication Exponent Table Program
	2.2	***Lists:*** Grade Sorter App, Grocery List App, Basketball Roster Program
	2.3	***Dictionaries:*** Thesaurus App, Code Breakers App
3		**Decision Flow Control Statements**
	3.1	***For Loops:*** Binary Hexadecimal Conversion App, Grade Point Average Calculator App
	3.2	***Conditionals:*** Voter Registration App, Rock, Paper, Scissors App
	3.3	***While Loops:*** Guess the Word App, PowerBall Simulation App
4		***Functions***
	4.1	***Functions:*** Head to Head Tic-Tac-Toe App, Bank Deposit and Withdrawal Program
	4.2	***Classes:*** Casino Blackjack App
5		***Graphics and GUI***
	5.1	***Turtl***e - Hirst Painting
	5.2	***Tkinter***- Building a Password Manager GUI App.
6		***Python in Data Sciences for Beginner***
	6.1	***NumPy, Pandas, Matplotlib:*** Data Analysis and visualization of any data set (Stock market/healthcare/weather/Agriculture)
7		**Project Development using Python for various engineering domains like electronics, mechanical etc.**

Course Assessment:

Lab:

ISE:

1. ISE-1

Experiments: 20 Marks
Quiz: 10 Marks
Design contest: 20 Marks

2. ISE-2

Experiments: 20 Marks
Quiz: 10 Marks
Mini Project: 20 Marks

Recommended Books:

1. Yashvant Kanetkar, "Let us Python: Python is Future, Embrace it fast", BPB Publications; 1st edition (8 July 2019).
2. Dusty Phillips, "Python 3 object-oriented Programming", Second Edition PACKT Publisher, August 2015.
3. John Grayson, "Python and Tkinter Programming", Manning Publications (1 March 1999).
4. Core Python Programming, Dr. R. Nageswara Rao, Dreamtech Press
5. Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox publication
6. Introduction to computing and problem solving using python, E Balagurusamy, McGraw Hill Education

Online Resources:

1. Python 3 Documentation: https://docs.python.org/3/
3. "The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/
4. http://spoken-tutorial.org
5. Python 3 Tkinter library Documentation: https://docs.python.org/3/library/tk.html
6. Numpy Documentation: https://numpy.org/doc/
7. Pandas Documentation: https://pandas.pydata.org/docs/
8. Matplotlib Documentation: https://matplotlib.org/3.2.1/contents.html
9. Scipy Documentation : https://www.scipy.org/docs.html
10. Machine Learning Algorithm Documentation: https://scikit-learn.org/stable/
11. https://nptel.ac.in/courses/106/106/106106182/
12. NPTEL course: "The Joy of Computing using Python"

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25IKS11EC01	Indian Knowledge System	2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Lab	--	--	--	--	--	

Pre-requisite Course Codes	--	
After the successful completion students should be able to :		
Course Outcomes	CO1	Enumerate the main characteristics of education system in Vedic and post Vedic period to enrich the intellectual imagination
	CO2	Review the ancient discovery and research in Indian number system and ancient Indian mathematics
	CO3	Review the contribution from Ancient Indian system to astronomy and metallurgy
	CO4	Trace the significant developments in Indian engineering and technology in Irrigation, painting, surgical techniques and shipbuilding
	CO5	Cultivate a deep sense of identity and pride in enriched scientific Indian heritage

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	What is Indian Knowledge System (IKS)? Why do we need it? Salient aspects of IKS.	1	2
	1.2	The Vedic Corpus: Introduction to Vedas, Sub-classification of Vedas, Messages in Vedas, Vedic Life: A Distinctive Features	1	3
2	2.1	Number systems in India, Measurements for time, distance, and weight, Bhūta-Saṃkhyā system, Kaṭapayādi system, Piṅgala and the Binary system	1	4
	2.2	Unique aspects of Indian Mathematics, Indian Mathematicians and their Contributions, Algebra, Geometry and Trigonometry	1	4
3	3.1	Indian contributions in astronomy, The celestial coordinate system, Elements of the Indian calendar, Notion of years and months, Indian Astronomical Instruments	1	4
	3.2	Wootz Steel, Mining and ore extraction, Metals and Metalworking Technology, Iron and steel in India, Lost wax casting of idols and artefacts, Apparatuses used for extraction of metallic components	1	4
4	4.1	Irrigation systems and practices in South India, Dyes and painting technology, Surgical techniques, Shipbuilding	1	3
	4.2	Temple architecture in India, Perspective of Arthaśāstra on town planning.	1	2
			Total	26

Course Assessment:

ISE-1: Quiz: 20Marks (Two 10 marks each)
Activity: Group Discussion on Indian Knowledge System: 10 Marks
Activity: Creative Activity: 20 Marks

ISE-2: Quiz: 20 Marks (Two 10 marks each)
Activity: Reflection discussion on Indian Knowledge System: 10 Marks
Activity: Creative Activity: 20 Marks

Recommended Books:

[1] B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R. N., "*Introduction to Indian Knowledge System: Concepts and Applications*" PHI, 2022

[2] Kapil Kapoor, Avadhesh K. Singh, "*Indian Knowledge Systems, Volume 1*", Indian Institute of Advanced Study, 2005

[3] R. P. Kulkarni, "*Glimpses of India Engineering and Technology: Ancient and Medieval Period*," Munshiram Manoharlal Publishers Pvt. Ltd., 2018

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
25HMM11EC01	Introduction to Emerging Technologies	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Lab	--	--	--	--	--	

Pre-requisite Course Codes	--	
After the successful completion students should be able to:		
Course Outcomes	CO1	Recognize the dynamic nature of emerging technologies and their evolving landscape.
	CO2	Demonstrate knowledge of the key characteristics and potential applications of emerging technologies.
	CO3	Identify the value, innovative solutions or applications for real-world challenges using emerging technologies
	CO4	Analyze the implications of emerging technologies on society, business, and various industries
	CO5	Identify various emerging technologies relevant to his/her discipline for personal and professional growth
	CO6	Recognize the need for continuous learning to keep pace with technological advancements.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction to Industrial Revolution, Important Inventions during various Industrial Revolutions (IR).	1,2	2
	1.2	Role of data, Enabling devices, Network and Human to Machine Interaction during IR	1,2	1
2	2.1	Data Science: Overview of data science, Data Science Life Cycle, Cloud Computing with examples of available Clouds, Big Data, Big data Life Cycle with Hadoop	1,2	3
	2.2	Artificial Intelligence and Machine Learning: Philosophy of AI, Components of AI, Important terminologies, AI Problem Solving, Real-World AI, Types of Machine Learning, Neural Networks, Applications: Computer Vision, Robotics, NLP. Societal Implications of AI.	1,2	3
	2.3	Fundamentals of Blockchain, Blockchain applications and architecture. Introduction to Cyber Security, Cyber attacks and defenses, Case studies.	1,2	3
	2.4	Robotic Process Automation, RPA Tools and Applications		1
3	3.1	Internet of Things (IoT): Introduction, IoT Sensors, IoT Data acquisition & platforms, IoT Data Communication, IoT data storage and Retrieval, IoT data analytics & visualization and IoT Security, IoT Product Development Life Cycle, Industrial IoT,	1,2	3

		Concept of Edge Computing. Case studies		
	3.2	Introduction to Immersive Technologies (AR, VR and MR), AR /VR systems with IOT, AI and Haptics, Tools needed to build AR Apps, usecases, Human Centric UX design	3	2
4	**4.1**	Semiconductor and Nanotechnology: Evolution of Semiconductor Industry, Trends and Innovations in Semiconductor Technologies with respect to material, devices, circuits, architecture and applications. Indian Semiconductor Industry: present status, market trends, challenges, policy initiatives by GoI	4	3
	4.2	Digital Manufacturing, Principles of 3D Printing, Classification and material used in 3D printing, software tools and applications to various fields. Introduction to Robotics, Drones and Autonomous Systems. Fundamentals of tools, software and hardware required to build robot and autonomous systems. Applications and Case studies.	1,6	3
	4.3	Other Trends in emerging technologies: 5G telecom networks and Electric Vehicles	6	2
			Total	**26**

Course Assessment:

Theory:

ISE-1: 50 Marks

Rubric based assessment for activities conducted.

ISE-2: 50 Marks

Rubric based assessment for activities conducted.

Recommended Books:

[1] Vasudha Tiwari. Sunil Kumar Chaudhary and Iqbal Ahmed Khan, "*Emerging Technology For Engineers*", Vayu Education of India, 1st Edition.

[2] Chanagala Shankar, "*Emerging Technologies*", Bluerose Publishers Pvt. Ltd, 1st Edition

[3] Chandradev Yadav, "*The Evolution of Immersive Technologies: A Journey into the Extraordinary*", 1st Edition

[4] Website of India Semiconductor Mission (https://ism.gov.in/)

[5] SWAYAM course on 'An Introduction to Artificial Intelligence'

[6] Other relevant online resources to be used.