CURRICULUM STRUCTURE

FIRST YEAR UG: B.TECH

COMPUTER ENGINEERING

REVISION: FRCRCE-2-25

Effective from Academic Year 2025-26
Board of Studies Approval: 28/02/2025
Academic Council Approval: 14/02/202, 08/03/2025 & 25/06/2025

Dr. DEEPAK BHOIR Dean Academics	Dr. Sujata P. Deshmukh HOD (Computer)	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

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 Computer Engineering Program:

SEM-I													
Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE1	MSE	ISE2	ESE	Total	Points	Total
25BSC11CE01	BSESC	BSC	Matrices and Differential Calculus	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
25BSC11CE04	BSESC	BSC	Engineering Chemistry	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25ESC11CE03	BSESC	ESC	Programming Fundamentals	TH	2	20	30	20	30	100	2	4
				TU	1	20	-	30	-	50	1	
				PR	2	20	-	30	-	50	1	
25PCC11CE03	PCPEC	PCC	Digital Electronics	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25PCC11CE01	PCPEC	PCC	Innovation and Design Thinking	PR	2	20	-	30	-	50	1	1
25PCC11CE04	PCPEC	PCC	Essential Psychomotor Skills for Engineers	PR	4	50	-	50	-	100	2	2
25PCC11CE02	PCPEC	PCC	Essential Computing Skills for Engineers	PR	4	50	-	50	-	100	2	2
25IKS11CE01	HSSM	IKS	Indian Knowledge System	TH	2	50	-	50	-	100	2	2
				Total	**TH:TU:PR 10:2:16=28**					**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
25BSC11CE03	BSESC	BSC	Integral Calculus and Probability Theory	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
25BSC11CE02	BSESC	BSC	Engineering Physics	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25ESC11CE01	BSESC	ESC	Engineering Graphics	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25ESC11CE04	BSESC	ESC	Human Health Systems	TH	1	50	-		-	50	1	1
25ESC11CE02	BSESC	ESC	Basic Electrical and Electronics Engineering	TH	2	20	30	20	30	100	2	4
				TU	1	20	-	30	-	50	1	
				PR	2	20	-	30	-	50	1	
25VSE11CE02	SC	VSEC	Creative Coding in Python	PR	4	50	-	50	-	100	2	2
25VSE11CE01	SC	VSEC	Measuring Instruments and Testing Tools	PR	4	50	-	50	-	100	2	2
25AEC11CE01	HSSM	AEC	Art of Communication	TH	1	40	-	60	-	100	1	2
				PR	2						1	
				Total	**TH:TU:PR 11:1:16=28**			-	-	**1100**	-	**20**

* Introduced as first course for DM/HR

NOTE: Kindly refer-

1. **'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			
25BSC11CE01	Matrices and Differential Calculus	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	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	Title	**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.		02
	1.2	System of Linear equations, their consistency and solutions.		02
	1.3	Eigenvalues and Eigenvectors of a square matrix and their properties(without proof)		02
	1.4	Cayley-Hamilton Theorem (without proof), verification and reductionof higher degree polynomials		02
	1.5	Similarity of matrices, diagonalizable and non-diagonalizable matrices		01
2	Title	**Successive Differentiation**	1,2,3,4	**03**
	2.1	Successive differentiation: nth derivative of standard functions.		02
	2.2	Leibnitz's Theorem (without proof) and problems		01
3	Title	**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.		03
	3.2	Euler's Theorem on Homogeneous functions with two		03

		independent variables (with proof). Deductions from Euler's Theorem. Maxima and Minima of a function of two independent variables,		
4	**Title**	**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).		02
	4.2	Cauchy-Riemann equations in Cartesian coordinates (without proof).		02
	4.3	Milne-Thomson method: Determine analytic function *f(z)*when realpart (u), imaginary part (v) or its combination au+bv is given.		02
	4.4	Harmonic function, Harmonic conjugate and Orthogonal trajectories.		02
			Total	**26**

Tutorial

Exp. No.	Tutorial Details	Marks
1	Matrices	**06**
2	Successive Differentiation	**08**
3	Partial Differentiation	**06**
4	Analytic Functions	**06**
5	Matlab / Scilab Practical	**06**
6	Matlab / Scilab Practical	**06**
7	Matlab / Scilab Practical	**06**
8	Matlab / Scilab Practical	**06**
	Total Marks	**50**

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. Continuous pre-defined marks-based evaluation for 20 marks.
2. ISE-2 will be conducted for the remaining two tutorials (20 marks) and four Matlab / Scilab practical (10 marks). Continuous pre-defined marks-based evaluation for 30 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			
25BSC11CE02	Engineering Physics	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	Derive the conditions for intensity maximum and minimum in interference and diffraction of light and solve numerical problems.
	CO2	Derive Schrodinger equation in time dependent and independent form and solve it for particle in a box problem.
	CO3	Explain the working of lasers and optical fiber and their applications.
	CO4	Explain Fermi level and its variations in semiconductors and derive expression for Hall Effect.
	CO5	Explain the Physical principles of sensors and their applications.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Wave Optics – Interference & Diffraction**	1	6
	1.1	Theory of interference of light - Thin films- wedge shaped film, Newton's rings, Anti reflection coating.		
	1.2	Fraunhofer diffraction at single slit – diffraction due to 'n' slits- plane transmission grating. Applications of grating.		
2		**Quantum Physics**	3	5
	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.		
3		**Laser & Fiber optics**	4,2	5
	3.1	Einstein's theory of matter radiation interaction and A and B coefficients; Properties of laser-spontaneous and stimulated emission, amplification of light by population inversion, different types of lasers: solid-state lasers (Nd-YAG), gas lasers (He-Ne, CO2), applications.		
	3.2	Optical fiber- principle [TIR]-types-material, mode, refractive index-Expression for acceptance angle and numerical aperture. Application-Communication.		
4		**Semiconductor Devices & Applications**	6	5
	4.1	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.		
5		**Physics of Sensors**	7	5
	5.1	Resistive sensors: a) Temperature measurement: PT100 construction, calibration, LM35. b) Thermocouples: concept, calibration, and application of J -type and		

		K-type thermocouple c) Humidity measurement using resistive sensors		
	5.2	Pressure sensor: Concept of pressure sensing by capacitive, flex and inductive method, Analog pressure sensor: construction working and calibration and applications.		
	5.3	Piezoelectric transducers: Concept of piezoelectricity, use of piezoelectric transducer as ultrasonic generator and application of ultrasonic transducer for distance measurement, liquid and air velocity measurement.		
	5.4	Optical sensor: Photodiode, construction and use of photodiode as ambient light measurement and flux measurement. Pyroelectric sensors: Construction and working principle, application of pyroelectric sensor as bolometer.		
			Total	26

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. Simulation using modern tools to solve the given problem statement for 10 marks

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	Determination of wavelengths of Mercury spectrum.

Recommended Books:

TEXT BOOKS

1. Optics by Subramaniam N & BrijLal, S Chand & Co. Pvt. Ltd., New Delhi,
2. Modern Physics by R Murugeshan, Kiruthiga, Sivaprasath S Chand
3. Quantum Mechanics by Sathyaprakash, Pragati Prakashan, Meerut.]
4. Applied Engineering Physics – Rajendran & Marikani (Tata McGraw Hill)
5. Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications
6. Solid State Electronic Devices- B. G. Streetman, Prentice Hall Publisher
7. Handbook of Modern Sensors Physics design and application- Jacob Fraden, Springer, AIP press.

REFERENCE BOOKS

1. Fundamentals of Optics by Jenkins A Francis and White E Harvey, McGRaw Hill Inc., New Delhi,
2. Quantum Mechanics by V. Devanathan, Narosa, Chennai.
3. Engineering Physics by M.N.Avadhanulu, S.Chand& Company Ltd.
4. Concepts of Modern Physics by Arthur Beisser, McGraw Hill, 7th edition.
5. Optics by R. Agarwal, S.Chand publishers.
6. Basic Electronics by B.L.Theraja, S.Chand publishers.
7. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York.
8. Electronic Instrumentation –H.S. Kalsi, Tata Mc Graw-Hill Education
9. Instrumentation & Measurement Techniques by Albert D. Helfrick & William D. Cooper (PHI) Edition

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25ESC11CE01	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	

Part A (Theory)

Pre-requisite Course Codes		
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 method.	1,4	3
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

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.

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

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			
		L	T	P	L	T	P	Total
		2	1	2	2	1	1	4
		Examination Scheme						
25ESC11CE02	Basic Electrical and Electronics Engineering		ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		TU	20		30		50	
		Lab	20		30		50	

Pre-requisite Course Codes		
Course Outcomes	CO1	Distinguish between various types of electrical sources
	CO2	Analyse both DC & AC circuits with independent sources.
	CO3	Discuss operation & applications of transformer & electrical machines
	CO4	Describe the working and applications different types of semiconductor diodes and BJT.
	CO5	Explain the working principle of sensors and identify their applications.
	CO6	Explain the basic method of AC to DC conversion.

Module No.	Unit No.	Topics	Ref.	Hrs
1.		**Introduction to DC Circuits**		
	1.1	Basic electrical quantities -Electrical energy and power- Introduction to Resistance, Inductance and capacitance, Types of sources .	1,2,4	5
	1.2	Ohm's Law-Fundamental circuit laws: KCL and KVL-D.C. circuits and network simplification (series, parallel, star/delta) Mesh and Nodal Analysis.	2,3,4	
	1.3	Principle of superposition, Maximum power transfer Theorem	1,2,3,4	
2.		**Fundamentals of AC**		
	2.1	Generation of alternating voltage & current (AC), fundamentals of AC - waveforms, definitions of time period, amplitude, frequency, phase shift, RMS value & average value	1,2	6
	2.2	R, L, C in AC circuits, Series RL, RC and RLC circuits-application of complex notation- phase difference and power factor, phasor diagram, series-parallel circuits, active, reactive, apparent power, series resonance.	1,2,3	
	2.3	Three phase circuits, advantages and applications, voltages, currents and power in Star connected and delta connected balanced circuits	3,4	
3.		**Transformers**		
	3.1	Construction, principle of operation, types of transformer, induced emf equation and transformation ratio	2,4	4
	3.2	Transformer at No load and On load condition, Losses in	2,4	

		transformer, Regulation and efficiency		
	3.3	Auto transformer working and applications	2,4	
4.		**Electrical Machines**		
	4.1	Construction, principle of operation, types, and applications of DC generator, DC motor, equation of generated emf/back emf	1,2	4
	4.2	Construction, principle of operation, types, and applications of Induction motor.	1,2	
5.		**Semiconductor Diodes**		
	5.1	Working of P-N junction Diode, I-V characteristic, application as a rectifier, introduction to filters (C, L, L-C & C-L-C)	5,6	4
	5.2	Types of Diodes such as LED, photo diode, zener diode characteristic and applications	5,6	
6.		**Bipolar Junction Transistor**		
	6.1	Construction, types - NPN & PNP, characteristic, modes of operation, applications (switch & amplifier)	7,8	3
			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)

Proposed List of Laboratory Experiments:-

1. Verification of Mesh and Nodal analysis.
2. Verification of Superposition Theorem.
3. Verification of Thevenin's Theorem.
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. Forward & reverse bias characteristics of PN junction diode
9. Application of PN junction diode – rectifiers (full-wave)

(iii)Tutorial: (Minimum 10 Tutorials covering all modules)

ISE-1for 20 Marks: Based on first 04 Tutorials of 5 marks each
ISE-2 for 30 Marks : Based on remaining tutorials (Minimum 6 tutorials)

Proposed List of Tutorials

No	Topics	Module
1	Series & Parallel circuits, Star-Delta Transformation	DC circuit
2	Mesh &Nodal Analysis	DC circuit
3	Source transformation, Superposition Theorem	DC circuit
4	Thevenin's Theorem, Maximum Power Transfer Theorem	DC circuit
5	AC fundamentals (ac waveform's instantaneous value, rms,avg, phasor algebra)	AC circuits
6	Analysis of Series AC circuits	AC circuits
7	Analysis of Parallel AC circuits	AC circuits
8	Series resonance	AC circuits
9	Analysis of three phase AC circuits (star connected load), Power in 3 phase circuits.	Three phase AC circuits
10	Analysis of three phase AC circuits (Delta connected load), Phasor diagrams.	Three phase AC circuits
11	Single phase transformer(Numerical based on EMF equation)	Single phase transformer
12	DC machines (Theory only)	DC machines
13	Rectifier and filter (Theory only)	Semiconductor Diodes

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. V. K. Mehta – Principles of Electronics, S. Chand Publishing, New Delhi
6. R. S. Sedha – A Textbook of Applied Electronics, S. Chand Publishing, New Delhi

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC11CE01	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.		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		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)**		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.		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		06
6		**The Design Challenge:** **(Takeaway)** Define Design Challenge, Prototyping Iteration, Pitching, Media **(Key Exercises)** 1. Demo day		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			
25PCC11CE02	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		
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]	2
	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]	2
	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]	2
	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
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
	2.2	Taking user input, control structures for making decisions and adapting to different situations, conditional data selection	[2]	2
	2.3	Visualizing data using 2D and 3D plots, introduction to toolboxes for different scientific computing tasks, creating and calling functions	[2]	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

	2.5	Preprocessing data- normalizing data, working with missing data	[2]	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]	2
	3.2	Creating tables and lists using HTML, creating forms in HTML, Embedding videos on web page	[3]	2
	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]	2
	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]	2
	3.5	DOM manipulation in Javascript, Form validation using Javascript	[3]	2
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]	2
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]	2
	5.2	Insertion of graphics and tables in document, creation of lists, mathematics environment, writing equations	[5]	2
	5.3	Writing algorithms, inserting code in document, creating table of contents, creating hyperlinks	[5]	2
	5.4	Bibliography management, citations, creating chapters using report class, inserting other .tex and .pdf files in document	[5]	2
	5.5	Presentation in LaTeX using beamer class, creating overlay in beamer, blocks in beamer presentation, presentation themes	[5]	2
	5.6	Usage of style files in a document	[5]	2
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]	2
	6.2	Use of advance formulae for data analysis (concatenate, vlookup, hlookup, match, countif, text, trim)	[6]	2

	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]	2
	6.4	Data visualization- creating 2D and 3D plots	[6]	2
	6.5	Data visualization using conditional formatting- creating formula-based rules	[6]	2
			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			
25VSE11CE01	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**		
	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 in measurement, types, classification, Calibration & its importance, Calibration method.		4
	1.3	Difference between sensor and transducer, classification of Types of electrical, electronic and mechanical sensors		4
2		**Units, Standards & Characteristics**		
	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 with sale, service and repair of measuring and test instruments.		4
3		**Mechanical Test & Measuring Instruments**		
	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 interferometry by optical flats and monochromatic light.		2
	3.6	Measurement of components deviations w.r.t. standard using mechanical comparator		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**		
	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**		
	5.1	Proximity Sensors – Capactive, Inductance, Optical sensors Mechanical 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 Assignment 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) **(Total marks = 20 marks)**
B) To conduct Minimum 6 experiment from the module 3, 4, 5 (Total marks = 6 x 5 = **30 marks**)

Recommended 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

[6] J. Millman and A. Grabel, "Microelectronics", Tata McGraw Hill, 2nd Edition.

[7] Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education, 2nd Edition.

[8] Engineering Metrology, K. J. Hume, Kalyani publication

[9] 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
25AEC11CE01	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
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**		
	1.1	**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**		2
3	3.1 3.2 3.3 3.4	**Communicative Competence** **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	4.1 4.2	**Effective Correspondence** **Introduction, Do's and Don'ts, Format and Types** • Application for internship • Request/Permission		2

5	**5.1**	• **Management Information System** • Introduction, Purpose, Structure, Characteristics, Limitation		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

I**SE: 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			
25BSC11CE03	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.		03
	1.2	Linear differential equations (Definition), equations reducible to linear form, Bernoulli's equation		03
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.		05
	2.2	Cauchy's homogeneous linear differential equation and Method of variation of parameters for second order.		02
3	Title	**Integral Calculus**	1,2,3,4	**07**
	3.1	Gamma functions: properties of gamma functions and integrals reducible to gamma functions.		01
	3.2	Beta functions: properties, relation between Beta and Gamma functions, integrals reducible to Beta functions, Duplication formula.		02
	3.3	Tracing of curves (Standard curves, Cardioide, Lemniscate, Spheres, Ellipsoids, Cylinders, Cones, Tetrahedrons, planes)		01
	3.4	Double Integration: definition and evaluation. Evaluate by changing the order of integration and by changing to polar form.		03
4	Title	**Probability**	1,2,3,4	**06**

	4.1	Definition and basics of probability, conditional probability.		01
	4.2	Total Probability theorem and Bayes' theorem.		01
	4.3	Discrete and continuous random variable with probability distributionand probability density function.		02
	4.4	Expectation, Variance, Moment generating function, Raw and centralmoments up to 4^{th} order.		02
			Total	**26**

Tutorial:

Exp. No.	Tutorial Details	Ref.	Marks
1	Linear Differential Equations of First Order		**6**
2	Linear Differential Equations of Higher Order		**8**
3	Integral Calculus		**6**
4	Probability		**6**
5	Matlab / Scilab Practical		**6**
6	Matlab / Scilab Practical		**6**
7	Matlab / Scilab Practical		**6**
8	Matlab / Scilab Practical		**6**
		Total Marks	**50**

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. Continuous pre-defined marks-based evaluation for 20 marks.
2. ISE-2 will be conducted for the remaining two tutorials (20 marks) and four Matlab / Scilab practical (10 marks). Continuous pre-defined marks-based evaluation for 30 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			
25BSC11CE04	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	1,2,4	5

		coatings (Galvanising)		
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
25ESC11CE03	Programming Fundamentals	2	1	2	2	1	1	4

Examination Scheme					
	ISE1	MSE	ISE 2	ESE	Total
Theory	20	30	20	30	100
TU	20	--	30	--	50
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	4
	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	4
	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	06
	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

Tutorial: Need to add

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

(iii)Tutorial: (Minimum 10 Tutorials covering all modules)

ISE-1for 20 Marks: Based on first 04 Tutorials of 5 marks each

ISE-2 for 30 Marks : Based on remaining tutorials (Minimum 6 tutorials)

Week No.	Topic
1st Week	Write Algorithm and Draw Flowchart for following problem statements 1. Fahrenheit and Celsius. 2. Gross salary. 3. Sum of three digit nos. 4. Swapping two nos. 5. A divisible by B using ternary op. 6. Largest of three using ternary. Home Assignment: Write Algorithm and Draw Flowchart for following problem statements 1. Simple Interest 2. Given an integer number in seconds as input, print the equivalent time in hours, minutes and seconds as output (Ex 7322 seconds is equivalent to 2 hrs 2 mins 2 secs) 3. Accept a number and display its equivalent ASCII number.
2nd week	1. Roots of Quadratic equation 2. Leap year 3. Largest of three nos. using nested if ..else 4. Type of triangle using else if ladder 5. Electricity Bill using if else if ladder 6. Vowels using switch case
3rd week	1. Factorial using for loop 2. A ^B using for 3. Fibonacci series using for 4. Series: 1+ 1/3+ 1/5…. 5. Series: 1 - 1/3+ 1/5…… 6. Series: 1- ½! + 1/3! – 1/4!
4th week	Patterns
5th Week	1. Sum of digits of a number 2. Reversing a number 3. Armstrong number 4. Binary to Dec 5. Dec to Binary 6. nPr and nCr
6th Week	1. Fibonacci using recursion 2. X^Y using recursion 3. GCD using recursion 4. Reversing a number using recursion 5. Printing binary form of a decimal no. using recursion (Home Assignment) 6. Maximum of an array 7. Sorting an array using bubble sort 8. Sum of array of size 'n' using recursion
7th Week	1. Reversing an array 2. Binary search 3. Clockwise rotation (optional) 4. Sum of each row and column of a matrix 5. Transpose of a matrix 6. Symmetric Matrix
8th Week	Strings: 1. Convert first letter of every word into uppercase 2. String copy without using library functions 3. Returning average of an array by passing array to fun 4. Reverse a string by passing string to function

9th Week	1. Printing details of the patients with a given decease using structure. 2. Adding two complex numbers using structure. 3. One program to clear basics of pointer (optional)
10th Week	Pointers
11th week	friend class and friend function 1) Rectangle and Square Relationship 2) Complex Number Operations
12th week	concept of class and object: 1) Student Record 2) Bank Account 3) Library Management
13th Week	function overloading 1) Calculate Area 2) Currency Converter 3) Volume Calculator

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			
25ESC11CE04	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	**Topic**	**Significance of Biology in Engineering**		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	**Topic**	**Human Organ Systems and Bio Designs – 1**		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	Topic	**Human Organ Systems and Bio Designs – 2**		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, bioengineeringsolutions for muscular dystrophy and osteoporosis)		
4	Topic	**Nature-Bioinspired Materials And Mechanisms**		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	Topic	**Trends in Bioengineering**		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:

- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- 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.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.

- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press,2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar LambertAcademic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016
- 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			
		L	T	P	L	T	P	Total
25PCC11CE03	Digital Electronics	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	1,2,	

		applications	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	5
	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			
25PCC11CE04	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		
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			
25VSE11CE02	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		
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**
		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			
25IKS11CE01	Indian Knowledge System	L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Lab	--	--	--	--	--	

Pre-requisite Course Codes		--
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:

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

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

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