SYLLABI FOR
BACHELOR OF TECHNOLOGY /MASTER OF TECHNOLOGY
(DUAL DEGREE PROGRAMMES)
(BACHELOR OF TECHNOLOGY PART ONLY)

(APPENDIX A)

OFFERED BY
UNIVERSITY SCHOOL OF INFORMATION, COMMUNICATION AND TECHNOLOGY
AT THE DWARKA CAMPUS OF

GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY
AN UNIVERSITY ESTABLISHED BY THE GOVERNMENT OF NCT OF DELHI

Approval History

1. 1st year and 2nd year scheme and syllabus (1st to 4th semester) and Framework for higher semesters (5th to 8th semesters or 3rd to 4th year) implemented from 2025-26 batch approved by Board of Studies of USICT on 28/07/2025.
2. 1st year and 2nd year scheme and syllabus (1st to 4th semester) and Framework for higher semesters (5th to 8th semesters or 3rd to 4th year) implemented from 2025-26 batch approved by Academic Council Sub-committee on 01/08/2025.

Vision of the School

Create high-quality engineering and computer application professionals

Mission of the School

To serve humanity by creating professionally competent, socially sensitive engineers with high ethical values who can work as individuals or in groups in multicultural global environments.

Syllabus of Papers / Courses

Note: This appendix is to be read together with the scheme of examinations of the corresponding programmes of study.

Paper Code(s): ICT-101	L : 3
Paper: Programming for Problem Solving	C : 3

Prerequisites: None

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to develop simple algorithms for arithmetic and logical problems and implement them in 'C'.
CO2	Ability to implement conditional branching, iteration and recursion and functions in 'C'
CO3	Ability to use arrays, pointers, union and structures to develop algorithms and programs in 'C'.
CO4	Ability to decompose a problem into functions and synthesize a complete program using divide and conquer approach in 'C'.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	2	1	1	-	-	-	2	1	1	3
CO2	3	3	2	1	1	-	-	-	2	1	1	3
CO3	3	3	3	1	1	-	-	-	2	1	1	3
CO4	3	3	3	1	1	-	-	-	2	1	1	3

Unit I

Structure of a C program, Basic data types (int, char, float, double, bool, fixed-width integers), Declarations and initializations, Constants using const and #define, Operators and expressions (arithmetic, relational, logical, bitwise, assignment, conditional, increment/decrement), Type conversions (implicit, explicit casting), Input/output (printf, scanf, format specifiers), Compound statements (blocks), Conditional statements (if, if-else, else-if, switch), Loops (while, do-while, for, infinite loops, early exit), break, continue, goto, return, Algorithm development including flowcharts, pseudocode representation, Tracing and dry run, structured programming. C89, C99, C11 and C23 extensions and usage

Unit II

Function declaration, definition, and invocation, Argument passing (by value, recursion), Inline functions and macro functions, Storage classes (auto, static, extern, register, thread_local), Scope and lifetime of variables, Header files and modular program design, One- and two-dimensional arrays (declaration, access, memory layout), Bubble sort, selection sort, insertion sort, linear and binary search, String input/output (gets, puts, fgets, fputs), Standard string manipulation (strlen, strcpy, strcat, strcmp, etc.), Arrays of strings, Command-line arguments. Root finding of a positive floating point number.

Unit III

Structures (struct definition, nested structures, array of structures, pointer to structures), Unions (union, use-cases, memory layout), Enumerated types (enum, typedef enum), Bit fields, Memory layout and alignment, Pointers (declaration, dereferencing, pointer arithmetic, arrays vs pointers, pointer to pointer), Dynamic memory allocation (malloc, calloc, realloc, free), Memory leak prevention, NULL and null pointer checks, Compound literals, Representation and Arithmetic on polynomials with floating point coefficients. Matrices and arithmetic operations on them (addition, subtraction and multiplication). File I/O (opening, closing, reading, writing text and

binary files, fopen, fclose, fprintf, fscanf, fread, fwrite, fgets, fputs), Error handling using errno, Command-line parameters

Unit IV

Abstract Data Types (ADTs), Singly and doubly linked lists , Stack (array and linked list implementation), Infix-to-postfix conversion, Parenthesis balancing, Queue (linear, circular, priority) (array and linked list implementation), Traversal, insertion, deletion in lists, Binary tree basics (creation, inorder, preorder, postorder traversal), Function pointers, Pointers to arrays and functions, Idea of Generic code using macros, _Generic for type-generic programming, Assertions and diagnostics (assert, _Static_assert), Safer macros and expressions, Forward declaration, Program segmentation, Header hygiene, recursion.

Textbooks:

1. *The C programming language*, B W Kernighan and D M Ritchie, Pearson Education, 1988.
2. Modern C, Jens Gustedt, O'Reilly, 2020
3. *ISO/IEC 9899-XXXX,* The ISO Standard for the C language.

References:

1. *Modern C,* Zoran Pavlovic, Manning Publications, 2020
2. *21st Century C*, Ben Klemens, O'Reilly Media, 2014
3. *C: How to Program*, Paul Deitel and Harvey Deitel, 8th Edition, Pearson, 2016
4. *Engineering Problem Solving With C,* Delores M. Etter, Pearson, 2013.
5. *Problem Solving and Program Design in C,* Jeri R. Hanly and Elliot B. Koffman, Pearson, 2016.
6. *C Programming: A Modern Approach*, K. N. King, W. W. Norton, 2008
7. MIT 6.087 Course Notes, Practical C Programming

Paper Code(s): ICT-151	**P : 2**
Paper: Programming for Problem Solving Lab	**C : 1**
Prerequisites: None	
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term-End Semester Examinations: 60 Marks	
Instructions: **1.** The course objectives and course outcomes are identical to that of ICT-101 as this is the practical component of the corresponding theory paper. **2.** The practical list shall be notified by the teacher in the first week of the class commencement.	

Paper Code(s): ICT-103 / ICT-118	L : 3
Paper: Basics of Electrical Engineering	C : 3

Prerequisites: None

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to understand and use Kirchpff's Laws to solve resistive circuit problems.
CO2	Ability to analyse resistive, inductive and capacitive circuits for transient and steady state sinusoidal solutions.
CO3	Understand the first order filters and magnetic circuits.
CO4	Understand the design of electrical machines.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	1	1	1	2
CO2	3	3	3	3	3	-	-	-	1	1	1	2
CO3	3	3	3	3	3	-	-	-	1	1	1	2
CO4	3	3	3	3	3	-	-	-	1	1	1	2

Unit I

Electric charge, current, voltage, energy, power, independent and dependent sources, Ohm's law, series and parallel resistors, voltage and current division, ideal and real circuit elements, source transformations, Kirchhoff's current law, Kirchhoff's voltage law, basic circuit modeling, practical resistor behavior, power calculations in resistive circuits.

Unit II

Nodal analysis, mesh analysis, linearity and superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, circuit simplification strategies, controlled sources in analysis, transient analysis of first-order circuits, natural and step response of RL circuits, natural and step response of RC circuits.

Unit III

Sinusoidal signals and phasors, impedance and admittance in frequency domain, node and mesh analysis in phasor domain, power in AC circuits, average and reactive power, complex power, power factor and correction, resonance in series and parallel RLC circuits, balanced three-phase circuits, phase sequence, line and phase quantities, power in three-phase loads.

Unit IV

Magnetic circuits, Faraday's and Lenz's laws, inductance and mutual inductance, ideal transformer model, introduction to real transformer behavior, energy conversion principles, operating principles of DC machines, types and characteristics of DC motors and generators, basic concepts of three-phase induction motors, concept of torque and slip, circuit protection devices, electrical safety and grounding, power systems overview for digital infrastructure, energy auditing and efficiency principles.

Textbooks:

1. *Fundamentals of Electric Circuits*, Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education, Latest Edition

References:

1. *Basic Electrical Engineering*, D. P. Kothari and I. J. Nagrath, McGraw-Hill Education, Latest Edition.
2. *Electrical Engineering Fundamentals*, Vincent Del Toro, Prentice Hall, 2nd Edition
3. *Electric Machinery,* A. E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans, McGraw-Hill Education, Latest Edition.
4. MIT OpenCourseWare – "Circuits and Electronics" (6.002X)

Paper Code(s): ICT-153 / ICT-162	**P : 2**
Paper: Basics of Electrical Engineering Lab	**C : 1**
Prerequisites: None	
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term-End Semester Examinations: 60 Marks	
Instructions: **1.** The course objectives and course outcomes are identical to that of ICT-103/ICT-118 as this is the practical component of the corresponding theory paper. **2.** The practical list shall be notified by the teacher in the first week of the class commencement.	

Paper Code(s): ICT-105	L : 3
Paper: System Modeling Techniques – I	C : 3

Prerequisites: None

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to use series, differential and integral methods to solve formulated engineering problems.
CO2	Ability to use Ordinary Differential Equations to solve formulated engineering problems.
CO3	Ability to use linear algebra to solve formulated engineering problems.
CO4	Ability to use vector calculus to solve formulated engineering problems.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	3	3	3	1	-	-	-	-	-	1	2
CO2	2	3	3	3	1	-	-	-	-	-	2	2
CO3	2	3	3	3	1	-	-	-	-	-	2	2
CO4	2	3	3	3	1	-	-	-	-	-	2	2

Unit I

Partial derivatives, Chain rule, Differentiation of Implicit functions, Exact differentials. Maxima, Minima and saddle points, Method of Lagrange multipliers. Integration, Differentiation under Integral sign, Jacobians and transformations of coordinates. Taylor's and Maclurian Series. Ordinary Differential Equations (ODEs): Basic Concepts. Geometric Meaning of y'= ƒ(x, y). Direction Fields, Euler's Method, Separable ODEs. Exact ODEs. Integrating Factors, Linear ODEs. Bernoulli Equation. Orthogonal Trajectories. Homogeneous Linear ODEs with Constant Coefficients. Differential Operators. Modeling of Free Oscillations of a Mass–Spring System, Euler–Cauchy Equations. Wronskian, Nonhomogeneous ODEs, Solution by Variation of Parameters

Unit II

Power Series Method for solution of ODEs, Bessel's Equation, Legendre's Equation, Hermite's equation, Laguerre's Equations. Corresponding Special Functions, Recurrence Relations for these special functions, their properties. Gamma and Beta functions and their properties

Unit III

Linear Algebra: Matrices and Determinants, Gauss Elimination, Linear Independence. Rank of a Matrix. Vector Space. Solutions of Linear Systems and concept of Existence, Uniqueness, Determinants. Cramer's Rule, Gauss–Jordan Elimination. The Matrix Eigenvalue Problem. Determining Eigenvalues and Eigenvectors, Symmetric, Skew-Symmetric, and Orthogonal Matrices. Eigenbases. Diagonalization. Quadratic Forms. Gram-Schmidt process. Cayley – Hamilton Theorem (without proof). LU and Cholesky decomposition, applications to systems of equations, Singular Value Decomposition (SVD) with applications.

Unit IV

Vector Calculus: Vector and Scalar Functions and Their Fields. Derivatives, Curves. Arc Length. Curvature. Torsion, Gradient of a Scalar Field. Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field, Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Stokes Theorem. Divergence Theorem of Gauss.

Textbooks:

1. *Advanced Engineering Mathematics*, Erwin Kreyszig, John Wiley, 10th Ed., 2011.
2. *Mathematical Methods for Physics and Engineering*, K. F. Riley, M. P. Hobson and S. J. Bence, CUP, 2013.

References:

1. Engineering Mathematics by K.A. Stroud with Dexter J. Booth, Macmillan, 2020.
2. Special Functions of Mathematics for Engineers. Larry C. Andrews, OUP, 1998
3. Advanced Engineering Mathematics by Larry Turyn, Taylor and Francis, 2014.
4. Advanced Engineering Mathematics by Dennis G. Zill, Jones & Bartlett Learning, 2018.
5. Advanced Engineering Mathematics with MATLAB by Dean G. Duffy, Taylor and Francis, 2017.
6. Advanced Engineering Mathematics by Merle C. Potter, Jack L. Lessing, and Edward F. Aboufadel, Springer (Switzerland), 2019.

Paper Code(s): ICT-107 / ICT-120	L : 3
Paper: Engineering Mechanics	C : 3
Prerequisites: None	

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to solve problems pertaining to force systems, equilibrium and distributed systems.
CO2	Ability to solve problems of friction and engineering trusses.
CO3	Ability to deal with the problems of kinematics and kinetics of particle
CO4	Ability to deal with the problems of kinematics and kinetics of rigid bodies.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	2	-	-	-	1	1	1	2
CO2	3	3	3	3	2	-	-	-	1	1	1	2
CO3	3	3	3	3	2	-	-	-	1	1	1	2
CO4	3	3	3	3	2	-	-	-	1	1	1	2

Unit I

Force System: Introduction, force, principle of transmissibility of force, resultant of a force system, resolution of a force, moment of force about a line, Varignon's theorem, couple, resolution of force into force and a couple, properties of couple and their application to engineering problems.

Equilibrium: Force body diagram, equations of equilibrium and their applications to engineering problems, equilibrium of two force and three force members.

Unit II

Structure: Plane truss, perfect and imperfect truss, assumption in the truss analysis, analysis of perfect plane trusses by the method of joints, method of section and graphical method.

Friction: Static and Kinetic friction, laws of dry friction, co-efficient of friction, angle of friction, angle of repose, cone of friction, frictional lock, friction in flat pivot and collar bearing, friction in flat belts.

Unit III

Kinematics of Particles: Rectilinear motion, plane curvilinear motion, rectangular coordinates, normal and tangential coordinates.

Kinetics of Particles: Equation of motion, rectilinear motion and curvilinear motion, work-energy equation, conservation of energy, concept of impulse and momentum, conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact.

Unit IV

Kinematics of Rigid Bodies: Concept of rigid body, types of rigid body motion, absolute motion, introduction to relative velocity, relative acceleration (Corioli's component excluded) and instantaneous center of zero velocity, Velocity and acceleration.

Kinetics of Rigid Bodies: Equation of motion, translatory motion and fixed axis rotation, application of work energy principles to rigid bodies conservation of energy.

Textbooks:

1. *Engineering Mechanics* by A.K.Tayal, Umesh Publications.

References:

1. *Engineering Mechanics' by K. L. Kumar, Tata Mc-Graw Hill*
2. *Engineering Mechanics' by S. Timoshenko, D. H. Young, J. V. Rao, Tata Mc-Graw Hill*
3. *Engineering Mechanics-Statics and Dynamics' by Irwing H. Shames, PHI.*
4. *Engineering Mechanics' by Basudev Bhattacharya, Oxford Higher Education.*

Paper Code(s): ICT-109	L : 3
Paper: Communications Skills	C : 3
Prerequisites: None	

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1:	Ability to understand the basic structure of language
CO2:	Ability to communicate effectively in writing.
CO3:	Ability to present their ideas effectively in professional and demanding situations.
CO4:	Ability to interpret texts and comprehend the extended discourse.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	3
CO4	-	-	-	-	-	-	-	-	3	3	-	3

Unit I

Basic Language Efficiency 1: Parts of Speech, Sentence Structure, Subject-Verb Agreement, Vocabulary, Common Errors,

Unit II

Basic Language Efficiency 2: Writing Skills: Types of Writing, Paragraph writing,Paraphrasing, Summarizing, Précis Writing

Unit III

Formal Written Communication: Meetings – Agenda and Minutes,Press release, Letter writing, Notice, Memorandum, E-mails

Unit IV

Appreciating written Texts for comprehension ability:

1. Steven Spielberg's Speech at Harvard Commencement 2016(https://www.youtube.com/watch?v=TYtoDunfu00)
2. Lecture by Johan Rockstrom: Let the Environment Guide our Development http://www.ted.com/talks/johan_rockstrom_let_the_environment_guide_our_development [8Hrs]

Textbooks:

1. *High English Grammar and Composition* by Wren, P.C. & Martin H., S.Chand & Company Ltd, New Delhi.
2. *Technical Communication: Principles & Practice* by Meenakshi Raman, New Delhi: Oxford University Press

References:

1. *Be Grammar Ready: The Ultimate Guide to English Grammar* by John Eastwood, New Delhi, Oxford University Press, 2020.
2. *Communication Skills: A Workbook* by Sanjay Kumar & Pushp Lata, New Delhi, Oxford University Press, 2018.
3. *Basic Technical Communication* by Kavita Tyagi & Padma Mishra, New Delhi, PHI Learning, 2012.
4. *Advanced Technical Communication* by Kavita Tyagi & Padma Mishra, New Delhi, PHI Learning, 2011.

Paper Code(s): HVEE-113	**L : 2**
Paper: Human Values and Ethics	**C : 2**
Prerequisites: None	
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term-End Semester Examinations: 60 Marks	
Instructions for paper setter:	
1. There should be 9 questions in the term end examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12. 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.	
Course Outcomes (CO):	
CO1	Understand value of education and self- development
CO2	Imbibe good values in students
CO3	Learn the importance of good character and human values
CO4	Overall Personality Development

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	-	-	-	-	3	-	3	-	-	-	-
CO2	-	-	-	-	-	3	-	3	-	-	-	-
CO3	-	-	-	-	-	3	-	3	-	-	-	-
CO4	-	-	-	-	-	3	-	3	-	-	-	-

Unit I

Introduction to Value Education, What are Values?, Importance of Values in life, Distinction between Human Values and Skills, Value Spectrum, Types of Values (Universal Values, Personal Values, Social Values, Moral Values, Spiritual Values), Sources of Values (Family, Society, Culture, Education), Self-exploration as a process for Value Education, Harmony in the Individual (Understanding the self, Body and Self, Needs of Self and Body, Realization of Co-existence), Harmony in Family (Relationships, Trust, Respect, Care, Affection, Guidance, Reverence, Glory), Harmony in Society (Justice, Social Order, Role of Society in Value Inculcation).

Unit II

Introduction to Ethics, Definition of Ethics, Distinction between Ethics and Morality, Importance of Ethics in human conduct, Ethical Relativism vs. Universal Ethics, Sources of Ethical Principles (Law, Religion, Philosophy, Conscience, Culture), Ethical Theories (brief introduction to Utilitarianism, Deontology/Duty-based ethics, Virtue Ethics), Ethical Decision-Making Process (Identifying the ethical problem, Gathering information, Evaluating alternatives, Making a decision, Reflecting on the outcome), Conscience and its role in ethical judgment.

Unit III

Concept of Profession and Professional Ethics, Ethics in the Engineering Profession, Importance of Professional Ethics for Engineers, Codes of Ethics (overview of general principles), Core Values of Professional Ethics (Integrity, Honesty, Objectivity, Impartiality, Confidentiality, Diligence, Fairness), Professional Responsibility, Accountability, Conflict of Interest, Gifts and Kickbacks, Whistleblowing (meaning, importance, ethical considerations), Data Privacy and Confidentiality (general awareness), Social and Environmental Responsibility of Professionals.

Unit IV

Ethics in a Globalized World, Cross-Cultural Ethical Understanding, Challenges of Cultural Relativism, Social Justice and Equity, Human Rights (Universal Declaration of Human Rights - overview), Environmental Ethics (brief overview, moral responsibility towards nature), Sustainable Development Goals (SDGs) as a framework for

ethical action, Ethical Leadership, Ethics in Governance, Role of Values and Ethics in Nation Building, Concept of a "Value-based Society", Individual's role in promoting ethical behavior and contributing to a harmonious society.

Textbooks:

1. A Foundation Course in Human Values and Professional Ethics, R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, 2nd edition, 2010.

References:

1. *An Introduction to Ethics, William Lillie, Allied Publishers, reprint edition, 2008.*
2. *Ethics in Engineering, Mike W. Martin and Roland Schinzinger, McGraw-Hill Education, 4th edition, 2005.*
3. *Practical Ethics, Peter Singer, Cambridge University Press, 3rd edition, 2011.*
4. *Business Ethics: Concepts and Cases, Manuel G. Velasquez, Pearson, 8th edition, 2017.*

Paper Code(s): ICT-111	L : 3
Paper: PCB Design	C : 3

Prerequisites: None

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Understand and Design PCB
CO2	Understand Component placement strategies and layout validation
CO3	Understand PCB fabrication steps
CO4	Design simple Single -layer and double-layer PCBs

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	3	-	-	-	-	-	-	1
CO2	3	3	3	3	3	-	-	-	-	-	-	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	-	-	-	1

Unit I

PCB types (single-layer, double-layer, multilayer), through-hole vs. SMD components, PCB materials and substrates, structure of a PCB (pads, vias, traces, silkscreen, solder mask), design workflow overview, schematic capture, netlists, introduction to EDA tools (KiCAD, Eagle, Altium Designer), library creation and part symbols.

Unit II

Component placement strategies, design for manufacturability (DFM), trace width and spacing calculation, ground and power planes, decoupling and bypass capacitors, differential pair routing, impedance matching basics, EMI/EMC guidelines, schematic to layout process, netlist management, layout validation (DRC, ERC), use of design constraints.

Unit III

PCB fabrication steps (photoresist, etching, plating, solder mask), via types (through-hole, blind, buried), panelization, surface finish types (HASL, ENIG), soldering methods (wave, reflow, hand soldering), SMD rework tools, bill of materials (BoM), Gerber file generation, pick-and-place file, understanding fabrication drawings.

Unit IV

Design of simple single-layer and double-layer PCBs:

- Power supply board (linear and switching)
- Microcontroller breakout board
- Sensor interface (e.g., temperature or motion)
- LED driver circuit

Signal integrity simulation basics, thermal considerations, component derating, PCB testing and debugging, integration with embedded systems.

Textbooks:

1. *Printed Circuit Board Design using KiCad,* Peter Dalmaris, Tech Explorations, Latest Edition.

2. Complete PCB Design Using OrCAD Capture and PCB Editor, Kraig Mitzner, Newnes (Elsevier).

References:

1. *PCB Design for Real-World Design*, Chris Schroeder, Prentice Hall. Latest Edition
2. *High-Speed Digital Design: A Handbook of Black Magic*, Howard Johnson & Martin Graham, Prentice Hall. Latest Edition
3. *Signal and Power Integrity – Simplified,* Eric Bogatin, Pearson. Latest Edition
4. Texas Instruments and Analog Devices App Notes on PCB Layout. Latest Edition
5. IPC Standards (IPC-2221, IPC-7351, IPC-A-600) – for layout, land patterns, and acceptability.

Paper Code(s): ICT-121	L : 3
Paper: Introduction to Manufacturing Process	C : 3

Prerequisites: None

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Understand casting process.
CO2	Understand joining process.
CO3	Understand forging and sheet metal work.
CO4	Basic understanding of new technology for manufacturing

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	1	1	1	2	-	-	-	-	-	1	1
CO2	2	1	1	1	2	-	-	-	-	-	1	1
CO3	2	1	1	1	2	-	-	-	-	-	1	1
CO4	2	1	1	1	2	-	-	-	-	-	1	1

Unit I

Definition of manufacturing, Importance of manufacturing towards technological and social economic development, Classification of manufacturing processes, Properties of materials.

Metal Casting Processes: Sand casting, Sand moulds, Type of patterns, Pattern materials, Pattern allowances, Types of Moulding sand and their Properties, Core making, Elements of gating system. Description and operation of cupola.

Working principle of Special casting processes: Shell casting, Pressure die casting, Centrifugal casting. Casting defects.

Unit II

Joining Processes: Welding principles, classification of welding processes, Fusion welding, Gas welding, Equipments used, Filler and Flux materials. Electric arc welding, Gas metal arc welding, Submerged arc welding, Electro slag welding, TIG and MIG welding process, resistance welding, welding defects.

Unit III

Deformation Processes: Hot working and cold working of metals, Forging processes, Open and closed die forging process. Typical forging operations, Rolling of metals, Principle of rod and wire drawing, Tube drawing. Principle of Extrusion, Types of Extrusion, Hot and Cold extrusion.

Sheet metal characteristics: Typical shearing operations, bending and drawing operations, Stretch forming operations, Metal spinning.

Unit IV

Ideation: Introduction, Steps of Ideation, Introduction of Product Design, Development and Prototyping.

3D Printing: Definition, Types, History, Feasibility of Rapid Prototyping Technology (RPT), Role of CAD in RPT, 3D Modeling software and its role in RPT, Creation of STL file from CAD model and FDM.

Laser Cutting and engraving: Definition, Types, History, 3D Modeling software, and Creation of compatible file format for Laser Cutting and engraving.

Wood Routing: Definition, Types, History, 3D Modeling software, and Creation of compatible file format for Wood Routing.

.

Textbooks:

1. *Manufacturing Technology: Foundry, Forming and WeldingVolume 1*, P. N Rao, , McGrawHill, 5e, 2018.
2. *Elements of Workshop TechnologyVol. 1 and 2*by Hajra Choudhury, Media Promoters Pvt Ltd.,2008.

References:

1. *Manufacturing Processes for Engineering Materials*, by Serope Kalpajian and Steven R.Schmid, Pearson Education, 5e, 2014.
2. *Fundamentals of Modern Manufacturing: Materials, Processes, and Systems* by Mikell P. Groover, John Wiley and Sons, 4e, 2010 .
3. *Production Technology* byR.K.Jain and S.C. Gupta, Khanna Publishers. 16th Edition, 2001.

Paper Code(s): ICT-119T	L : 2
Paper: Programming in C++	C : 2

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to write procedural C++ programs
CO2	Ability to use dynamic memory allocation in C++
CO3	Ability to use simple STL templates
CO4	Ability to write object oriented programs in C++

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	3	-	-	-	-	-	-	1
CO2	3	3	3	3	3	-	-	-	-	-	-	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	-	-	-	1

Unit I

Differences in program structure between C and C++, header files and compilation model, scope resolution operator ::, namespaces and using, input/output using cin, cout, and manipulators, auto and type inference, reference variables, default function arguments, function overloading and name mangling, const, constexpr, inline, strongly typed enums (enum class), compile-time expressions and usage of decltype.

Unit II

Dynamic memory management (new, delete, nullptr, RAII), smart pointers (unique_ptr, shared_ptr, weak_ptr), const correctness with pointers, function pointers and lambdas (syntax and closures), default constructors, copy constructors and assignment operators, function templates, compile-time polymorphism using templates, basics of SFINAE and type traits.

Unit III

Standard containers: vector, array, list, map, set, unordered_map, iterators and range-based for loops, algorithms from <algorithm> (sort, find, count, accumulate, for_each), lambdas with STL, std::pair, std::tuple, structured bindings, introduction to std::optional, std::variant, and std::any.

Unit IV

Structures with methods, difference between struct and class, member functions, encapsulation, access specifiers, this pointer, static class members, constructors and destructors, initialization lists, RAII principles, function templates and class templates, template specialization, separating interface and implementation in modular design.

Textbooks:

1. *Programming: Principles and Practice Using C++,* Bjarne Stroustrup, 2nd Edition, Addison-Wesley, 2014.

References:

1. *The C++ Programming Language,* Bjarne Stroustrup, 4th Edition, Addison-Wesley, 2013.

2. *A Tour of C++,* Bjarne Stroustrup, 2nd Edition, Addison-Wesley, 2018.
3. *Effective Modern C++,* Scott Meyers, O'Reilly Media, 2014.
4. *Accelerated C++,* Andrew Koenig & Barbara Moo, Addison-Wesley, 2000.
5. *C++ Primer*, Stanley B. Lippman, Josée Lajoie, and Barbara Moo, 5th Edition, Addison-Wesley, 2012.
6. *Object-Oriented Design with Applications*, Grady Booch, 3rd Edition, Addison-Wesley, 2007
7. *C++ Software Design*, Klaus Iglberger, Manning Publications, 2023
8. *Clean Code in C++,* Stephan Roth, Packt Publishing, 2020
9. *Clean Architecture: A Craftsman's Guide to Software Structure and Design*, Robert C. Martin, Prentice Hall, 2017
10. *ISO/IEC 14882.xxxx*, C++ ISO /IEC standards

Paper Code(s): ICT-119P	**P : 2**
Paper: Programming in C++ Lab	**C : 1**
Prerequisites: None	
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term-End Semester Examinations: 60 Marks	
Instructions: **1.** The course objectives and course outcomes are identical to that of ICT-119T as this is the practical component of the theory paper. **2.** The practical list shall be notified by the teacher in the first week of the class commencement.	

Paper Code(s): ICT-102	L : 3
Paper: Data Structures	C : 3
Prerequisites: None	

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	To be able to understand difference between structured data and data structure
CO2	To be able to create common basic data structures and trees
CO3	To have a knowledge of sets, heaps and graphs
CO4	To have basic knowledge of sorting and searching algorithms

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	2	2	2	3	-	-	-	2	2	2	3
CO2	3	2	2	2	3	-	-	-	2	2	2	3
CO3	3	2	2	2	3	-	-	-	2	2	2	3
CO4	3	2	2	2	3	-	-	-	2	2	2	3

Unit I

Abstract Data Types (specification, performance implications), growth of functions and asymptotic analysis, Master's theorem (without proof). Analysis of array vs linked representations, Sparse Matrices (transpose and multiplication), Comparison-based sorting: insertion, shell, merge, quick, heap sort — algorithm and comparisons, Time and space complexity, Stability and adaptivity of sorts, Sorting in practice: library sorting functions, Sorting linked lists, Divide and conquer review via mergesort/quick sort, Introduction to non-comparison-based sorting (counting, radix — concept only).

Unit II

Binary trees: traversal techniques, recursive vs non-recursive, Binary Search Trees (BST): insertion, deletion, search, AVL Trees: balancing, rotations, complexity, Heaps and priority queues: heapify, build-heap, insert/delete, Applications: expression trees, interval trees, use of recursion and stack in tree processing, Performance trade-offs among tree variants. Multi-way search trees: m-ary search tree, B-Trees (order, height, node structure, insertion, deletion), B+ Trees (leaf-level chaining, indexing applications), Search operations in B+ Trees

Unit III

Hash tables: hash function design, collision handling (chaining, open addressing), Load factor, rehashing strategies, Dictionary ADT and map APIs, Trie data structure: insertion, search, memory model, Disjoint Sets (Union-Find) with path compression and union by rank, Bit-fields and memory efficiency

Unit IV

Graph representations: adjacency list, adjacency matrix, edge list, Graph traversal algorithms (BFS, DFS) and applications (cycle detection, component labeling), Minimum Spanning Tree (Kruskal, Prim), Shortest paths (Dijkstra, Bellman-Ford), Graph design for real applications (idea of social networks, compiler dependency graphs)

Textbooks:

1. *Data Structures and Algorithm Analysis in C,* Mark Allen Weiss, Pearson Education India, Latest Edition.
2. *Fundamentals of Data Structures in C*, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Universities Press (India) Pvt. Ltd., 2008

References:

1. *Data Structures with C*, Seymour Lipschutz, McGraw-Hill Education, 2010
2. Data Structures and Algorithms, Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, Addison-Wesley, 1983
3. *Data Structures: A Pseudocode Approach with C,* Richard Gilberg , Behrouz A. Forouzan Cengage Learning, Latest Edition
4. *Data Structures and Program Design in C*, Robert Kruse, Pearson, Latest Edition
5. *Data structures using C*, Y. Langsam, M. J. Augenstein and A. M. Tanenbaum, PHI

Paper Code(s): ICT-152	**P : 2**
Paper: Data Structures Lab	**C : 1**
Prerequisites: None	
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term-End Semester Examinations: 60 Marks	
Instructions: **1.** The course objectives and course outcomes are identical to that of ICT-102 as this is the practical component of the corresponding theory paper. **2.** The practical list shall be notified by the teacher in the first week of the class commencement.	

Paper Code(s): ICT-104	L : 3
Paper: Python Programming	C : 3
Prerequisites: None	

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to write procedural programmes in Python.
CO2	Ability to write programs using standard data structures.
CO3	Ability to use object oriented paradigm to write program in Python.
CO4	Ability to write modular program in Python

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	1	2	1	3	-	-	-	1	1	1	1
CO2	-	1	2	1	3	-	-	-	1	1	1	1
CO3	-	1	2	1	3	-	-	-	1	1	1	1
CO4	-	1	2	1	3	-	-	-	1	1	1	1

Unit I

Identifiers, keywords, indentation, comments, documentation strings, Unicode and encoding, data types and type hints, object identity vs equality, operator precedence and associativity, input/output (print formatting with f-strings, format(), old %), command-line arguments using sys.argv, control flow: if, elif, else, match statement (PEP 634), loops: for, while, break, continue, else with loops, iterator protocol (__iter__, __next__), comprehensions (list, set, dict, nested), unpacking and zipping, enumerate, zip, range.

Unit II

Defining and calling functions, arguments: positional, keyword, default, variable-length (*args, **kwargs), recursion, anonymous functions with lambda, map, filter, reduce, any, all, sorted, min, max with custom keys, first-class functions, closures, decorators (basic and with arguments), generators (yield, send), iterators vs generators, import system, module search path, creating and importing user-defined modules, packages and __init__.py, virtual environments and dependency management, built-in collections: list, tuple, dict, set, frozenset, Counter, defaultdict, OrderedDict, deque.

Unit III

Classes and objects, class and instance attributes, methods (self), constructor (__init__), attribute access control, class variables and methods (@classmethod, @staticmethod), inheritance, method overriding, composition vs inheritance, super(), abstract classes and interfaces using abc, operator overloading (__add__, __eq__, etc.), duck typing, multiple inheritance, MRO (Method Resolution Order), introspection (dir(), hasattr(), getattr()), exception hierarchy, custom exceptions, structured exception handling (try-except-else-finally), resource management with with, file I/O, JSON and CSV processing, pickling, error and exception best practices.

Unit IV

Modeling with Python data structures (lists, stacks, queues, dictionaries, sets), simulation problems, trees: node-based and list-based representations, binary tree traversal, recursion vs iteration, search and sorting using Pythonic methods, time and space complexity analysis using empirical profiling, introduction to timeit and

cProfile, unit testing (unittest, doctest, pytest), assertions, type checking (mypy, typeguard), type annotations and gradual typing (PEP 484), introduction to NumPy arrays, basic file-based or JSON-based persistence, project structure, naming conventions (PEP 8), packaging and publishing modules, documentation with pydoc and sphinx.

Textbooks:

1. *Fluent Python*, Luciano Ramalho, O'Reilly Media, Latest Edition.

References:

1. *Think Python: How to Think Like a Computer Scientist*, Allen B. Downey, Green Tea Press, Latest Edition.
2. *Effective Python*, Brett Slatkin, Addison-Wesley, Latest Edition.
3. *Python for Everybody*, Charles Severance, Open Access Edition.
4. *Automate the Boring Stuff with Python*, Al Sweigart, No Starch Press, Latest Edition.

Paper Code(s): ICT-154	**P : 2**
Paper: Python Programming Lab	**C : 1**
Prerequisites: None	
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term-End Semester Examinations: 60 Marks	
Instructions: **1.** The course objectives and course outcomes are identical to that of ICT-104 as this is the practical component of the corresponding theory paper. **2.** The practical list shall be notified by the teacher in the first week of the class commencement.	

Paper Code(s): ICT-106 / ICT-115	L : 3
Paper: Digital Electronics and Computer Organization	C : 3
Prerequisites: None	

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to understand codes and minimize Boolean expression
CO2	Design and Implement Combinational and Sequential Circuits
CO3	Ability to Design Finite state machines of the Moore and Mealy types
CO4	Understand functioning of a digital computer

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	3	-	-	-	-	-	-	1
CO2	3	3	3	3	3	-	-	-	-	-	-	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	-	-	-	1

Unit I

Number systems: binary, octal, decimal, hexadecimal, base conversions, complements (1's, 2's, 9's, 10's), binary arithmetic, signed number representations (sign-magnitude, 1's and 2's complement), overflow conditions. Binary codes: BCD, Gray code, ASCII, parity bits, Hamming codes. Boolean algebra: axioms and theorems, switching algebra, logic gates and their realization, truth tables, canonical forms, minterms and maxterms. Logic simplification using Boolean algebra and Karnaugh maps (up to 5 variables), don't care conditions, NAND-NAND and NOR-NOR networks. Quine-McClusky's Algorithm. Combinational hazards, static-1 and static-0 hazards, hazard-free realization.

Unit II

Design and implementation of: adders (half, full, carry lookahead), subtractors, comparators, encoders, decoders, priority encoders, multiplexers, demultiplexers. Function realization using MUX, DEMUX, and ROM. Design of arithmetic circuits: 4-bit adders/subtractors, BCD adders. Magnitude comparator, code converters , parity generator/checker. Use of standard ICs and programmable logic devices (PLA, PAL — basic introduction). Binary multipliers: combinational array multiplier. Introduction to Verilog-based truth-table and logic-level modeling.

Unit III

Bistable elements: latches (SR, D), flip-flops (SR, D, JK, T — level and edge-triggered), characteristic equations, excitation tables, timing diagrams. Flip-flop timing: setup, hold, propagation delay, metastability. Counters: asynchronous, synchronous, up-down, modulus-n, Johnson, ring counters. Shift registers and bidirectional shift registers. Sequential design methodology using state diagrams, Moore and Mealy machines, state reduction. Design of synchronous sequential circuits , up/down and modulus counters , shift registers, Ring counter , Johnson counter , timing diagram , serial adder , sequence detector, Design of sequence detectors, control logic with FSMs. Classification of memories: ROM, RAM, static and dynamic RAM, memory cell design concepts, memory timing, address decoding logic.

Unit IV

Functional components of a digital computer: control unit, ALU, registers, memory, and interconnect. Instruction cycle: fetch, decode, execute. Register transfer language (RTL), micro-operations, and control signals. Control unit design: hardwired control logic (detailed), microprogramming (basic concepts only). Introduction to bus structures, memory read/write sequences. Addressing modes: immediate, direct, indirect, register, indexed. I/O mechanisms: program-controlled, interrupt-driven, DMA overview. Basic instruction format and design: 1-address, 2-address, 3-address machine. Conceptual design of a simple accumulator-based computer..

Textbooks:

1. *Digital Logic and Computer Design*, M. Morris Mano, Pearson Education, Latest Edition.

References:

1. *Digital Design and Computer Architecture*, David Harris & Sarah Harris, Morgan Kaufmann, Latest Edition.
2. *Computer System Architecture*, M. Morris Mano, Rajib Mall Pearson Education, 2017
3. *Computer Organization and Embedded Systems*, Carl Hamacher, Z. Vranesic, S. Zaky, McGraw-Hill, Latest Edition.
4. *Fundamentals of Digital Logic with Verilog Design*, Stephen Brown and Zvonko Vranesic, McGraw-Hill, Latest Edition.
5. *Digital Systems: Principles and Applications*, Ronald J. Tocci, Neal S. Widmer, Pearson, Latest Edition.
6. *Computer System Architecture*, M. Morris Mano, Pearson Education, Latest Edition.
7. *Fundamentals of Logic Design*, Charles H. Roth, Jr., Larry L. Kinney, Cengage, Latest Edition.
8. *Computer Organization and Embedded Systems*, Hamacher, Vranesic, Zaky, McGraw Hill, Latest Edition.
9. *Computer Architecture: A Quantitative Approach*, John L. Hennessy and David A. Patterson, Morgan Kaufmann, Latest Edition.

Paper Code(s): ICT-156 / ICT-155	**P : 2**
Paper: Digital Electronics and Computer Organization Lab	**C : 1**
Prerequisites: None	
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term-End Semester Examinations: 60 Marks	
Instructions: **1.** The course objectives and course outcomes are identical to that of ICT-106/ICT-115 as this is the practical component of the corresponding theory paper. **2.** The practical list shall be notified by the teacher in the first week of the class commencement.	

Paper Code(s): ICT-108	L : 3
Paper: System Modelling Techniques - II	C : 3

Prerequisites: None

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to do line integration
CO2	Ability to use the residue theorem to solve problems
CO3	Use Laplace and Fourier methods to solve ODE
CO4	Ability to solve simple PDE

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	-	-	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2

Unit I

Roots, Derivative. Analytic Function, Cauchy–Riemann Equations. Laplace's Equation, Exponential Function, Trigonometric and Hyperbolic Functions. Euler's Formula, de'Moivre's theorem (without proof), Logarithm. General Power. Principal Value.Singularities and Zeros. Infinity,
Line Integral in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Functions, Taylor and Maclaurin Series.

Unit II

Complex Analysis – II: Laurent Series, Residue Integration Method. Residue Integration of Real Integrals,
Geometry of Analytic Functions: Conformal Mapping, Linear Fractional Transformations (Möbius Transformations), Special Linear Fractional Transformations, Conformal Mapping by Other Functions, Applications: Electrostatic Fields, Use of Conformal Mapping. Modeling, Heat Problems, Fluid Flow. Poisson's Integral Formula for Potentials

Unit III

Laplace Transforms: Definitions and existence (without proof), properties, First Shifting Theorem (s-Shifting), Transforms of Derivatives and Integrals and ODEs, Unit Step Function (Heaviside Function).Second Shifting Theorem (t-Shifting), Short Impulses. Dirac's Delta Function. Partial Fractions, Convolution. Integral Equations, Differentiation and Integration of Transforms. Solution of ODEs with Variable Coefficients, Solution of Systems of ODEs. Inverse Laplace transform and its properties.
Fourier Analysis: Fourier Series, Arbitrary Period. Even and Odd Functions. Half-Range Expansions, Sturm–Liouville Problems. Fourier Integral, Fourier Cosine and Sine Transforms, Fourier Transform. Usage of fourier analysis for solution of ODEs. Inverse Fourier transform and its properties.

Unit IV

Partial Differential Equations (PDEs): Basic Concepts of PDEs. Modeling: Vibrating String, Wave Equation. Solution by Separating Variables. Use of Fourier Series. D'Alembert's Solution of the Wave Equation. Characteristics.

Modeling: Heat Flow from a Body in Space. Heat Equation Solution by Fourier Series.Steady Two-Dimensional Heat Problems. Dirichlet Problem. Heat Equation: Modeling Very Long Bars.Solution by Fourier Integrals and Transforms. Modeling: Membrane, Two-Dimensional Wave Equation. Rectangular Membrane. Laplacian in Polar Coordinates. Circular Membrane. Laplace's Equation in Cylindrical and Spherical Coordinates. Potential. Solution of PDEs by Laplace Transforms.

Textbooks:

1. *Advanced Engineering Mathematics* by Erwin Kreyszig, John Wiley, 10th Ed., 2011.

References:

1. *Engineering Mathematics* by K.A. Stroud with Dexter J. Booth, Macmillan, 2020.
2. *Advanced Engineering Mathematics* by Larry Turyn, Taylor and Francis, 2014.
3. *Advanced Engineering Mathematics* by Dennis G. Zill, Jones & Bartlett Learning, 2018.
4. *Advanced Engineering Mathematics with MATLAB* by Dean G. Duffy, Taylor and Francis, 2017.
5. *Advanced Engineering Mathematics* by Merle C. Potter, Jack L. Lessing, and Edward F. Aboufadel, Springer (Switzerland), 2019.
6. *Mathematical Methods for Physics and Engineering*, by K. F. Riley, M. P. Hobson and S. J. Bence, CUP, 2013.

Paper Code(s): ICT-158	**P : 2**
Paper: System Modelling Techniques Lab	**C : 1**
Prerequisites: None	
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term-End Semester Examinations: 60 Marks	
Instructions: **1.** The course objectives and course outcomes are identical to that of ICT-105 and ICT-108 as this is the practical component of these theory papers. **2.** The practical list shall be notified by the teacher in the first week of the class commencement.	

Paper Code(s): ICT-110 / ICT-117	L : 3
Paper: Semiconductor Engineering and its applications	C : 3

Prerequisites: None

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term-End Semester Examinations: 60 Marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Understand the semiconductor material
CO2	Understand different types of diodes and their properties
CO3	Understand Bipolar Junction transistor structures and their properties
CO4	Understand IC fabrication techniques

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	3	-	-	-	-	-	-	1
CO2	3	3	3	3	3	-	-	-	-	-	-	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	-	-	-	1

Unit I

Crystal lattices, unit cells, Miller indices, crystal directions, energy levels and energy bands, direct and indirect bandgap materials, semiconductor materials (Si, Ge, GaAs), intrinsic and extrinsic semiconductors, carrier concentration, Fermi energy, density of states, drift and diffusion of carriers, mobility, conductivity and resistivity, carrier generation and recombination, Einstein relation

Unit II

PN junction formation, equilibrium conditions, built-in potential, depletion region, Poisson's equation, carrier injection and current flow under bias, I-V characteristics, junction capacitance, temperature effects, Zener and avalanche breakdown, diode models and approximations, switching behavior, small signal analysis, real diode characteristics, metal-semiconductor contacts (ohmic and Schottky), Schottky diode, tunneling process, tunnel diodes.

Unit III

Bipolar junction transistor structure, modes of operation, current components, configurations and I-V characteristics, large signal current gains, Early effect, JFET structure and operation, MOSFET types (enhancement and depletion), MOSFET I-V characteristics, light-matter interaction in semiconductors, LEDs and photodiodes, photoconductivity, solar cells, phototransistors, laser diodes (introductory), PIN and avalanche photodiodes, applications in sensors and communication systems

Unit IV

Overview of IC fabrication, crystal growth and wafer preparation, oxidation, diffusion, ion implantation, photolithography, etching, metallization, cleanroom protocols, device modeling basics, continuity equation, drift-diffusion model, small-signal and large-signal models for PN junctions and optoelectronic devices, introduction to TCAD simulation tools (conceptual overview only)

Textbooks:

1. *Semiconductor Physics and Devices*, Donald A. Neamen, McGraw-Hill, Latest Edition.
2. *Solid State Electronic Devices*, Ben G. Streetman and Sanjay Banerjee, Pearson Education, Latest Edition.

References:

1. *Fundamentals of Semiconductor Devices*, Anderson and Anderson, McGraw-Hill, Latest Edition.
2. *Physics of Semiconductor Devices*, S.M. Sze and Kwok K. Ng, Wiley-Interscience, Latest Edition.
3. *Semiconductor Device Fundamentals*, Robert F. Pierret, Addison-Wesley, Latest Edition.
4. *Introduction to Microelectronic Fabrication*, Richard C. Jaeger, Prentice Hall, Latest Edition.
5. *Electronic Devices and Circuit Theory,* Robert L. Boylestad and Louis Nashelsky, Pearson Education, Latest Edition.

Paper Code(s): ICT-160 / ICT-157	**P : 2**
Paper: Semiconductor Engineering and its applications Lab	**C : 1**
Prerequisites: None	
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term-End Semester Examinations: 60 Marks	
Instructions: **1.** The course objectives and course outcomes are identical to that of ICT-110/ICT-117 as this is the practical component of these theory papers. **2.** The practical list shall be notified by the teacher in the first week of the class commencement.	

Paper Code(s): ICT-112	L : 2
Paper: Environmental Studies	C : 2
Prerequisites: None	

Marking Scheme:

1. Teachers Continuous Evaluation: 100 marks
2. This is NUES, non-credit and qualifying Paper. All evaluations to be conducted by the concerned teacher.

Course Outcomes (CO):

CO1	Understand Environment as a System of interconnected components
CO2	Understand environmental resources, renewable and non-renewable
CO3	Understand causes of different types of pollutions of the Environment and its effect on climate change
CO4	Understand regulations and policies related to environment

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	-	-	-	-	-	3	3	3	-	-	-	-
CO2	-	-	-	-	-	3	3	3	-	-	-	-
CO3	-	-	-	-	-	3	3	3	-	-	-	-
CO4	-	-	-	-	-	3	3	3	-	-	-	-

Unit I

Introduction to Environmental Studies, Scope and importance, Key environmental, Historical perspectives on human-environment interactions, Basic ecological principles and concepts, Levels of organization in ecology, Ecosystem components (biotic and abiotic), Energy flow in ecosystems, Biogeochemical cycles, Biodiversity and its conservation, Importance of biodiversity, Threats to biodiversity, Ecosystem services and their value.

Unit II

Renewable and non-renewable resources, Principles of sustainable resource use, Water resources and management, Global water distribution and availability, Water pollution , Challenges in water management, Land resources and degradation, Soil formation and types, Soil degradation processes, Land use patterns and their environmental impacts, Mineral resources and environmental consequences of extraction, Energy resources, Environmental impacts associated with different energy sources, Forests and wildlife resources, Importance of forests, Causes and effects of deforestation, Principles of wildlife conservation, Role of protected areas.

Unit III

Air pollution, Water pollution, Soil pollution, Noise pollution, Marine pollution, Thermal pollution, Hazardous waste management (sources, effects, mitigation for different pollution type). Electronic Waste (E-Waste) Management, Environmental toxicology, Public health and environment, Climate change (greenhouse effect, greenhouse gases, evidence of global warming and its impacts), Ozone layer depletion, Acid rain, Smog, Environmental disasters (overview of major natural and man-made disasters).

Unit IV

Overview of environmental legislation and policies, Role of government agencies in environmental protection, Concept and purpose of Environmental Impact Assessment (EIA), Sustainable development, Environmental ethics and philosophy (anthropocentrism, biocentrism, ecocentrism, deep ecology), Population and environment Urbanization and its environmental challenges, Role of environmental movements and Non-Governmental Organizations (NGOs), Importance of public participation in environmental decision-making, Case studies of environmental challenges and solutions, Individual actions for environmental protection and sustainability.

Textbooks:

1. *Environmental Studies*, Erach Bharucha, Orient Blackswan, 3rd edition, 2020.

References:

1. Environmental Science: Earth as a Living Planet, Daniel B. Botkin and Edward A. Keller, John Wiley & Sons, 11th edition, 2022.
2. Silent Spring, Rachel Carson, Houghton Mifflin, 1st edition, 2002.
3. Fundamentals of Ecology, Eugene P. Odum and Gary W. Barrett, Brooks Cole, 5th edition, 2005.
4. Living in the Environment, G. Tyler Miller and Scott Spoolman, Cengage Learning, 21st edition, 2021.

5. Environmental Science: Toward a Sustainable Future, Richard T. Wright and Dorothy F. Boorse, Pearson, 14th edition, 2021.
6. Environment, Peter H. Raven, David M. Hassenzahl, and Linda R. Berg, John Wiley & Sons, 11th edition, 2023.
7. The Human Impact on the Natural Environment, Andrew Goudie, Wiley Blackwell, 8th edition, 2018.
8. Energy and Civilization: A History, Vaclav Smil, MIT Press, 1st edition, 2017.
9. Environmental Chemistry, Colin Baird and Michael Cann, W. H. Freeman, 5th edition, 2012.
10. Environmental Chemistry, Stanley E. Manahan, CRC Press, 10th edition, 2017.
11. Environmental and Occupational Medicine, William N. Rom and Steven B. Markowitz (Eds.), Lippincott Williams & Wilkins, 5th edition, 2017.
12. The Limits to Growth, Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William W. Behrens III, Universe Books, 1st edition, 1972.
13. Environmental Ethics, Kristin S. Shrader-Frechette, Rowman & Littlefield Publishers, 3rd edition, 2002.
14. Environmental Geography, H. M. Saxena, Rawat Publications, 2nd edition, 2006.
15. Ecology, Environmental Science and Conservation, J. S. Singh, S. P. Singh, and S. R. Gupta, S. Chand & Company, 1st edition, 2014.
16. Environmental and Natural Resource Economics, Tom Tietenberg and Lynne Lewis, Pearson, 12th edition, 2022.
17. Principles of Ecosystem Stewardship: Resilience, Self-Organization, and Adaptation in Social-Ecological Systems, F. Stuart Chapin III, Margaret A. Palmer, and Osvaldo E. Sala (Eds.), Springer, 1st edition, 2010.
18. Studies and articles on the informal e-waste recycling sector in India.
19. United Nations Environment Programme (UNEP) publications on various environmental issues.
20. United Nations Sustainable Development Goals (SDGs) reports and official website.
21. United States Environmental Protection Agency (EPA) publications on pollution control.
22. World Health Organization (WHO) reports on environmental health.
23. World Wildlife Fund (WWF) reports on forest and wildlife conservation.