Rajarshi Janak University

Faculty of Science, Technology, & Engineering
Course of Study for B.Sc. CSIT
(First Year/ First semester)

Course Title: Technical Communication English
Nature of Course: Theory (6 Hrs.)
Credit Hrs.: 3

Course Code: CSEN 103
Full Marks: Ext(60)+Int(40)
Pass Marks: Ext(24)+Int(16)

Course Objectives:
After taking this course, students will be able to:

- Produce technical documents that use tools commonly employed by computer science professionals;
- Communicate effectively in a professional context, using appropriate rhetorical approaches for technical documents, adhering to required templates, and complying with constraints on documents format;
- Adapt content and rhetorical strategies according to the audience and purpose for each document;
- Select appropriate, credible sources to support the claims, findings or recommendations made in technical documents; and
- Incorporate ideas from source material, including images and figures.

Course Contents

Unit-1 Communication Process [5 hrs.]
Concept, Nature and Significance of Communication Process; Types of Communication; Models of Communication; Verbal and Non-verbal Communication; Barriers of Communication.

Unit-2 Basic Communication Skills [5 hrs.]
Introduction to Communication Skills: Oral Presentation; Reading, Listening, and Note Taking Skills; Writing Skills; Field Diary and Laboratory record.

Unit-3 Technical Skills for Effective Communication [9 hrs.]
Technical and Scientific Writing /Reporting; Forms of Scientific and Technical Writing; Features and Style of Technical Writing; Mechanics of Style: Abbreviations; Footnotes; Indexing and Bibliographic Procedures; Precise Writing / Abstracting / Summarizing; Curriculum Vitae / Resume Writing

Unit-4 Oral Communication and Organizational Skills [7 hrs.]
Impromptu Presentation and Extempore; Individual and Group Presentations; Group Discussion; Organizing Seminar and Conferences; Podcasting

Unit-5 Applications of Technical Writing [11 hrs.]

Literature Review; Article Writing (Overview); Letters; Memos; E-mail; Blog Writing; The Job Search; Instructions; Web Pages; PowerPoint Presentation; Brochures; Newsletters; Fliers; Graphics

Unit-6 Structural and Functional Grammar [8 hrs.]

Sentence Structure (identification of sentence, its types and transformation); Basic Grammatical Concepts on (Phrases and Clauses; Case: Subjective case, Possessive case, Objective case; Correct usage of Nouns; Correct usage of Pronouns and Antecedents; Correct usage of Adjectives; Correct usage of Adverbs; Correct usage of Articles; Agreement of Verb with the Subject: Tense; Voice; Reported Speech): teachers should not focus in detail because learners have already prior knowledge related to the given topics.

Text Books/ Reference Books:

1. Jha, S. K. & Meena Malik, *"Communication Skills"*
2. Gerson, Dr. Steven M., *"Writing That Works: A Teacher's Guide to Technical Writing"*, Developed and Published by Kansas Curriculum Centre, Washburn University, Topeka, KS. (For Unit-5)
3. Raman, Meenakshi and Prakash Singh, *"Business Communication",* 2nd Edition OXFORD UNIVERSITY PRESS.
4. Rutherford, Andrea J., *"Basic Communication Skills for Technology",* 2nd Edition, PEARSON EDUCATION.

Rajarshi Janak University

Institute of Science, Technology and Engineering
Course of Study for B.Sc. CSIT
(First Semester/First Year)

Course Title: Physics
Course Code: CSPH 102
Nature of Course: Theory (3 hr.) + Lab(3 hr.)
Full Marks: Ext(40+20)+Int(40)
Credit hrs. : 3
Pass Marks: Ext(16+8)+Int(16)

Course Description:
This course introduces the foundational concepts of Physics tailored for undergraduate students in Information Technology. The curriculum bridges classical and modern physics principles with real-world IT applications. Topics include mechanics, electromagnetism, quantum mechanics, and semiconductor physics, emphasizing their role in the development and functioning of hardware, sensors, and communication technologies. Through theoretical learning, practical problem-solving, and laboratory experiments, students will develop a strong physical intuition and the ability to apply physics principles in designing innovative IT solutions.

Course Objectives:
At the end of this course the students should be able:

- Understand the fundamental laws of physics and their applications in Information Technology systems.
- Analyze mechanical systems and electromagnetic phenomena relevant to computing and telecommunications.
- Explore the principles of quantum mechanics and semiconductor physics as they apply to electronic devices and circuits.
- Conduct experiments to measure and evaluate physical parameters, linking theoretical concepts with practical applications.
- Develop problem-solving skills to address challenges at the intersection of physics and information technology.

Course Contents Unit-1

Review **[3 hrs.]**

Newton's laws of motion, Conservation Laws and non-Conservative forces, Kinetic energy, wok-energy principle, potential energy in the case of conservative force field, conservative force as a negative gradient of P.E. curl of conservative force, Law of conservation of Mechanical energy for conservative forces.

Unit-2

Particle Dynamics **[5 hrs.]**

Rotational dynamics, torque, moment of inertia, angular momentum, conservation of angular momentum, Rotational Kinetic Energy, Motion of charged Particles in constant electric field. Motion of charge particle in uniform magnetic field, cyclotron, Motion of charged particle in combined electric and magnetic field.

Unit-3

Harmonic Oscillator **[7 hrs.]**

Physical Pendulum: Differential equation for motion of physical pendulum, time period, interchangeability of point suspension and point oscillation, maximum and minimum time period. **Torsional pendulum:** Differential equation for motion of torsional pendulum, Time Period, Modulus of rigidity of suspension wire of torsional pendulum. **Damped Oscillation:** Differential equation, critical damping, overdamping and underdamping, power dissipation and quality factor (Q-factor), LCR series circuit as damped EM(electromagnetic) oscillation, Forced or driven harmonic oscillation, resonance, Driven EM Oscillation

Unit-4

Electrostatics **[7 hrs.]**

Electric field intensity, electric dipole and dipole moment, electric field intensity due to dipole (at an axial and equatorial line), electric quadrupole and quadrupole moment. Electric field intensity due to quadrupole (at an axial line), Electric potential due to a dipole, electric potential due to quadrupole (at an axial line), Electric flux, Gauss's Law, Applications of Gauss's aw: Spherical charge distribution (conducting, and non-conducting), Capacitor and Capacitance, Parallel plate capacitor, supercapacitor (introduction only), energy stored in electric field, energy density, Gauss law of dielectrics, Relation between electric field(E), displacement vector (D) and Polarization vector(P)

Unit-5

Magneto-statics **[5 hrs.]**

Lorentz force, force on charge involving in magnetic field, force on current carrying conductor placed in magnetic field, **Hall effect**, **Biot-Savart' law**, Application of Biot-Savat Law, Magnetic field due to straight conductor carrying current in it, magnetic field on the axis of a current carrying coil, magnetic dipole formed by the current carrying coil and magnetic moment of that coil, Magnetic force between current carrying conductors, Energy stored in magnetic field and energy density, Magnetic energy in coupled circuits.

Unit-6

Maxwell's Equation **[4 hrs.]**

Gauss's divergence theorem, stokes theorem, Induced magnetic field in capacitor (Ampere-Maxwell law in electromagnetism), displacement current, Equation of continuity, Maxwell' EM wave equations (Integral form and Differential form), EM wave equation without and with source, Relation between electric and magnetic fields in EM wave, poynting vector

Unit-7

Circuit Analysis **[5 hrs.]**

Kirchoff's current and voltage law, concept of current source and voltage source, application of Kirchoff's current and voltage law to simple circuits, Thevenin's and Norton's theorems and their applications. Basic diode circuit: Forward and reverse biasing, knee voltage, breakdown voltage

Unit-8

Bipolar Junction Transistor **[4 hrs.]**

CB, CC, CE configurations and their characteristics, relation between α and β, DC load line and Q point , CB, CE, and CC amplifiers (introduction only)

Unit-9

Introduction of Quantum Mechanics **[5 hrs]**

Introduction, inadequacy of classical mechanics, De-Broglie theory, Heisenberg's uncertainty principle, phase velocity, group velocity. Wave function, Interpretation of wave function, Schrodinger wave equations, normalization of wave function.

Laboratory Work:

1. To draw I-V characteristics of Ohmic and non Ohmic resistors and find voltage current ratio.
2. To determine the impedance of a given LCR circuit.
3. To study characteristics of NPN transistor in CE mode, CB mode, CC mode.
4. To construct and study the working of NOT-AND-OR, NAND, NOR gates.
5. To study the characteristic of simple junction diode and Zener diode
6. To determine the value of acceleration due to gravity by using Bar Pendulum.
7. To determine the moment of inertia of a flywheel.
8. To determine the angular acceleration of a flywheel.
9. To determine of modulus of rigidity of wire by torsional pendulum.
10. To determine the low resistance by Carey Foster bridge.
11. To determine the magnetic field using search coil.

Note:
Course instructor can conduct atleast 7 experiments according to the requirement.

Text Books/ References Books

1. D. S. Mathur, "**Mechanics", (revised by P.S. Hemne),** S. Chand and Company Ltd
2. David J. Griffith, "**Introduction to Electrodynamics:**", 3rd Edition, 2002,Prentice Hall of India, New Delhi
3. A. P. Malvino, "**Principles of Electronics**", Tata Mc-Graw Hill Publication, 7th Edition
4. John R. Ritz, Frederick J. Milford and Robert W. Christy, "**Foundations of Electromagnetic Theory**", Narosa Publishing House
5. Newtonian Mechanics, P. French, "**MIT Introductory Physics Series**", Viva Bools Pvt Ltd
6. D. Halliday, R. Resnick, J. R. Christman and J. Walker, "**Fundamentals of Physics**", wiley
7. B. L. Theraja, "**Basic Electronics**",S.Chand& Company Ltd, New Delhi
8. V. K. Meheta,"**Principles of Electronics**",S.Chand& company Ltd. 5th Edition
9. Arora C. L. "**B.Sc. Practical Physics"**, S. Chand and Company Ltd. (2010)
10. Squires G. L. "**Practical Physics",** Cambridge University Press (1999)
11. Powel J.L. and Craseman V. **"Quantum Mechanics"** Narosa Publishing House, New Delhi 1994
12. Mathews P.M. and Venkatesan K. " **A Textbook of Quantum Mechanics**" Tata Mc-Graw Hill Publication,1997

Rajarshi Janak University
Faculty of Science, Technology, and Engineering
Course of Study for B.Sc.CSIT
(First Year / First Semester)

Course Title: Mathematics-I
Nature of Course: Theory (6 Hrs)
Credit Hrs: 3

Course Code: CSMT 101
Full Marks: Ext(60)+Int(40)
Pass Marks: Ext(24)+Int(16)

Course Description:
Functions, limits, continuity, differentiation, and integration of a single variable are all covered in this course. logarithmic, exponential, derivatives and antiderivatives, their applications, differential equations, vectors, and their uses, partial derivatives, and multiple integration are all covered.

Course Objectives:
This course aims to increase students' understanding and ability to translate real-world situations into mathematical assertions, generate course-appropriate solutions to mathematical problems, and represent mathematical answers visually or numerically.

Course Contents
Unit-1
Review of Elementary Concept of Sets and Functions: [4 hrs.]
Sets(only review), Representing function of one variable, Polynomial, Trigonometric, Exponential and Logarithmic functions, Range and domain of functions and their graphs, and inverse of functions.
Unit-2
Limits, Continuity, Discontinuous, and Derivatives: [5 hrs.]

Concept of Limit, Limit at infinity, Continuity, Conditions for function to be continuous and Location of finite Discontinuity, Asymptotes of Graphs, Concept of Derivative, Differentiation rules, Linearization and Differentials, Higher order Derivatives, Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy Mean Value Theorem, Maclaurin's, and Taylor's Theorem, and their applications.

Unit-3
Application of Derivatives: [5 hrs.]
Extreme Values of Functions on Closed Intervals, Monotonic Functions and the First Derivative Test, Concavity and Curve Sketching, Applied Optimization, and Newton’s Method.
Unit-4
Antiderivatives: [4 hrs.]
Review of Antiderivatives, Area and Estimating with Finite Sums, Sigma Notation and Limits of Finite Sums, The Definite integral, The Fundamental Theorem of Integral Calculus (Without Proof), Indefinite Integrals and the Substitutions, and the area between curves.

Unit-5

Application of Antiderivatives: [5 hrs.]

Volumes Using Cross-Sections, Volume using Cylindrical Shells, Arc Length, Areas of Surfaces of Revolution, Approximate Integrations.

Unit 6 [5 hrs.]

Double Integrals:

Double and Iterated Integrals over Rectangles, Double Integrals over General Regions, Area by Double Integration, Double Integrals in Polar Form, Applications of Double Integrals.

Unit-7

Ordinary Differential Equations: [5 hrs.]

Introduction, First Order Differential Equations, Variables Separable Equations, Linear Equations, Homogeneous and Non-homogeneous Equations, Exact equations, and Second Order Linear Differential Equations.

Unit-8

Partial Derivatives: [4 hrs.]

Functions of Several Variables, Partial Derivatives, Homogeneous functions, Euler's Theorem on Homogeneous Functions, Verification of Euler's Theorem with Examples.

Unit-9

Plain and Space Vectors: [4 hrs.]

Introduction, Applications, Dot product and Cross Product, Equations of Lines and Planes, Derivatives and Integrals of Vector Functions, Arc length and Curvature, Normal and Binomial Vectors.

Unit-10

Infinite Sequences and Series: [4 hrs.]

Sequences, Infinite Series, the Integral Test, Comparison Tests, Absolute Convergence; the Ratio and Root Tests, Alternating Series and Conditional Convergence, Power Series, and Taylor and Maclaurin Series**.**

Text Books/ Reference Books:

1. James Stewart, *"Calculus Early Transcendentals"*, 7E CENGAGE Learning.
2. George B. Thomas, *"Early Transcendentals"*, 12thEd. Wesley.
3. Howard Anton, IRL Bivens, and Stephen Davis, Calculus, 10th Edition, John Willey & Sons, Inc.

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Course of Study for B.Sc.CSIT
(First Semester/First Year)

Course Title: Digital Logic
Nature of Course: Theory (3Hrs) +lab (3 Hrs.)
Credit Hrs: 3 Hrs

Course Code: CSIT 105
Full Marks: Ext(40+20)+Int(40)
Pass Marks: Ext(16+8)+Int(16)

Course Description:
This modules is a foundational course that explores the principles and applications of digital systems. Students will learn the fundamentals of Boolean algebra, logic gates, combinational and sequential circuits, and the design of digital systems. Emphasis is placed on developing problem-solving skills through the analysis and synthesis of digital circuits. Practical applications in computing, communication, and embedded systems are also covered to provide real-world context. This course combines theoretical concepts with hands-on laboratory sessions to equip students with the knowledge and skills required for designing and implementing digital systems.

Course Learning Objectives:
By the end of this course, students will be able to:

1. Understand the fundamental principles of digital systems and Boolean algebra.
2. Analyze and design combinational logic circuits using logic gates and minimization techniques.
3. Understand the operation and applications of sequential circuits, including flip-flops, counters, and registers.
4. Develop skills to implement digital circuit designs using hardware description languages (e.g., Verilog) and simulation tools.
5. Apply digital logic concepts to solve real-world problems in computing and electronic systems.
6. Demonstrate proficiency in the use of laboratory equipment and software for the design and testing of digital systems.

Course Contents

Unit 1
Number System and Computer Codes **[7 hrs]**
Introduction, Types of number system, Applications, Weighted Number Systems, Conversions among number Systems, Binary Arithmetic,1's and 2's Complement,9's and 10's complement, Addition and Subtraction of Binary Numbers, Non-Weighted Number Systems: BCD code, Gray code, XS-3 code, Parity, Even and Odd Parity, BCD adder, Error detection and correction technique

Unit-2
Boolean algebra and Logic Gates [**7 hrs]**

Introduction, Signals, Analog and Digital Signals, Boolean Algebra, Truth Tables, Laws and Theorems of Boolean Algebra, Representation of Boolean Functions, Review of Basic Logic gates, Universal Gates, Arithmetic Gates, Implementations using Logic Gates, NAND and NOR Implementations, Positive and Negative Logic

Unit-3

Simplification of Boolean Functions and Combinational Logic [7 hrs]

K-Map, Truth Table to Karnaugh Map Sum-of-Products Method , Pairs, Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, conversion of SOP to POS and Vice-versa, Multi-Level NAND and NOR Circuits, Product-of-sums simplifications

Unit-4

Data-Processing Circuits [8 hrs]

Adders: Half Adder, Full Adder, Parallel Binary Adder, Subtractors: Half Subtractor, Full Subtractors, Multiplexers, De-multiplexers, Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Code Converter, Magnitude Comparator, Programmable Array Logic(PAL), Programmable Logic Arrays(PLA), Read-Only Memory(ROM)

Unit-5

Sequential Circuits [7 hrs]

RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge triggered JK FLIP-FLOPs , FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Various Representation of FLIP-FLOPs, Conversions of Flip-Flops, Applications of FLIP-FLOPs ,Design using state equation and state reduction table.

Unit 6

Registers, Counters and Memory [5hrs]

Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, **Counters:** Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus. Decade Counters, Pre-setable Counters, Counter Design as a Synthesis problem, Basic Memory Operations and Types

Unit-7 [2hrs]

Finite State Machines: Mealy State Machine, Moore State Machine, Components of ASM Charts

Unit-8

Logical Processor Design [3 hrs]

Processor Organization, Arithmetic and Logic Unit, Design of Arithmetic Circuit, Design of Logic Circuit, Design of Arithmetic Logic Unit, Status Register, Design of Shifter

Laboratory Works:

The laboratory work includes implementing the concept of digital electronics using different kit. Also the instructor can use the different online or offline simulation or VHDL software to demonstrate the working of different circuits.

1. Familiarization of logic gates and different kit
2. Combinational circuits
3. Code converters
4. Proof of De-Morgan's Theorem
5. Adder and Subtractors
6. Sequential Circuits
7. Flip-Flops
8. Counters

Text Books/Reference Books

1. Floyd, *"Digital Fundamentals"*, PHI
2. M Morris Mano, *"Digital Logic and Computer Design"*, Pearson, 2017.
3. Stephen Brown, ZvonkoVranesic, *"Fundamentals of Digital Logic Design with VHDL"*, 2nd Edition,Tata McGraw Hill,2005.
4. R D Sudhaker Samuel *"Illustrative Approach to Logic Design"*, Sanguine-Pearson, 2010.

Rajarshi Janak University
Faculty of Science and Technology
Course of Study for B.Sc. CSIT
(First Semester/First Year)

Course Title: Computer Concept and Programming
Nature of Course: Theory (3 Hr)+Practical (3 Hr)
Credit hrs.: 3

Course Code: CSIT 104
Full Mark: Ext(60+20)+Int(40)
Pass Mark: Ext(16+8)+Int(16)

Course Objectives:
This course will enable students to:

- Familiarize with writing of algorithms, fundamentals of C and philosophy of problem solving.
- Implement different programming constructs and decomposition of problems into functions.
- Use and implement data structures like arrays and structures to obtain solutions.
- Define and use of pointers with simple applications.
- Define different modes of graphics with simple application

Course Contents

Unit-1
Computer Fundamental and Programming Methodology [3 hrs.]
Introduction, Components of PC, Computer Architecture, Memory Types, Memory Hierarchy, Computer Peripherals, Input and Output Devices, Basic of Computer Networking, Computer Program, Steps for Program Development, Problem Solving Tools: Algorithmic Thinking and Flowchart, Pseudocode, Program Control Structures, Program Methodology, Program Models.

Unit-2
Overview of C Language [4 hrs.]
Introduction, C Character Set, Tokens, Identifiers, Keywords, Constants, Variables, Data Types, Type Conversion, Operators and Expressions, Structure of a C program, Managing Input and Output Operations, Common Errors in Programming, Debugging Basics.

Unit-3
Control Structures [6 hrs.]
Introduction, Decision Making Statements, Looping Statements, Branching Statements, Common Pitfalls: Infinite loops, Misplacement of Conditionals.

Unit-4
Arrays and Strings [6 hrs.]
Introduction, Types of Arrays, One-Dimensional Array, Multidimensional Arrays, String as Array of Characters, String Handling Functions

Unit-5

Functions **[8 hrs.]**

Introduction, User Defined Functions, Return Statement, Function Call, Types of Functions based on their Return Type and Function Call, Inline Functions, Recursions, Arrays and Functions, Preprocessor Directives and Standard Library Functions

Unit-6

Pointers **[5 hrs.]**

Introduction, Pointer Declaration, Initializing Pointers, Arithmetic Operations with Pointer, Pointers and Arrays, Pointers and Strings, Pointers and Functions, Pointer to a Pointer, Pointer to Void, Dynamic Memory Allocation

Unit-7

Structures and Unions **[5 hrs.]**

Introduction, Structure Declaration and Accessing Structure Elements, Initialization of a Structure, Array and Structures, Nested Structures, Structure and Function, Unions, Pointer to Structures and Unions

Unit-8

File Handling in C **[5 hrs.]**

Introduction, Basic Terminology Associated with Files, Types of Files, Streams and Files, Binary vs Text File ad File Buffering, File System Structures, Various Types of File Access Methods, Input and Output Operations on Files and Standard Devices, File Operations, Error Handling in Files, Command Line Arguments

Unit-9

Introduction to Graphics **[3 hrs.]**

Modes, Initialization, Graphics Function, drawing shapes, lines, working with Colours

Laboratory Work:

The Laboratory work must cover programming part of all the topics covered in the course. The instructor can conduct the programming as required. Some important contents that should be included in lab exercises are as follows:

1. Create algorithms and flowchart for solving the problem.
2. Create, compile, debug, run and test simple C programs
3. Create decision making programs using control statements like; if, if..else, if..else ladder, nested if, and switch cases.
4. Create programs using loops (for, while, do while, nested loops) and realize the differences between entry controlled and exit controlled loops.
5. Create, manipulate arrays and matrices (single and multi-dimensional), work with pointers, dynamically allocate/de-allocate storage space during runtime, manipulate strings (character arrays) using various string handling functions.
6. Create user-defined functions with/without parameters or return type, create recursive functions, use function call by value and call by address, work with automatic, global and static variables.

7. Create programs that addresses pointer arithmetic, pointers and arrays, pointer and character strings, pointers and functions, pointer and structure, and dynamic memory allocation.
8. Create and use simple structures, array of structures, nested structure. Passing structure and array of structure to function, concept of pointer to structure
9. Create files that address random access and input/output operations in file, create files to keep records and manipulation of records etc.
10. Create graphics program that address some basic functions of *graphics.h* header file, e.g. line(), arc(), circle(), rectangle() etc.

Mini project can be assigned by Course Instructor covering the content from the syllabus taught.

Text Books/Reference Books

- Balagurusamy, E. (2019), **Programming in ANSI C (8th ed.),** New Delhi, India: Tata McGraw-Hill.
- Bryon S Gottfried (2018), **Programming with C (4th ed.),** Mc Graw Hill India.
- PK Sinha, **Computer Fundamentals (8th ed.)**, BPB Publications, India
- Dennis M. Ritchie, Brian W. Kernighan, **The C Programming Language (2nd ed.)**, Prentice Hall.
- Kanetkar, Y. P. (2022), **Let us C (15th Ed.)**, New Delhi, BPB Publication