# COURSE STRUCTURE

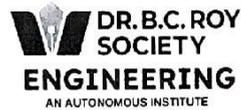## *for*

# B.TECH. DEGREE

## *in*

# COMPUTER SCIENCE & DESIGN

## *(Applicable from the academic session 2024-2025)*

**DR. B.C. ROY SOCIETY**
**ENGINEERING**
AN AUTONOMOUS INSTITUTE

## Dr. B. C. Roy Engineering College

### *An Autonomous Institution*

*Approved by: All India Council for Technical Education (AICTE)*

*Affiliated to: Maulana Abul Kalam Azad University of Technology, West Bengal*
*(Formerly Known as -WBUT)*

### Jemua Road, Durgapur, West Bengal, India,713206

The first year course structure (Page 3 and Page 4) is unanimously accepted and approved in the first BoS meeting held in the Department of a) Physics, b) Chemistry, c) Mathematics, d) English, e) Electrical Engineering, f) Electronics and Communication Engineering, g) Computer Science and Engineering, h) Mechanical Engineering.

The BoS of CSD (Computer Science & Design) in its first meeting (held in the Department of CSD (Computer Science & Design) on 6th November 2024 has unanimously accepted and approved the four year course structure of CSD (Computer Science & Design).

HOD
Computer Sc. & Design
Dr. B. C. Roy Engineering College

# Dr. B. C. Roy Engineering College, Durgapur
## (An Autonomous Institution)
### Syllabus for B. Tech in Computer Science & Design

| \ | | | Semester: III | | |
|---|---|---|---|---|---|
| Sl. No. | Course Type | Course Code | Course Title | Engagement Type | Credit |
| 1 | ES | CSD-301 | Digital System Design | T | 3 |
| 2 | PC | CSD-302 | Data Structure & Algorithms | T | 3 |
| 3 | PC | CSD-303 | Computer Organisation & Architecture | T | 3 |
| 4 | PC | CSD-304 | Microprocessor & Microcontroller | T | 3 |
| 5 | PC | CSD-305 | Creative Thinking Process and Design | T | 3 |
| 6 | BS | CSD-306 | Mathematics-III | T | 3 |
| 7 | ES | CSD-391 | Digital System Design Lab | P | 2 |
| 8 | PC | CSD-392 | Data Structure & Algorithms Lab | P | 2 |
| 9 | PC | CSD-393 | Computer Organisation & Architecture Lab | P | 2 |
| 10 | PC | CSD-394 | IT Workshop with Python | P | 2 |
| TOTAL CREDIT | | | | | 26 |

| Semester-III | | | |
|---|---|---|---|
| **Subject/Course Name** | Digital System Design | **Subject/Course Code** | CSD-301 |
| **Contact Lecture/Week** | 3 | **Tutorial** | 1 |
| **Credit** | 3 | **Maximum Marks** | 100 |
| **Examination Scheme** | | | |
| **Internal Exam (CIA)** | 40 | **Final Exam (ESE)** | 60 |

| **Objective** | |
|---|---|
| 1 | To acquire the basic knowledge of different Analog components and their applications |
| 2 | To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits. |
| 3 | To prepare students to perform the analysis and design of various digital electronic circuits |
| 4 | |
| 5 | |

| **Prerequisite** | |
|---|---|
| 1 | Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic BJTs, |
| 2 | Basic concept of the working of P-N diodes, Schottky diodes, |
| 3 | Basic FETs and OPAMP as a basic circuit component. Concept of Feedback. |
| 4 | |

| Unit | Content | Hours/Unit |
|---|---|---|
| 1 | Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillators A stable & Monostable Multi vibrators; Schimtt Trigger circuits, 555 Timer. | 9 |
| 2 | Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms; Minimization of logic expressions by algebraic method. Combinational circuits – Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De- Multiplexer and Parity Generator. | 11 |

| 3 | Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter | 10 |
| 4 | A/D and D/A conversion techniques –Basic concepts (D/A :R-2-R only [2L] A/D: successive approximation [2L]) Logic families- TTL, ECL, MOS and CMOS - basic concepts. (2L) | 6 |

**Textbook and Reference Books**

| 1 | Microelectronics Engineering –Sedra & Smith - Oxford. |
| 2 | Analog Electronics, A.K. Maini, Khanna Publishing House (AICTE Recommended -2018) |
| 3 | Analog Electronics, L.K. Maheswari, Laxmi Publications (AICTE Recommended -2018) |
| 4 | Principles of Electronic Devices & circuits—B L Thereja &Sedha—S Chand |
| 5 | Digital Electronics – Kharate – Oxford |
| 6 | Digital Electronics – Logic & Systems by J. Bigmell &R. Donovan; Cambridge Learning. |
| 7 | Digital Logic and State Machine Design (3rd Edition) – D. J. Comer, OUP |

| 8 | Electronic Devices & Circuit Theory – Boyelstad &Nashelsky - PHI |

| **Course Outcome :** On completion of the course students will be able to |  |
| --- | --- |
| CSD-301.1 | Define / Explain the fundamental concepts / terms of Digital System Design and its necessity / importance. |
| CSD-301.2 | Apply the basic principles to solve simple model problems related to Digital System Design in the real world. |
| CSD-301.3 | Analyze a given Digital System Design problem, design and implement a solution, and compute the output. |
| CSD-301.4 | Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Digital System Design problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution. |
| CSD-301.5 | Identify unsolved real world Digital System Design problems, Synthesize pragmatic ideas and Create innovative solutions to such problems |

**Course Articulation Matrix:**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **Average** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |

|      | PSO1 | PSO2 | PSO3 |
|------|------|------|------|
| CO1  | 3    | 3    | 3    |
| CO2  | 3    | 3    | 3    |
| CO3  | 3    | 3    | 3    |
| CO4  | 3    | 3    | 3    |
| CO5  | 3    | 3    | 3    |

# Dr. B. C. Roy Engineering College, Durgapur
## (An Autonomous Institution)
### Syllabus for B. Tech in Computer Science & Design

| Semester-III | | | |
|---|---|---|---|
| **Subject/Course Name** | Data Structure & Algorithms | **Subject/Course Code** | CSD-302 |
| **Contact Lecture/Week** | 3 | **Tutorial** | 1 |
| **Credit** | 3 | **Maximum Marks** | 100 |
| **Examination Scheme** | | | |
| **Internal Exam (CIA)** | 40 | **Final Exam (ESE)** | 60 |

| Objective | |
|---|---|
| 1 | To learn the basics of abstract data types. |
| 2 | To learn the principles of linear and nonlinear data structures. |
| 3 | To build an application using sorting and searching |
| 4 | |
| 5 | |

| Prerequisite | |
|---|---|
| 1 | Basic Computation and Principles of C |
| 2 | Mathematics, basics of set theory |
| 3 | |
| 4 | |

| Unit | Content | Hours/Unit |
|---|---|---|
| 1 | Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis. | 9 |
| 2 | Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis. | 9 |

| 3 | Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.<br><br>Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis.<br><br>Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis. | 9 |
|---|---|---|
| 4 | Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis. | 9 |

**Textbook and Reference Books**

| 1 | Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung. |
|---|---|
| 2 | "Data Structure & Algorithms Using C", 5thEd., Khanna Publishing House |
| 3 | "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson freed. |
| 4 | "Data Structures in C" by Aaron M. Tenenbaum. |
| 5 | "Data Structures" by S. Lipschutz. |
| 6 | "Data Structures Using C" by Reema Thareja. |
| 7 | "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev. |
| 8 | "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein |

**Course Outcome :** On completion of the course students will be able to

| CSD-302.1 | Define / Explain the fundamental concepts / terms of Data Structure & Algorithms and its necessity / importance. |
|---|---|
| CSD-302.2 | Apply the basic principles to solve simple model problems related to Data Structure & Algorithms in the real world. |
| CSD-302.3 | Analyze a given Data Structure & Algorithms problem, design and implement a solution, and compute the output. |
| CSD-302.4 | Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Data Structure & Algorithms problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution. |
| CSD-302.5 | Identify unsolved real world Data Structure & Algorithms problems, Synthesize pragmatic ideas and Create innovative solutions to such problems |

**Course Articulation Matrix:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **Average** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |

| | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 |

| Semester-III | | | |
|---|---|---|---|
| **Subject/Course Name** | Computer Organization & Architecture | **Subject/Course Code** | CSD-303 |
| **Contact Lecture/Week** | 3 | **Tutorial** | 1 |
| **Credit** | 3 | **Maximum Marks** | 100 |
| **Examination Scheme** | | | |
| **Internal Exam (CIA)** | 40 | **Final Exam (ESE)** | 60 |

| **Objective** | |
|---|---|
| 1 | To prepare students to perform the analysis and design of various digital electronic circuits. |
| 2 | To know how Computer Systems work & its basic principles |
| 3 | To know how I/O devices are being accessed and its principles etc |
| 4 | |
| 5 | |

| **Prerequisite** | |
|---|---|
| 1 | Concept of basic components of a digital computer, Basic concept of Fundamentals & Program structures. Boolean Algebra |
| 2 | Basic number systems, Binary numbers, representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming |
| 3 | Boolean Algebra |
| 4 | |

| Unit | Content | Hours/Unit |
|---|---|---|
| 1 | Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes. [7L] Commonly used number systems. Fixed and floating point representation of numbers. [1L] | 8 |
| 2 | Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. [3L] Design of ALU. [1L] Fixed point multiplication -Booth's algorithm. [1L] Fixed point division - Restoring and non- restoring algorithms. [2L] Floating point - IEEE 754 standard. [1L] | 8 |

| 3 | Memory unit design with special emphasis on implementation of CPU-memory interfacing. [2L] Memory organization, static and dynamic memory, memory hierarchy, associative memory. [3L] Cache memory, Virtual memory. Data path design for read/write access. [5L] | 10 |
|---|---|---|
| 4 | Design of control unit - hardwired and micro-programmed control. [3L] Introduction to instruction pipelining, Hazards [2L] Introduction to RISC architectures. RISC vs CISC architectures. [2L] I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA. [3L] | 10 |

**Textbook and Reference Books**

| 1 | Mano, M.M., "Computer System Architecture", PHI. |
|---|---|
| 2 | Behrooz Parhami "Computer Architecture", Oxford University Press |
| 3 | Hayes J. P., "Computer Architecture & Organisation", McGraw Hill, |
| 4 | Hamacher, "Computer Organisation", McGraw Hill, |
| 5 | N. Senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers" OUP |
| 6 | Chaudhuri P. Pal, "Computer Organisation & Design", PHI, |
| 7 | P N Basu- "Computer Organization & Architecture", Vikas Pub |
| 8 | Rajaraman – "Computer Organization & Architecture", PHI |
| 9 | B. Ram – "Computer Organization & Architecture", Newage Publications |

**Course Outcome:** On completion of the course students will be able to

| CSD-303.1 | Define / Explain the fundamental concepts / terms of Computer Organization & Architecture and its necessity / importance. |
|---|---|
| CSD-303.2 | Apply the basic principles to solve simple model problems related to Computer Organization & Architecture in the real world. |
| CSD-303.3 | Analyze a given Computer Organization & Architecture problem, design and implement a solution, and compute the output. |
| CSD-303.4 | Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Computer Organization & Architecture problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution. |
| CSD-303.5 | Identify unsolved real world Computer Organization & Architecture problems, Synthesize pragmatic ideas and Create innovative solutions to such problems |

**Course Articulation Matrix:**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| Average | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |

|     | PSO1 | PSO2 | PSO3 |
| --- | --- | --- | --- |
| **CO1** | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 |

# Dr. B. C. Roy Engineering College, Durgapur
## (An Autonomous Institution)
### Syllabus for B. Tech in Computer Science & Design

| Semester-III | | | |
|---|---|---|---|
| **Subject/Course Name** | Microprocessor & Microcontroller | **Subject/Course Code** | CSD-304 |
| **Contact Lecture/Week** | 3 | **Tutorial** | 1 |
| **Credit** | 3 | **Maximum Marks** | 100 |
| **Examination Scheme** | | | |

| **Internal Exam (CIA)** | 40 | **Final Exam (ESE)** | 60 |
|---|---|---|---|

**Objective**

| 1 | To introduce students with the architecture and operation of typical microprocessors. |
|---|---|
| 2 | To familiarize the students with the programming and interfacing of microprocessors. |
| 3 | To provide strong foundation for designing real world applications using microprocessors. |
| 4 | |

**Prerequisite**

| 1 | Data and number system, Boolean algebra, Combinational and Sequential circuits. |
|---|---|
| 2 | |

| Unit | Content | Hours/Unit |
|---|---|---|
| 1 | Introduction and Architecture of 8085 microprocessor: Definition of Microprocessor & Microcomputer System, The evolution of microprocessors (from 4 bits onwards). Basic functions of a microprocessor. Various sections of 8085 Microprocessor such as Register section, Arithmetic & Logic Unit, Timing control unit, Interface Section etc., Pin configuration of 8085, timing diagram & execution, DE multiplexing& buffering of system buses of 8085 CPU. Instruction set, classification of instructions, addressing modes, software model of 8085 CPU. | 10 |
| 2 | Assembly Language Programming using 8085 CPU: Program writing for different arithmetic operation with 8-bit & 16-bit binary numbers and BCD numbers, writing program using time delays & calculation of T-states, Concepts of Stack & Sub routine, Program for searching & sorting using Stack & Subroutine. Code conversion, concept of look-up table. | 11 |
| 3 | Memory and Memory interfacing, Interrupt structure of 8085 and I/O interfacing technique: Memory elements; RAM, ROM, PROM, EPROM, EEPROM, Memory constituents. Memory expansion; Interfacing of RAM, ROM, EPROM & DRAM etc., EPROM programming. & their uses. Different interrupts used for 8085, RIM, SIM. | 8 |

| 4 | Peripheral mapped I/O & Memory mapped I/O, data transfer schemes synchronous, asynchronous & interrupt driven data transfer, DMA data transfer, and Use of SID and SOD pins of 8085. | 4 |
|---|---|---|

**Textbook and Reference Books**

| 1 | Microprocessor Architecture, Programming & Application-R. Gaonkar, Wiley. |
|---|---|
| 2 | Fundamentals of microprocessor, Uday Kumar, Pearson. |
| 3 | 8085 Microprocessor Programming & Interfacing- N.K Srinath - PHI. |
| 4 | Microprocessor-Theory & Application-M. Rafiquezzaman; PHI. |
| 5 | Advanced Microprocessor & Peripherals-Ray & Bhurchnadi, Tata - McGrowHill. |
| 6 | Fundamentals of Microprocessors and Microcontrollers – B. Ram, Dhanpat Rai. |
| 7 | |
| 8 | |

**Course Outcome :** On completion of the course students will be able to

| CSD-304.1 | Define / Explain the fundamental concepts / terms of Microprocessor & Microcontroller and its necessity / importance. |
|---|---|
| CSD-304.2 | Apply the basic principles to solve simple model problems related to Microprocessor & Microcontroller in the real world. |
| CSD-304.3 | Analyze a given Microprocessor & Microcontroller problem, design and implement a solution, and compute the output. |
| CSD-304.4 | Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Microprocessor & Microcontroller problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution. |
| CSD-304.5 | Identify unsolved real world Microprocessor & Microcontroller problems, Synthesize pragmatic ideas and Create innovative solutions to such problems |

**Course Articulation Matrix:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **Average** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |

|      | PSO1 | PSO2 | PSO3 |
|------|------|------|------|
| CO1  | 3    | 3    | 3    |
| CO2  | 3    | 3    | 3    |
| CO3  | 3    | 3    | 3    |
| CO4  | 3    | 3    | 3    |
| CO5  | 3    | 3    | 3    |

| Semester-III | | | |
|---|---|---|---|
| **Subject/Course Name** | Creative Thinking Process and Design | **Subject/Course Code** | CSD-305 |
| **Contact Lecture/Week** | 3 | **Tutorial** | 1 |
| **Credit** | 3 | **Maximum Marks** | 100 |
| **Examination Scheme** | | | |
| **Internal Exam (CIA)** | 40 | **Final Exam (ESE)** | 60 |
| **Objective** | | | |
| 1 | This course aims to present an overview of the design thinking involved at each stage of the design process: the methods used by designers to generate and refine creative ideas, the key considerations that help shape them and the feedback and review elements that allow design teams to learn from each job and contribute to future commissions. | | |
| 2 | | | |
| **Prerequisite** | | | |
| 1 | | | |

| Unit | Content | Hours/Unit |
|---|---|---|
| 1 | Introduction: Example of different kinds of designs and designers, Good and bad designs, Design problems, Definition of Design, engineering design and design research, their Importance.<br><br>Product life cycle, Morphology of design, Introduction to system design process, Stage models.<br><br>Introduction to Task Clarification: overall process and steps, Methods for Data collection and collation including patent analysis, Methods for identification of requirements: Role Playing, Checklists, Solution neutral problem statements, etc. Quantifying requirements and Assigning importance to requirements, Linking Customer requirements to engineering requirements: Quality Function Deployment techniques. | 14 |

| 2 | **Idea generation**<br>Introduction to conceptual design: Identification of functions, Ideation, Simulation and Consolidation into solution proposals, Methods for Identification of functions such as functional decomposition techniques, Methods for Ideation, such as Brainstorming, value, Synectics, etc., Methods for consolidation into solution proposals, such as Morphological charts, Morphological matrix, etc., Methods for simulation: analytical, virtual and physical simulations<br><br>**Refinement**<br>Methods for improvement of solution proposals, such as contradiction analysis, various other TRIZ techniques, etc, Systematic evaluation of concepts: ordinal methods and cardinal methods. Thinking in images, Thinking in signs, Appropriation, Humour, Personification, Visual metaphors, Modification, Thinking in words, Words and language, Type 'faces', Thinking in shapes, Thinking in proportions, Thinking in colour | 14 |
|---|---|---|

| 3 | **Prototyping**<br>Developing designs, 'Types' of prototype, Vocabulary<br>**Implementation**<br>Format, Materials, Finishing, Media, Scale, Series/Continuity | 8 |
|---|---|---|

**Textbook and Reference Books**

| 1 | Gavin Ambrose, Paul Harris, "Basics Design - 8: Design Thinking", illustrated, reprint, AVA Publishing, 2010 |
|---|---|
| 2 | Christian Müller-Roterberg, "Handbook of Design Thinking", Kindle Direct Publishing ISBN: 978- 1790435371, November 2018. |
| 3 | Christine Charyton, *Creative Engineering Design Assessment*, Springer |
| 4 | Warren K Wake Wake, *Design Paradigms: A Sourcebook for Creative Visualization*, John Wiley & Sons |
| 5 | |

**Course Outcome:** On completion of the course students will be able to

| CSD-305.1 | Define / Explain the fundamental concepts / terms of Creative Thinking Process and Design and its necessity / importance. |
|---|---|
| CSD-305.2 | Apply the basic principles to solve simple model problems related to Creative Thinking Process and Design in the real world. |
| CSD-305.3 | Analyze a given Creative Thinking Process and Design problem, design and implement a solution, and compute the output. |
| CSD-305.4 | Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Creative Thinking Process and Design problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution. |
| CSD-305.5 | Identify unsolved real world Creative Thinking Process and Design problems, Synthesize pragmatic ideas and Create innovative solutions to such problems |

**Course Articulation Matrix:**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| Average | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |

|  | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| CO1 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 |

# Dr. B. C. Roy Engineering College, Durgapur
## (An Autonomous Institution)
### Syllabus for B. Tech in Computer Science & Design

| Semester-III | | | |
|---|---|---|---|
| **Subject/Course Name** | Mathematics-III (Differential Calculus) | **Subject/Course Code** | CSD-306 |
| **Contact Lecture/Week** | 3 | **Tutorial** | Nil |
| **Credit** | 3 | **Maximum Marks** | 100 |
| **Examination Scheme** | | | |
| **Internal Exam (CIA)** | 40 | **Final Exam (ESE)** | 60 |

| Objective | |
|---|---|
| 1 | To know Convergence of sequence and series |
| 2 | To know Limit, continuity and partial derivatives, Chain rule, Implicit function |
| 3 | To know First Order Differential Equation, Exact, Linear and Bernoulli's equations, Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph |
| 4 | |
| 5 | |

| Prerequisite | |
|---|---|
| 1 | Concept Linear Algebra Determinant and its properties (up to third order) |
| 2 | Minor and cofactors, Matrices, addition, multiplication and transpose of a matrix, Symmetric and skew symmetric |
| 3 | |
| 4 | |

| Unit | Content | Hours/Unit |
|---|---|---|
| 1 | Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions. | 7 |
| 2 | Limit, continuity and partial derivatives, Chain rule, Implicit function, Jacobian, Directional derivatives, Total derivative; Maxima, minima and saddle points; Gradient, curl and divergence and related problems. | 7 |
| 3 | Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes (Statement only) and related problems. | 7 |

| | | |
|---|---|---|
| 4 | First Order Differential Equation, Exact, Linear and Bernoulli's equations, Equations of first order but not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's form, general & singular solution. <br><br> Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation. | 7 |
| 5 | Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph. Matrix Representation: Incidence & Adjacency matrix. Tree: Basic Concept of tree, Binary tree, Spanning Tree, KrusKal and Prim's algorithm for finding the minimal spanning tree. | 8 |

**Textbook and Reference Books**

| | |
|---|---|
| 1 | Higher Algebra, S. K. Mapa, Levant Books. |
| 2 | Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd. |
| 3 | Co-ordinate Geometry, S. L. Loney |
| 4 | Integral Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd. |
| 5 | Differential Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd. |
| 6 | Advanced Engineering Mathematics, E Kreyszig |
| 7 | Advanced Engineering Mathematics, Chandrika Prasad & Reena Garg, Khanna Publishing House (AICTE Recommended Textbook -2018) |
| 8 | |

**Course Outcome :** On completion of the course students will be able to

| | |
|---|---|
| CSD-306.1 | Define / Explain the fundamental concepts / terms of Mathematics-III (Differential Calculus) and its necessity / importance. |
| CSD-306.2 | Apply the basic principles to solve simple model problems related to Mathematics-III (Differential Calculus) in the real world. |
| CSD-306.3 | Analyze a given Mathematics-III (Differential Calculus) problem, design and implement a solution, and compute the output. |
| CSD-306.4 | Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Mathematics-III (Differential Calculus) problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution. |
| CSD-306.5 | Identify unsolved real world Mathematics-III (Differential Calculus) problems, Synthesize pragmatic ideas and Create innovative solutions to such problems |

**Course Articulation Matrix:**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **Average** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |

|  | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 |

| Semester-III (PRACTICAL) | | | |
|---|---|---|---|
| **Subject/Course Name** | IT Workshop with Python | **Subject/Course Code** | CSD-394 |
| **Contact Practical/Week** | 4 | **Tutorial** | Nil |
| **Credit** | 2 | **Maximum Marks** | 100 |
| **Examination Scheme** | | | |
| **Internal Exam (CIA)** | 40 | **Final Exam (ESE)** | 60 |
| **Objective** | | | |
| 1 | To master an understanding of scripting & the contributions of scripting languages | | |

| | | | |
|---|---|---|---|
| 2 | Design real life problems and think creatively about solutions | | |
| 3 | Apply a solution in a program using Python. | | |
| 4 | To be exposed to advanced applications of mathematics, engineering and natural sciences to program  real life problems. | | |
| 5 | | | |
| **Prerequisite** | | | |
| 1 | Knowledge of Programming Logic | | |
| 2 | Experience with a high level language (C/C++,) is suggested | | |
| 3 | Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory. | | |
| 4 | | | |

| Sl No | Content |
|---|---|
| 1 | **Introduction**: History, Features, Setting up path, working with Python, Basic Syntax, Variable and Data Types, Operator. |
| 2 | **Conditional Statements**: If, If- else, Nested if-else, Looping, For, While, Nested loops |
| 3 | Control Statements: Break, Continue, Pass |
| 4 | **String Manipulation**: Accessing Strings, Basic Operations, String slices, Function and Methods. |
| 5 | **Lists**: Introduction, Accessing list, Operations, Working with lists, Function and Methods |
| 6 | **Tuple**: Introduction, Accessing tuples, Operations, Working, Functions and Methods |
| 7 | **Dictionaries**: Introduction, Accessing values in dictionaries, working with dictionaries, Properties |

| 8 | **Functions**: Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables |
|---|---|
| 9 | **Modules**: Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions. |
| 10 | **Exception Handling**: Exception, Exception Handling, except clause, Try? Finally clause, User Defined Exceptions. |

**Course Articulation Matrix:**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **Average** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |

|  | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 |

| Semester-III (PRACTICAL) | | | |
|---|---|---|---|
| **Subject/Course Name** | Digital System Design Lab | **Subject/Course Code** | CSD-391 |
| **Contact Practical/Week** | 4 | **Tutorial** | Nil |
| **Credit** | 2 | **Maximum Marks** | 100 |
| **Examination Scheme** | | | |
| **Internal Exam (CIA)** | 40 | **Final Exam (ESE)** | 60 |
| **Objective** | | | |
| 1 | Know the characteristics of various components. | | |
| 2 | Understand the utilization of components. | | |
| 3 | Design and analyse small signal amplifier circuits | | |
| 4 | Postulates of Boolean algebra and to minimize combinational functions | | |
| 5 | Design and analyse combinational and sequential circuits | | |
| 6 | Know about the logic families and realization of logic gates. | | |
| **Prerequisite** | | | |
| 1 | Theoretical Knowledge about the subject CSD-301 | | |
| 2 | | | |

| Sl No | Content |
|---|---|
| 1 | **Analog Electronics** : Design a Class A amplifier |
| 2 | Design a Phase-Shift Oscillator |
| 3 | Design of a Schmitt Trigger using 555 timer |
| 4 | **Digital Electronics**: Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output. |
| 5 | Construction of simple Decoder & Multiplexer circuits using logic gates. |
| 6 | Realization of RS / JK / D flip flops using logic gates |
| 7 | Design of Shift Register using J-K / D Flip Flop |
| 8 | Realization of Synchronous Up/Down counter |
| 9 | Design of MOD- N Counter |
| 10 | Study of DAC |

**Course Articulation Matrix:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| Average | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |

| | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| CO1 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 |

# Dr. B. C. Roy Engineering College, Durgapur
## (An Autonomous Institution)
### Syllabus for B. Tech in Computer Science & Design

| Semester-III (PRACTICAL) | | | |
|---|---|---|---|
| **Subject/Course Name** | Data Structure & Algorithms Lab | **Subject/Course Code** | CSD-392 |
| **Contact Practical/Week** | 4 | **Tutorial** | Nil |
| **Credit** | 2 | **Maximum Marks** | 100 |
| **Examination Scheme** | | | |
| **Internal Exam (CIA)** | 40 | **Final Exam (ESE)** | 60 |
| **Objective** | | | |
| 1 | Be able to design and analyze the time and space efficiency of the data structure | | |
| 2 | Be capable to identity the appropriate data structure for given problem | | |
| 3 | Have practical knowledge on the applications of data structures | | |
| 4 | | | |
| **Prerequisite** | | | |
| 1 | Pre-requisites as in CSD-302 | | |
| 2 | | | |

| Sl No | Content |
|---|---|
| 1 | Implementation of array operations |
| 2 | Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements |
| 3 | Merging Problem: Evaluation of expressions operations on Multiple stacks & queues: |
| 4 | Implementation of linked lists: inserting, deleting, and inverting a linked list. Implementation of stacks & queues using linked lists |
| 5 | Polynomial addition, Polynomial multiplication |
| 6 | Recursive and Non-recursive traversal of Trees |
| 7 | Threaded binary tree traversal. AVL tree implementation |
| 8 | Application of Trees. Application of sorting and searching algorithms |
| 9 | Hash tables implementation: searching, inserting and deleting, searching & sorting techniques. |

| | |
|---|---|
| 10 | Some programming beyond syllabus |

**Course Articulation Matrix:**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |
| **Average** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 |

|  | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 |

| Semester-III (PRACTICAL) | | | |
|---|---|---|---|
| **Subject/Course Name** | Computer Organization & Architecture Lab | **Subject/Course Code** | CSD-393 |
| **Contact Practical/Week** | 4 | **Tutorial** | Nil |
| **Credit** | 2 | **Maximum Marks** | 100 |
| **Examination Scheme** | | | |
| **Internal Exam (CIA)** | 40 | **Final Exam (ESE)** | 60 |
| **Objective** | | | |
| 1 | | | |
| 2 | | | |
| **Prerequisite** | | | |
| 1 | Pre-requisites as in CSD-303 | | |
| 2 | | | |

| Sl No | Content |
|---|---|
| 1 | Familiarity with IC-chips: a) Multiplexer, b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification from Data-book. |
| 2 | Design an Adder/Subtractor composite unit. |
| 3 | Design a BCD adder. |
| 4 | Design of a 'Carry-Look-Ahead' Adder circuit. |
| 5 | Use a multiplexer unit to design a composite ALU |
| 6 | Use ALU chip for multibit arithmetic operation |
| 7 | Implement read write operation using RAM IC |
| 8 | 8. (a) & (b) Cascade two RAM ICs for vertical and horizontal expansion. |
| 9 | Any experiment specially designed by the college (Detailed instructions for Laboratory Manual to be followed for further guidance) |

**Course Articulation Matrix:**

|         | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1     | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 1   | 1   | 2    | 1    | 3    |
| CO2     | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 1   | 1   | 2    | 1    | 3    |
| CO3     | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 1   | 1   | 2    | 1    | 3    |
| CO4     | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 1   | 1   | 2    | 1    | 3    |
| CO5     | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 1   | 1   | 2    | 1    | 3    |
| Average | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 1   | 1   | 2    | 1    | 3    |

|     | PSO1 | PSO2 | PSO3 |
|-----|------|------|------|
| CO1 | 3    | 3    | 3    |
| CO2 | 3    | 3    | 3    |
| CO3 | 3    | 3    | 3    |
| CO4 | 3    | 3    | 3    |
| CO5 | 3    | 3    | 3    |