COURSE STRUCTURE

For

B.TECH. DEGREE

in

COMPUTER SCIENCE & ENGINEERING

(Applicable from the academic session 2024-2025)

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 CSE (Computer Science and Engineering) in its first meeting (held in the Department of CSE (Computer Science and Engineering) on 6th November 2024 has unanimously accepted and approved the four year course structure of CSE (Computer Science and Engineering).

Head
Dept. Computer Science & Eng
Dr. B. C. Roy Engineering College
Durgapur

Semester 3								
Sl No	**Course Type**	**Paper Code**	**Paper Name**	**Marks**	**L**	**T**	**P**	**Credit**
Theory								
1	PC	CS301	Data Structure & Algorithms	100	3	0	0	3
2	PC	CS302	Computer Organization & Architecture	100	3	0	0	3
3	BS	CS303	Advance Engineering Mathematics	100	3	0	0	3
4	ES	CS304	Analog & Digital Electronics	100	3	0	0	3
5	BS	CS305	Biology	100	3	0	0	3
			Total Theory	500	15	0	0	15
Practical								
6	PC	CS391	Data Structure & Algorithms Lab	100	0	0	4	2
7	PC	CS392	Computer Organization & Architecture Lab	100	0	0	4	2
8	PC	CS393	Python Programming Lab	100	0	1	4	3
9	ES	CS394	Analog & Digital Electronics Lab	100	0	0	4	2
			Total Practical	400	0	1	16	9
			Total of 3rd Semester	900	15	1	16	24
Total Credits								**24**

Course Name: Data Structure & Algorithm
Course Code: CS301
(Semester-III)
Category: Major
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   - ESC-CS 202(Programming for Problem Solving)
   - BSC-M 101(Mathematics-I) & BSC-M 202(Mathematics-II), basics of set theory

2. **Course Learning Objectives:**
   i. To learn the basics of abstract data types.
   ii. To learn the principles of linear and nonlinear data structures.
   iii. To build an application using sorting and searching

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Data Structure & Algorithm
   Course Code: CS301
   Hours per Week: 3L : 0T : 0P
   Credits: 3

Module	Topics	Lectures
Unit 1	**Introduction to Data Structure.** Basic Terminologies: Elementary Data Organizations. Classification of Data Structure, Data Structure Operations: insertion, deletion, traversal etc. Algorithms, Different approaches to designing an algorithm. Asymptotic Notations: Big O, Omega, Theta notation. Time and Space complexity: (Worst-case, Average-case, Best-case time complexity).	5L
Unit 2	**Arrays:** Introduction, Declaration of Arrays, Operations on Arrays: (Traversing, Inserting, Deleting, Merging), Sparse Matrices, Applications of Arrays.	4L
Unit 3	**Linked Lists:** **Introduction.** **Singly linked lists (Algorithms and complexity analysis):** Operations: Traversing, Searching, Inserting, Deleting. **Circular Linked List(Algorithms and complexity analysis):** Operations: Inserting, Deleting. **Doubly Linked List(Algorithms and complexity analysis):** Operations: Inserting, Deleting. **Circular Doubly Linked List(Algorithms and complexity analysis):** Operations: Inserting, Deleting. **Header Linked List, Application of Linked List** 3.7.1 Polynomial Representation.	10L
Unit 4	**Stacks (Algorithms and complexity analysis):** Introduction to Stack. Array Representation of Stacks. Operations on a Stack: Push, Pop, Peek and Display. Linked Representation of Stacks. Operations on a Linked Stack: Push, Pop and Display.	6L

	Applications of Stacks: Recursion, Evaluation of Arithmetic Expressions: Infix, Prefix, Postfix and Tower of Hanoi Problem. **Queues (Algorithms and complexity analysis):** Introduction to Queues. Array Representation of Queues. Linked Representation of Queues. Types of queues and their operations: Linear Queues, Circular Queues, Dques or Double Ended Queues, Priority Queues. Applications of Queues.	
Unit 5	**Trees(Algorithms and complexity analysis)**: **Introduction & Basic Terminologies.** **Binary Trees:** Binary Tree Creation, Binary Tree Traversal (Pre-order, In-order, Post-order), Constructing a Binary Tree from Traversal Result. **Binary Search Trees:** Operations of Binary Search trees: Searching, insertion, deletion, determining the height, finding the smallest and largest node etc. **Threaded Binary Tree:** Types, Traversing, Advantage and Disadvantage. **AVL Tree:** (Operations on AVL trees, Searching)[in Brief] **Red-Black Tree:**[in Brief] Properties, Operations, Applications. **Introduction to M-Way search Tree**.[in Brief] B Trees: Operations of B Tree(searching, insertion, deletion), Application of B Tree.	8L
Unit 6	**Sorting(Algorithms and complexity analysis)**: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Shell Sort and Radix Sort. **Searching(Algorithms and complexity analysis)**:Linear Search, Binary Search and Interpolation Search. **Hashing:** Introduction, Hash Tables, Hash Functions. **Graph:** Introduction, Basic Terminologies, Graph Traversal algorithms(BFS and DFS), Shortest path algorithms.	7L

6. References:

Text & References Books:

- "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
- "Data Structure & Algorithms Using C", 5th Ed., Khanna Publishing House (AICTE Recommended – 2018)
- "Fundamentals of Data Structures of C" by Ellis Horowitz, SartajSahni, Susan Andersonfreed.
- "Data Structures in C" by Aaron M. Tenenbaum.
- "Data Structures" by S. Lipschutz.
- "Data Structures Using C" by ReemaThareja.
- "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
- "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein
- "Data Structures through C" by YashwantKanetkar, BPB Publications.
- "Expert Data Structures with C++" by R.B Patel, Khanna Publishing House

7. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CS301.1	Explain how the choices of data structure & algorithm methods impact the performance of an algorithm.	Explain	L2
CS301.2	Discuss different kinds of operations, algorithms with complexity analysis and applications of stack, queue and linked list.	Remember, Understand, Apply	L2
CS301.3	Understand the non-linear data structure like trees and graphs, their definitions, algorithms with complexity analysis and applications.	Remember, Understand, Apply	L2
CS301.4	Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.	Remember, Understand, Apply	L2
CS301.5	Illustrate the benefits of dynamic and static data structures implementations.	Remember, Understand, Apply	L3

8. Mapping of course outcomes to module / course content

Module	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
1	3	2	1	1	1	-
2	2	3	-	-	1	-
3	2	3	-	-	1	-
4	2	3	-	-	1	-
5	1	-	3	-	1	-
6	1	-	2	3	1	-

9. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CS301.1	3	2	2	2	-	1	-	-	-	-	3
CS301.2	3	3	3	3	-	1	-	-	-	-	3
CS301.3	3	3	3	3	-	1	-	-	-	-	3
CS301.4	3	3	3	3	-	1	-	-	-	-	3
CS301.5	3	2	2	2	-		-	-	-	-	3
AVG.	**3.0**	**2.6**	**2.6**	**2.6**	-	**1.0**	-	-	-	-	**3.0**

10. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS301.CO1	3	1	—
CS301.CO2	3	2	—
CS301.CO3	3	2	1
CS301.CO4	3	2	—
CS301.CO5	2	2	—

***** End of Syllabus*** < CS301>**

Course Name: Computer Organization & Architecture
Course Code: CS302
(Semester- III)
Category: Major
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

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

2. **Course Learning Objectives:**
   i. To prepare students to perform the analysis and design of various digital electronic circuits.
   ii. To know how Computer Systems work & its basic principles.
   iii. To know how I/O devices are being accessed and its principles etc

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Computer Organization & Architecture
   Course Code: CS302
   Hours per Week: 3L : 0T : 0P
   Credits: 3

Module	Topics	Lectures
Unit 1	**Basic Organization of Stored Program Computer** – and operation sequence for execution of a program **Role of Operating Systems and Compiler/Assembler** – in instruction execution **Fetch-Decode-Execute Cycle** – with emphasis on control flow **Concept of Operator, Operand, Registers, and Storage** **Instruction Format** – structure of instructions **Instruction Sets and Addressing Modes** – types and usage [7L] **Commonly Used Number Systems** – Binary, Octal, Hexadecimal, etc. **Fixed and Floating Point Representation of Numbers** – (basic intro only) [1L]	8L
Unit 2	**Overflow and Underflow Concepts** – [Part of overall ALU functionality] **Design of Adders** – Ripple Carry and Carry Look-Ahead Principles [3L] **Design of ALU** – Structure and functional blocks [1L] **Fixed Point Arithmetic**: ● **Multiplication** – Booth's Algorithm [1L] ● **Division** – Restoring and Non-Restoring Algorithms [2L] **Floating Point Representation** – IEEE 754 Standard [1L]	8L
Unit 3	**Memory Unit Design** – With special emphasis on CPU-memory interfacing [2L] **Memory Organization** – Static and dynamic memory, memory hierarchy, associative memory [3L] **Advanced Memory Concepts** – Cache memory, Virtual memory[2L] **Data Path Design** – For read/write access [3L]	10L
Unit 4	**Design of Control Unit** – Hardwired and Microprogrammed Control [3L] **Instruction Pipelining** – Introduction, Pipeline Hazards [2L] **RISC Architectures** – Introduction to RISC, RISC vs. CISC [1L]	6L
Unit 5	**I/O Operations** – Handshaking, Polled I/O, Interrupt, DMA [3L] **Introduction to ARM Architecture** – Register set, instruction format, pipeline features [3L]	6L

6. **References:**
   Text & References Books:
   - Mano, M.M., "Computer System Architecture", PHI.

- Behrooz Parhami “Computer Architecture”, Oxford University Press
- Hayes J. P., “Computer Architecture & Organisation”, McGraw Hill,
- Hamacher, “Computer Organisation”, McGraw Hill,
- N. Senthil Kumar, M. Saravanan, S. Jeevananthan, “Microprocessors and Microcontrollers” OUP
- Chaudhuri P. Pal, “Computer Organisation & Design”, PHI,
- P N Basu- “Computer Organization & Architecture” ,Vikas Pub
- Rajaraman – “Computer Organization & Architecture”, PHI
- B.Ram – “Computer Organization & Architecture”, Newage Publications

7. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CS302.1	Illustrate the history of modern computers and the Von Neumann architecture	Illustrate	L2
CS302.2	Demonstrate basic number systems, Binary numbers, representation of signed and unsigned numbers, Floating point representation	Demonstrate	L2
CS302.3	Define addressing modes, instruction formats.	Define	L1
CS302.4	Distinguish the organization of various parts of a system memory hierarchy i.e. cache memory, virtual memory etc.	Distinguish	L4
CS302.5	Classify basics of systems topics like, single-cycle (MIPS), multi-cycle (MIPS), parallel, pipelined, superscalar, and RISC/CISC architectures.	Classify	L4
CS302.6	Define different control unit operations and I/O organization	Define	L1

8. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	Y	Y	Y	-	-	-
2	-	Y	Y	-	-	-
3	-	-	-	Y	-	-
4	-	-	-	-	Y	Y

9. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3	2	-	-	-	-	-	-
CO2	3	3	3	3	3	-	-	-	-	1	-
CO3	3	3	3	1	3	-	-	-	-	2	-
CO4	3	2	3	3	2	-	-	-	-	1	-
CO5	3	2	3	3	-	-	-	-	-	2	2
CO6	3	3	3	2	3	-	-	-	-	3	3
AVG.	3	2.67	3	2.5	2.6	0.0	0.0	0.0	0.0	1.8	2.5

10. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS302.CO1	1	—	—
CS302.CO2	2	—	—
CS302.CO3	2	1	—
CS302.CO4	2	1	1
CS302.CO5	3	2	1
CS302.CO6	2	1	—

***** End of Syllabus*****

Course Name: Advanced Engineering Mathematics
Course Code: CS303
(Semester III)
Course Broad Category: B. Tech CSE

1. **Course Prerequisite:**
   Concept of Mathematics in B. Tech 1st and 2nd semester.

2. **Course Learning Objectives:**
   This module provides students with essential mathematical tools for analyzing and solving real-world problems. It introduces concepts of probability, including random variables, key distributions, and stochastic processes like Markov chains and Poisson Processes. Students will learn statistical methods such as measures of central tendency, correlation, regression, curve fitting, and hypothesis testing for data analysis. Numerical approximation techniques are covered, focusing on interpolation and solving nonlinear equations while understanding numerical errors and solution of ODE by numerical Methods. The module also explores methods for solving optimization problems involving single variable and multivariable functions.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies, Guest Lectures.

   Evaluation System –

i. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
ii. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
iii. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Advanced Engineering Mathematics Course Code: CS303(CSE)
   Hours per Week: 3L: 1T: 0P
   Credits: 3

Module	Topics	45L
1.	**Probability:** Review on Basic Probability theory, Random Variable, Discrete and continuous random variables, Mathematical expectation, properties of expectation and variance, Discrete (Binomial and Poisson's distribution) and Continuous Probability Distribution (Normal and exponential distribution). Continuous and Discrete Bivariate distributions and their properties, Conditional and Marginal densities.	10L
2.	**Stochastics Process:** Definition, classification, and examples of stochastic processes; stationary and autoregressive processes; discrete-time Markov chains; continuous-time Markov chains, Poisson process.	8L

Module	Topics	45L
3.	**Statistics:** Law of large numbers, central limit theorem, sampling distributions, chi square distribution, Student's 't' distribution, F distribution. **Applied Statistics:** Correlation and regression – Rank correlation, Curve fitting by the method of least squares-fitting of straightlines. **Inferential Statistics:** Estimation of Parameters: Point estimation: sufficiency, unbiased estimation, maximum likelihood estimation, confidence intervals for mean, Hypothesis testing: type-I and type-II errors, One and two tailed tests. Test for single mean, difference of means, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	12L
4.	**Approximation in numerical computation:** Motivation and application, Rounding off a number, Different types of error (Significant, inherent, Truncation etc.), Different kinds of difference operators. **Interpolation-**Newton forward/backward interpolation, Lagrange's interpolation formula. **Numerical solutions of nonlinear algebraic/transcendental equations**: Bisection and Newton-Raphson methods. **Solution of ODE:** RK4 Method.	9L
5.	**Optimization:** Hyperplanes and Linear Varieties; Convex and concavity of non-linear function. Introduction and Classical Optimization Techniques: Statement of an Optimization problem, classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization, multi variable Optimization- without constraints, multivariable Optimization with equality constraints- Solution by method of Lagrange multipliers, Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.	6L

5.

References:

Text Book:

- Kapoor, V.K., and Gupta, S.C.: Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
- Kapoor, V.K., and Gupta, S.C.: Fundamentals of Applied Statistics, Sultan Chand & Sons.
- Medhi, J.: Stochastic Processes, New Age International Publishers.
- Ravindran, Phillips, Solberg: Operations Research Principles and Practices
- M. K. Jain, S.R.K. Iyengar & R.K. Jain: Numerical Methods for scientific & Engineering Computation.
- E. Kreyszig: Advanced Engineering Mathematics, Wiley Publications

Reference Books:

- Mukhopadhyay, P.: Mathematical Statistics, New Central Book Agency.
- Dreyfus, S.E.: The Art and Theory of Dynamic Programming: Theory and Applications, Academic Press.

- Goon, A.M., Gupta, M.K., and Dasgupta, B.: Outlines of Statistics, Vol. II, The World Press Private Ltd.
- Hoel, P.G.: Introduction to Mathematical Statistics, John Wiley & Sons.
- Hogg, R.V., Tanis, E.A., and Rao, J.M.: Probability and Statistical Inference (7th Edition), Pearson.
- Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.
- Stephen G. Nash, A. Sofer: Linear and Non-linear Optimization, McGraw Hill
- S.S. Sastry: Introductory methods of Numerical Analysis, PHI learning.

6. Course Outcomes (CO):

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CS303.1	Learn to apply different tools in basic probability theory which would enable them to devise engineering solutions to encounter in their profession life.	Identify	Remember
CS303.2	Understand the uncertainties and risks, and to model and analyze the lifetime or failure characteristics of components, systems, or processes.	Explain	Understand
CS303.3	Apply statistical tool in analyzing the data in making decisions of any real-life problems.	Implement	Apply
CS303.4	Solve complex problems using numerical methods and approximation techniques with precision and accuracy.	Organize	Analyze
CS303.5	Formulate and optimize solutions for practical problems by applying systematic and logical approaches.	Assess	Evaluate
CS303.6	Build up logical and analytical skills to create a new idea appreciated by academics, research & emerging trends in industry.	Construct	Create

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	2	1	-	-	1
2	2	3	1	-	-	1
3	2	1	3	1	-	1
4	1	-	2	3	-	1
5	2	1	2	2	3	1

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	1	2	-	-	-	-	-	1
CO2	2	2	2	1	-	-	-	-	-	-	1
CO3	1	2	2	1	1	-	-	-	-	-	1
CO4	1	2	1	1	2	-	-	-	-	-	2
CO5	2	2	2	2	2	-	-	-	-	-	1
CO6	1	1	1	1	-	-	-	-	-	-	1

9. Mapping to Program Specific Outcome (PSO)

	PSO1	PSO2	PSO3
CS303.CO1	2	—	—
CS303.CO2	2	—	—
CS303.CO3	3	—	—
CS303.CO4	3	—	—
CS303.CO5	3	—	1
CS303.CO6	2	—	2

***** End of Syllabus*****

Course Name: Analog & Digital Electronics Course Code: CS304
(Semester-III)
Category: Major
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   i. Basic Electronics Parts I & II learned in the First year, semesters 1&2. Basic BJTs,.
   ii. Basic concept of the working of P-N diodes, Schottky diodes,
   iii. Basic FETs and OPAMP as a basic circuit component. Concept of Feedback
2. **Course Learning Objectives:**
   a. To acquire the basic knowledge of different analog components and their applications
   b. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
   c. To prepare students to perform the analysis and design of various digital electronic circuits
3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology –Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.
4. **Course Content:**
   Course Name: Analog & Digital Electronics Course Code: CS304
   Hours per Week: 3L:0T:0P
   Credits: 3

Module	Topics	Lectures
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 Astable & Monostable Multivibrators; Schimtt Trigger circuits, 555 Timer.	9L
Unit 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	11L
Unit 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	10L

Unit 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)	6L

5. References:

Text & References 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
9. Bell-Linear IC & OP AMP—Oxford
10. P.Raja- Digital Electronics- Scitech Publications
11. Morries Mano- Digital Logic Design- PHI
12. R.P.Jain—Modern Digital Electronics, 2/e ,McGraw Hill
13. H.Taub & D.Shilling, Digital Integrated Electronics- McGraw Hill.
14. D.RayChaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
15. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
16. J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
17. Leach & Malvino—Digital Principles & Application, 5/e, McGraw Hill
18. Floyed & Jain- Digital Fundamentals-Pearson.

6. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CS304.1	Realize the basic operations of different analog components.		
CS304.2	Realize basic gate operations and laws Boolean algebra.		
CS304.3	Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.		

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-

4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

9. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS304.CO1	1	—	—
CS304.CO2	2	—	—
CS304.CO3	2	1	—

***** End of Syllabus*****

Course Name: BIOLOGY FOR ENGINEERS
Course Code: CS305
(Semester- III)
Course Broad Category: BASIC SCIENCE

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1. **Course Prerequisite:**
   - Class-X-XII level knowledge of Biology and Bio-Environmental Science.
   - Undergraduate level introductory knowledge of Bio- Engineering.

2. **Course Learning Objectives:**
   - This course imparts basic knowledge of biology, evolution, general awareness of environmental pollution effects and bio-engineering's aspects with cancer biology that provides the basic ideas among the engineering students for a better foundation of technical education.
   - To provide fundamentals among the upcoming young engineers and to carry out advanced technical and machinery research projects in biology and allied domains.

3. **Teaching methodology for the course:**

Teaching methodology –

- Lectures and Presentations,
- Interactive Discussions and Studies,
- Guest Lectures ,
- Field Visits.

4. **Evaluation System for the course :**
   Evaluation System –

CIA 1 (Total: 40 Marks)

- Class Test (Objective + Subjective): 25 Marks (Duration: 1 hour)
- Assignment: 10 Marks
- Attendance: 5 Marks

CIA 2 (Total: 40 Marks)

- Class Test (Objective + Subjective): 25 Marks (Duration: 1 hour)
- Assignment: 10 Marks
- Attendance: 5 Marks

5. **Course Content:**
   Course Name: Biology For Engineers
   Course Code: CS305
   Hours per Week: 3L: 0T: 0P
   Credits: 3

Module	Topics	36 L
6.	**Introduction to Biology in Engineering** ● Science & Engineering ● Biology in Engineering ● Instruments inspired by Biology (Camera and Aeroplane) ● Major Biological discoveries of18thto21thCentury. CO Explain that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.	3L
7.	Cell Biology ● Cell types (Unicellular & Multi cellular, Prokaryotic & Eukaryotic, Plant & Animal Cell) ● Cell organelles and the irfunction (Cell Wall, Cell Membrane, Nucleus, Ribosome, Mitochondria and other cellular organelles) ● Cell Division ● Biomolecules - Carbohydrates, Proteins, Lipids and Nucleic Acids, ● Biochemical qualitative tests for macromolecules CO Identify that Cell is a basic material of life, required biomolecules are valuable for Cell, i.e. living organisms.	5L
8.	**Microbiology** ● Classification of microorganisms, Bacteria, viruses, fungi, and protozoa. ● Hierarchy classification of living organisms. ● Growth curves and factors affecting growth. ● Applications in Engineering (Industrial microbiology and Environmental Microbiology, Soil Engineering) CO Demonstrate that hierarchy classification of living organisms and their growth factors and also economic engineering application.	3L
9.	**Genetical Engineering** ● Laws of inheritance, Monohybrid and dihybrid crosses, Extensions to Mendelism ● Molecular basis of Inheritance (DNA replication, transcription, and translation, Genetic code and mutations) ● Concept of Gene, Gene mapping, Concept of operon, Geneticdisorders	4L

Module	Topics	36 L
	CO Develop that Genetics is the main part of bio-engineering.	
10.	**Biochemistry and Biophysical techniques** ● Thermodynamics in Biology, Enzyme Kinetics and Regulation ● Metabolic Pathways (Glycolysis, Krebscycle, oxidative phosphorylation: Cell surface receptors, signaling through G-protein coupled receptors, Phosphatidyl inositol pathway, second messengers, cellular transport- Na+-K+ ATPase pump.) ● Hormones ● Biophysical techniques (Chromatography, Electrophoresis, Spectroscopy, Centrifugation, Microscopy, PCR) CO Explain that biochemistry and biophysics gives us details knowledge about all bio-metabolisms of living organisms.	5L
15.	**Environmental Bio-Engineering** ● Origin of Life and theories of Evolution, Natural selection and adaptation, Phylogenetic Tree, ● Patterns and Mechanism of Evolution (Genetic Grift, Mutation, Genetic Variation, Gene Flow,) ● Evolution in Human Genome CO Remember that Evolution, is a very important part of human genetic mutation, which can keeping pace with evolution. ● Ecosystems, Biodiversity and its importance, Pollution and its effects ● Bioremediation(Principlesandtechniques,Applicationsinenvironmental engineering) ● Engineering technology in Wildlife Sciences and Conservation CO Design that there is a relationship between environment and bio engineering.	6L
16.	**Biotechnology & Bioinformatics** ● Principles and processes of Biotechnology ● Application of Biotechnology in health and agriculture ● Recombinant DNA Technology, Tissue Culture ● Bioinformatics tools and databases, Sequence alignment and analysis, Applications CO Demonstrate applications of Bioinformatics and biotechnology in your daily life.	5L
17.	**Immunology & Cancer Biology** ● Innate and adaptive immunity, Cells and organs of the immune system, Humor al and cell-mediated immunity ● Immunological Disorders and treatment ● Types and stages of cancer, Genetic and environmental factors	5L

Module	Topics	36 L
	• Molecular Mechanisms (Oncogenes and tumor suppress orgenes, Cell cycle regulation and apoptosis) and Treatment. CO Presenting the details information of bio engineering applications in medical field according to diseases and its treatments.	

6. References Text Book:

1. Biology of Engineers, McGraw Hill (ISBN: 978-11-21439-931)
2. Biology For Engineers: Dr. Sandhimita Mondal & Dr. Arnab Ganguli : Aryan Publishing House
3. Lehninger's Principles of Biochemistry by David L Nelson; A.L. Lehninger and Michael M. Cox, 5thedition, Worth Publishing.
4. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company.
5. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons.
6. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers
7. Principles Of Cancer Biology : Lewis J. Kleinsmith : Pearson Education Limited Edinburgh Gate, Harlow, Essex CM20 2JE ISBN 10:1-292-02788-6 ISBN 13: 978-1-292-02788-3 Pearson Education India.
8. Fundamentals of Biochemistry : J.L Jain : S CHAND & Company Limited

7. Reference Books:

9. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher.
10. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
11. Smith &Vanness, Thermodynamics for Chemical Engineers, MGH
12. Shuler and Kargi, Bioprocess engineering: Basic concepts, 2nd edition, Prentice Hall publisher
13. Electron Microscopy in Biology: J. R. Harris (ed).
11. Biochemistry by Lubert Stryer, John L Tymoczko, Jerry M. Berg, 5th edition, W.H. Freeman Company.
12. Principles of Fluorescence Spectroscopy, J.R. Lakowicz; (Springer)
13. Fundamentals of Molecular Spectroscopy - C.N. Banwell, (Tata- McGraw-Hill)
14. Biological Spectroscopy-I.D. Cambell & R.A. Durk, (Benjamin Cummings)
15. Biophysics-V. Pattabhi & N. Gautham (Narosa, New Delhi)
16. Introduction to Electron Microscopy: S. Wischnitzer.
17. Textbook of soil and water conservation, **AUTHORS: RAJIV DUBEY, VINAY KUMAR GAUTAM, DEEPAK SHARMA, LAXMI L. SOMANI AND R.C. DADHEECH PUBLISHING YEAR: 2020 ISBN**: **9788183215350**

8. Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO-1	Explain that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.	Explain	Understand
CO-2	Identify that the cell is a basic material of life, required biomolecules are valuable for Cell, i.e. living	Identify,	Understand
CO-3	Demonstrate the hierarchy classification of living organisms and their growth factors and also economic engineering application	Demonstrate	Apply
CO-4	Develop that Genetics is the main part of bio-engineering.	Develop	Create
CO-5	Explain that biochemistry and biophysics gives us details knowledge about all bio-metabolisms of living organisms.	Explain	Understand
CO-6	Remember that Evolution, is a very important part of human genetic mutation, which can keeping pace with evolution. Design that there is a relationship between environment and bio engineering.	Remember Design	Understand Create
CO-7	Demonstrate applications of Bioinformatics and biotechnology in your daily life.	Demonstrate	Apply
CO-8	Presenting the details information of bio engineering applications in medical field according to diseases and its treatments.	Presenting	Analyse

9. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6	CO7	CO8
1	3	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-
3	-	-	3	2	-	-	3	-
4	-	-	2	3	-	-	-	3
5	-	-	-	-	3	-	-	-
6	-	-	-	-	-	3	-	-
7	3	-	-	-	2	-	2	-
8	-	3	2	-	-	-	-	-

10. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	2	-	-	-	-	-
CO2	1	2	3		2	-	2	-	-	-	-	1
CO3	1	2	3	2	2	-	2	-	-	-	-	1
CO4	1	2	3	3	2	-	2	-	-	-	-	2
CO5	1	2	2	2	-	-	2	-	-	-	-	-
CO6	1	2	-	-	-	-	2	-	-	-	-	-
CO7	1	2	-	-	-	-	2	-	-	-	-	-
CO8	1	2	-	-	-	-	2	-	-	-	-	-

11. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS305.CO1	—	—	—
CS305.CO2	—	—	—
CS305.CO3	1	—	1
CS305.CO4	1	—	1
CS305.CO5	—	—	—
CS305.CO6	1	—	2
CS305.CO7	1	—	2
CS305.CO8	1	—	2

End of Syllabus

Course Name: Data Structure & Algorithm Lab
Course Code: CS391
(Semester-III)
Category: Major
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   - ESC-CS 202 (Programming for Problem Solving).
   - BSC-M 101(Mathematics-I) & BSC-M 202(Mathematics-II), basics of set theory.

2. **Course Learning Objectives:**
   i. To build an application of linear and nonlinear data structures.
   ii. To build an application using sorting and searching

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   For each laboratory courses there shall be a CIA during the semester for 60 marks and 40 marks for ESE.
   - **Continuous Internal Assessment of laboratory courses (PCIA) [60 Marks]**
     - Regular Laboratory Performance (20 Marks)
     - Experiment Execution and Results (15 Marks)
     - Laboratory Record/Report (10 Marks)
     - Viva Voce/Quiz (5 Marks)
     - Attendance (10 Marks)
   - **End Semester Examination of Laboratory Course (PESE) [40 marks]**
     - Write-Up about the given Experiment/Program [10 marks]
     - Execution of the Experiment/Program [10 marks]
     - Evaluation of the outcome or results of the Experiment/Program [10 marks]
     - Viva-Voce (on the concerned Experiment/Programming) [10 marks]

4. **Course Content:**
   Course Name: Data Structure & Algorithm Lab
   Course Code: CS391
   Hours per Week: 0L : 0T : 4P
   Credits: 2

Module	Topics	Lab
Unit 1	Implementation of array operations. Stacks: adding, deleting elements. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion. Linear Queue: Adding & deleting elements. Circular Queue: Adding & deleting elements. Double Ended Queue: Adding & deleting elements.	5P
Unit 2	Merging Problem: Evaluation of expressions operations on Multiple stacks & queues:	1P
Unit 3	Implementation of linked lists: Linear Linked list: inserting, deleting. Circular Linked list: inserting, deleting. Doubly Linked list: inserting, deleting and inverting a linked list. Implementation of stacks & queues using linked list. Polynomial addition, Polynomial multiplication.	4P
Unit 4	Binary search Tree, Threaded binary tree traversal. AVL tree implementation. Application of sorting and searching algorithms.	4P
Unit 5	Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.	1P

Linear Data Structure	
Laboratory Experiments:	
1	Implementation of array operations.
2	Stacks: adding, deleting elements. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion. Linear Queue: Adding & deleting elements. Circular Queue: Adding & deleting elements. Double Ended Queue: Adding & deleting elements.
3	Merging Problem: Evaluation of expressions operations on Multiple stacks & queues:
4	Implementation of linked lists: Linear Linked list: inserting, deleting. Circular Linked list: inserting, deleting. Doubly Linked list: inserting, deleting and inverting a linked list. Implementation of stacks & queues using linked lists
5	Polynomial addition, Polynomial multiplication.
Non Linear Data Structure	
6	Recursive and Non-recursive traversal of Trees
7	Binary search Tree, 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.

Any experiment specially designed by the college

(Detailed instructions for Laboratory Manual to be followed for further guidance)

5. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CS391.1	Apply the knowledge of arrays, Evaluate the different kinds of operations of stack and queue.		L3
CS391.2	Implement stack, queue, addition, and multiplication of polynomials using the concept of linked lists.		L3
CS391.3	Solve recursive and non-recursive tree traversal, threaded binary tree traversal, and AVL tree implementation.		L3
CS391.4	Demonstrate through a program the applications of tree, sorting, and searching algorithms.		L3
CS391.5	Solve different operations of hash tables.		L3

6. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5
1	3	3	-	1	-
2	1	3	-	-	-
3	2	3	-	-	-
4	3	2	3	3	-
5	1	1	1	2	3

7. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CS391.1	3	2	3	2	-	-	-	3	-	-	3
CS391.2	3	2	3	2	-	-	-	3	-	-	3
CS391.3	3	2	3	2	-	-	-	3	-	-	3
CS391.4	3	2	3	2	-	-	-	3	-	-	3
CS391.5	3	2	3	2	-	-	-	3	-	-	3
AVG	**3**	**2**	**3**	**2**	-	-	-	**3**	-	-	**3**

8. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS391.CO1	2	1	—
CS391.CO2	3	2	—
CS391.CO3	3	2	—
CS391.CO4	3	2	—
CS391.CO5	3	2	—

***** End of Syllabus*** < CS391>**

Course Name: Computer Organization & Architecture Lab
Course Code: CS392
(Semester-III)
Category: Major
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

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

2. **Course Learning Objectives:**
   i. To gain practical experience in designing and implementing logic gates, adders, multiplexers, and other digital circuits.
   ii. To explore different arithmetic operations and their implementation in hardware.
   iii. To develop skills in designing and implementing basic digital circuits and systems using hardware description languages (HDLs) like VHDL or Verilog.
   iv. To gain a practical understanding of how computers are organized and how different components interact.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   For each laboratory courses there shall be a CIA during the semester for 60 marks and 40 marks for ESE.
   - **Continuous Internal Assessment of laboratory courses (PCIA) [60 Marks]**
     - Regular Laboratory Performance (20 Marks)
     - Experiment Execution and Results (15 Marks)
     - Laboratory Record/Report (10 Marks)
     - Viva Voce/Quiz (5 Marks)
     - Attendance (10 Marks)
   - **End Semester Examination of Laboratory Course (PESE) [40 marks]**
     - Write-Up about the given Experiment/Program [10 marks]
     - Execution of the Experiment/Program [10 marks]
     - Evaluation of the outcome or results of the Experiment/Program [10 marks]
     - Viva-Voce (on the concerned Experiment/Programming) [10 marks]

4. **Course Content:**
   Course Name: Computer Organization & Architecture Lab
   Course Code: CS392
   Hours per Week: 0L:0T:4P
   Credits: 2

Laboratory Experiments:	
1	Familiarity with IC-chips: a) Multiplexer, b) Decoder, c) Encoder d) 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	Familiarization with VHDL application using VHDL block diagram and coding method.
7	Implementation of a) Multiplexer, b) Decoder, c) Encoder d) Comparator using VHDL coding.
8	Use ALU chip for multi-bit arithmetic operation
9	Implement read write operation using RAM IC
10	8. (a) & (b) Cascade two RAM ICs for vertical and horizontal expansion.

Any experiment specially designed by the college

(Detailed instructions for Laboratory Manual to be followed for further guidance)

5. References:

Text & References Books:

- Computer System Architecture, M. Morris Mano

6. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CS392.1	Understand the behaviour of logic gates.	Understand	L2
CS392.2	Design combinational circuits for basic components of computer systems and Applications.	Design	L6
CS392.3	Analyze the operational behaviour of different circuits using VHDL simulation method.	Analyze	L4
CS392.4	Implement Arithmetic logic units and different types of memory blocks.	Implement	L3
CS392.5	Design to cascade multiple RAM chips for vertical and horizontal expansion.	Design	L6
CS392.6	Implement Carry-Look-Ahead Adder and BCD adder circuit adder/subtractor composite unit. .	Implement	L3

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	Y	Y	-	-	-	-
2		y		-	-	Y
3	-	Y	-		-	Y
4		Y	-		_	Y
5	-	Y	-	Y	-	-
6	-	-	Y	-	-	-
7	-	-	Y	-		
8				Y		
9				Y		
10					Y	

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	3	–	2	–	–	3	–	–	3
CO2	3	1	3	–	2	–	–	3	–	–	3
CO3	3	1	3	–	2	–	–	3	–	–	3
CO4	3	1	3	–	2	–	–	3	–	–	3
CO5	3	1	3	–	2	–	–	3	–	–	3
CO6	3	1	3	–	2	–	–	3	–	–	3
AVG.	**3**	**1**	**3**	**–**	**2**	**–**	**–**	**3**	**–**	**–**	**3**

9. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS392.CO1	1	—	—
CS392.CO2	2	1	—
CS392.CO3	2	1	—
CS392.CO4	3	2	1
CS392.CO5	2	1	—
CS392.CO6	3	2	—

***** End of Syllabus*** < CS392>**

Course Name: Python Programming Lab
Course Code: CS393
(Semester-III)
Category: Major
Course Broad Category: Professional Core Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   - o Knowledge of Programming Logic.
   - o Experience with a high level language (C/C++,) is suggested.

2. **Course Learning Objectives:**
   - i. Be able to interpret the basic syntax of python variables, data types and operator in python.
   - ii. Be able to make use of conditional and control flow statement in python fluently.
   - iii. Be able to define the use of string and list data type in proficiency level.
   - iv. Be able to discover the method to create and manipulation of python data structure like tuple, dictionary and set.
   - v. Be able to explain the use of python function and uses of different modules in python.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   For each laboratory courses there shall be a CIA during the semester for 60 marks and 40 marks for ESE.
   - ❖ **Continuous Internal Assessment of laboratory courses (PCIA) [60 Marks]**
     - Regular Laboratory Performance (20 Marks)
     - Experiment Execution and Results (15 Marks)
     - Laboratory Record/Report (10 Marks)
     - Viva Voce/Quiz (5 Marks)
     - Attendance (10 Marks)
   - ❖ **End Semester Examination of Laboratory Course (PESE) [40 marks]**
     - Write-Up about the given Experiment/Program [10 marks]
     - Execution of the Experiment/Program [10 marks]
     - Evaluation of the outcome or results of the Experiment/Program [10 marks]
     - Viva-Voce (on the concerned Experiment/Programming) [10 marks]

4. **Course Content:**
   Course Name: Python Programming Lab
   Course Code: CS393
   Hours per Week: 0L: 1T: 4P
   Credits: 1+2=3

Module	Topics	Tutorial+ Practical
1	Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator.	1
2	Conditional Statements: If, If- else, Nested if-else, Looping, For, While, Nested loops.	2
3	Control Statements: Break, Continue, Pass.	1
4	String Manipulation: Accessing Strings, Basic Operations, String Slices, Function and Methods.	2
5	Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods.	2
6	Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods.	2
7	Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.	2
8	Sets: Introduction, Accessing values in sets, Working with sets, Properties.	1
9	Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.	1
10	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.	2

5. **References:**

Text & References Books:

i. Python Programming - Using Problem Solving Approach, By Reema Thareja.

6. **Course Outcomes:**

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CS393.1	Interpret the basic syntax of python variables, data types and operator in python.	Interpret	L2
CS393.2	Make use of conditional and control flow statement in python fluently.	Make use of	L3
CS393.3	Define the use of string and list data type in proficiency level.	Define	L1
CS393.4	Discover the method to create and manipulation of python data structure like tuple, dictionary and set.	Discover	L4
CS393.5	Explain the use of python function and uses of different modules in python.	Explain	L5

7. **Mapping of course outcomes to module / course content**

Module	CO1	CO2	CO3	CO4	CO5
1	3	-	-	-	-
2	-	3	-	-	-
3	-	3	-	-	-
4	-	-	3	-	-
5	-	-	3	-	-
6	-	-	-	3	-
7	-	-	-	3	-
8	-	-	-	3	-
9	-	-	-	-	3
10	-	-	-	-	3

8. **Mapping of the Course Outcomes to Program Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	-	1	1	-	-	1	-	3
CO2	3	2	1	-	1	1	1	-	1	-	2
CO3	3	3	3	1	3	2	-	2	1	1	2
CO4	3	3	3	1	2	-	1	1	-	1	3
CO5	3	3	3	2	3	2	2	2	3	1	3
AVG.	**3.0**	**2.8**	**2.4**	**1.3**	**2.0**	**1.5**	**1.3**	**1.6**	**1.5**	**1.0**	**2.6**

9. **Mapping to PSO**

Course Outcome	PSO1	PSO2	PSO3
CS393.CO1	2	2	—
CS393.CO2	3	3	—
CS393.CO3	2	2	—
CS393.CO4	3	3	—
CS393.CO5	2	3	1

***** End of Syllabus*** < CS393>**

Course Name: Analog & Digital Electronics
Lab Course Code: CS394
(Semester-III)
Category: Major
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   vii. Basic Electronics Parts I & II learned in the First year, semesters 1&2. Basic BJTs,.
   viii. Basic concept of the working of P-N diodes, Schottky diodes,
   ix. Basic FETs and OPAMP as a basic circuit component. Concept of Feedback
2. **Course Learning Objectives:**
   iv. To acquire the basic knowledge of different analog components and their applications
   v. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
   vi. To prepare students to perform the analysis and design of various digital electronic circuits
3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology –Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   D. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   E. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   F. End-Semester Exam (60 Marks)- Summative Assessment.
4. **Course Content:**
   Course Name: Analog & Digital Electronics Lab
   Course Code: CS394
   Hours per Week: 0L:0T:4P
   Credits: 2

Module	Topics	Lectures
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 Astable & Monostable Multivibrators; Schimtt Trigger circuits, 555 Timer.	9L
Unit 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	11L
Unit 3	Sequential Circuits -Basic Flip-flop & Latch,	10L

	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	
Unit 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)	6L

5. References:

Text & References Books:

Laboratory Experiments:

Analog Electronics

1. Design a Class A amplifier
2. Design a Phase-Shift Oscillator
3. Design of a Schmitt Trigger using 555 timer

Digital Electronics

4. 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

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

6. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CS394.1	Realize the basic operations of different analog components.		
CS394.2	Realize basic gate operations and laws Boolean algebra.		
CS394.3	Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.		

7. **Mapping of course outcomes to module / course content**

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-

8. **Mapping of the Course outcomes to Program Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-
AVG.	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

9. **Mapping to PSO**

Course Outcome	PSO1	PSO2	PSO3
CS394.CO1	1	—	—
CS394.CO2	2	—	—
CS394.CO3	2	1	—

***** End of Syllabus*****