# BE SCHEME & SYLLABUS

## Second Year
### (III and IV Semester)

With effect from 2022-23

## Computer Science & Business Systems

## ST JOSEPH ENGINEERING COLLEGE
### AN AUTONOMOUS INSTITUTION
Vamanjoor, Mangaluru - 575028

## MOTTO

**Service & Excellence**

## VISION

**To be a global premier Institution of professional education and research.**

## MISSION

- Provide opportunities to deserving students of all communities, the Christian students in particular for quality professional education.

- Design and deliver curricula to meet the national and global changing needs through student-centric learning methodologies.

- Attract, nurture and retain the best faculty and technical manpower.

- Consolidate the state-of-art infrastructure and equipment for teaching and research activities.

- Promote all round personality development of the students through interaction with alumni, academia and industry.

- Strengthen the Educational Social Responsibilities (ESR) of the institution.

# ST JOSEPH ENGINEERING COLLEGE

An Autonomous Institution
Vamanjoor, Mangaluru - 575028

Affiliated to VTU – Belagavi & Recognized by AICTE New Delhi
NBA – Accredited: B.E.(CSE,ECE,EEE, ME and CIV) & MBA
NAAC – Accredited with A+

## B.E. SCHEME & SYLLABUS
### (With effect from 2022-23)

## Computer Science and Business Systems

### SECOND YEAR

### (III and IV Semester)

# AUTONOMY AND ACCREDITATION

St Joseph Engineering College (SJEC) is an Autonomous Institute under Visvesvaraya Technological University (VTU), Belagavi, Karnataka State, and is recognized by the All-India Council for Technical Education (AICTE), New Delhi. SJEC is registered under the trust "Diocese of Mangalore, Social Action Department".

The SJEC has been conferred Fresh Autonomous Status from the Academic Year 2021-22. The college was granted autonomy by the University Grants Commission (UGC) under the UGC Scheme for Autonomous Colleges 2018 and conferred by VTU. The UGC Expert Team had visited the college on 28-29 November 2021 and rigorously assessed the college on multiple parameters. The fact that only a handful of engineering colleges in the state have attained Autonomous Status adds to the college's credibility that has been on a constant upswing. Autonomy will make it convenient for the college to design curricula by recognizing the needs of the industry, offering elective courses of choice and conducting the continuous assessment of its students.

At SJEC, the Outcome-Based Education (OBE) system has been implemented since 2011. Owing to OBE practised at the college, SJEC has already been accredited by the National Board of Accreditation (NBA). Five of the UG programs, namely Computer Science & Engineering, Mechanical Engineering, Electronics and Communication Engineering, Electrical & Electronics Engineering and Civil Engineering and MBA programs, have accreditation from the NBA.

Also, SJEC has been awarded the prestigious A+ grade by the National Assessment and Accreditation Council (NAAC) for five years. With a Cumulative Grade Point Average (CGPA) of 3.39 on a 4-point scale, SJEC has joined the elite list of colleges accredited with an A+ grade by NAAC in its first cycle. The fact that only a small percentage of the Higher Education Institutions in India have bagged A+ or higher grades by NAAC adds to the college's credibility that has been on a constant upswing.

The college is committed to offering quality education to all its students, and the accreditation by NAAC and NBA reassures this fact. True to its motto of "Service and Excellence", the college's hard work has resulted in getting this recognition, which has endorsed the academic framework and policies that the college has been practicing since its inception. The college has been leveraging a flexible choice-based academic model that gives students the freedom to undergo learning in respective disciplines and a transparent and continuous evaluation process that helps in their holistic development.

# CONTENTS

# ABOUT THE DEPARTMENT

SJEC takes pride to launch in partnership with India's leading IT Service and Consulting Company – TCS, an industry ready BE Programme titled Computer Science and Business Systems (CSBS) to cater to the rising need of engineering talent with skills in Business Systems. This Four-Year undergraduate degree programme is offered with an intake of 60, Autonomous under VTU -Belagavi. This state of-the-art programme aims to impart knowledge of cutting-edge technologies and business skills with hands-on exposure to help the students be industry-ready.

The Computer Science and Business Systems programme in collaboration with TCS aims to expose students not only to the core topics of Computer Science but also develop an equal understanding of humanities, human values and management sciences. This programme is an apt choice for students aspiring to be business leads in the IT industry. Students will also gain excellent industrial exposure on emerging topics such as Business Analytics, Machine Learning, Cloud Computing, Internet of Things etc.

# DEPARTMENT VISION

To impart value-based quality education with the motive of transforming mankind with excellence and competing areas of engineering, technology and management.

# DEPARTMENT MISSION

1. Focus on the practical aspects of the curriculum to make learning a meaningful and interesting experience.
2. Encourage active collaboration with industries, communities, and fellow institutions within the country and abroad.
3. Infuse strong moral and ethical principles in students in order to make them conscientious citizens and excellent human beings.
4. Cultivate the competitive spirit required for success.

# PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To provide students with a solid foundation and the ability to use engineering concepts, mathematics, physics, and humanities required to develop, analyse, design, and implement solutions to the problems in intelligent computing and business systems.

2. To develop in students, the knowledge of computer science and engineering to work in domains such as artificial intelligence, machine learning and data science.

3. To foster in students, the capacity of teamwork through efficient communication in multidisciplinary projects.

4. To prepare students for building successful careers in artificial intelligence, data science and business systems to meet the needs of society while incorporating professional ethics.

5. To inspire learners to pursue higher education in their desired fields and engage in research.

# PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

**1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.

**2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**4. Conduct investigations on complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and the synthesis of information to provide valid conclusions.

**5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and a leader in a team, to manage projects and in multidisciplinary environments.

**12. Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

# PROGRAM SPECIFIC OUTCOMES (PSOs)

1. **Entrepreneurship and Freelancing**: Recognize the tenets of entrepreneurship, freelancing and the prerequisites for starting a business in the IT or related fields.

2. **Competitive Exams**: Participate skillfully in competitive examinations for certification, professional advancement, and admission to higher studies.

| | | | | Teaching Hours/Week | | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **III Semester (B.E. - CSBS)** | | | | | | | | | | | |

| SI. No | Course and Course Code | | Course Title | Teaching Department | Paper Setting Board | Theory Lecture L | Tutorial T | Practical/ Drawing P | Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | PCC | 22CBS31 | Mathematics for Computer Science | MAT | MAT | 2 | 2 | - | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22CBS32 | Digital Principles and Design (Integrated) | CBS | CBS | 2 | 2 | 2 | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22CBS33 | Data Structures and Applications (Integrated) | CBS | CBS | 3 | - | 2 | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22CBS34 | Computer Organization and Architecture | CBS | CBS | 3 | - | - | 03 | 50 | 50 | 100 | 3 |
| 5 | ESC | 22CBS35X | ESC/ETC/PLC | CBS | CBS | 3 | - | - | 03 | 50 | 50 | 100 | 3 |
| 6 | PCCL | 22CBS36L | Object Oriented Programming with Java Laboratory | CBS | CBS | - | - | 2 | 03 | 50 | 50 | 100 | 1 |
| 7 | HSMC | 22UHV37 | Universal Human Values - II | COM | COM | 2 | - | - | 02 | 50 | 50 | 100 | 2 |
| | | 22BFE37 | Biology for Engineers | COM | COM | | | | | | | | |
| 8 | AEC/SDC | 22IEP38 | IoT Enabled Prototyping | COM | COM | - | - | 2 | 02 | 50 | 50 | 100 | 1 |
| 9 | MNCC | 22ITB39A / 22ITC39B | Industry Oriented Training – Business Etiquettes/ Industry Oriented Training – Computing Skills | COM | COM | - | - | 2 | 02 | 50 | - | 50 | - |
| | | | **Total** | | | 15 | 4 | 10 | 24 | **450** | **400** | **850** | **21** |

| 22CBS35X : Engineering Science Course/Emerging Technology Course/Programming Language Course | | | |
|---|---|---|---|
| 22CBS351 | Fundamentals of Economics | 22CBS352 | Introduction to R Programming |

| SI. No | Course and Course Code | | Course Title | Teaching Department | Paper Setting Board | Theory Lecture (L) | Tutorial (T) | Practical/ Drawing (P) | Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **IV Semester (B.E. - CSBS )** | | | | | | | | | | |
| 1 | PCC | 22CBS41 | Computational Statistics | MAT | MAT | 2 | 2 | - | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22CBS42 | Operating Systems (Integrated) | CBS | CBS | 2 | 2 | 2 | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22CBS43 | Design and Analysis of Algorithms (Integrated) | CBS | CBS | 3 | - | 2 | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22CBS44 | Financial Management | CBS | CBS | 3 | - | - | 03 | 50 | 50 | 100 | 3 |
| 5 | ESC | 22CBS45X | ESC/ETC/PLC | CBS | CBS | 3 | - | - | 03 | 50 | 50 | 100 | 3 |
| 6 | PCCL | 22CBS46L | Web Programming Laboratory | CBS | CBS | - | - | 2 | 03 | 50 | 50 | 100 | 1 |
| 7 | HSMC | 22UHV47 | Universal Human Values – II | COM | COM | 2 | - | - | 02 | 50 | 50 | 100 | 2 |
| | | 22BFE47 | Biology for Engineers | COM | COM | | | | | | | | |
| 8 | AEC/SDC | 22CTE48 | Computational Tools for Engineers | COM | COM | - | - | 2 | 02 | 50 | 50 | 100 | 1 |
| 9 | AEC/SDC | 22ITB49A / 22ITC49B | Industry Oriented Training – Business Etiquettes/ Industry Oriented Training – Computing Skills | COM | COM | - | - | 2 | 02 | 50 | - | 50 | - |
| | | | **Total** | | | 15 | 4 | 10 | 24 | **450** | **400** | **850** | **21** |

| 22CBS45X : Engineering Science Course/Emerging Technology Course/Programming Language Course | | | |
|---|---|---|---|
| 22CBS451 | Design Thinking | 22CBS452 | C# Programming with DotNet |

# III Semester

| Mathematics for Computer Science | | | |
|---|---|---|---|
| Course Code | **22CBS31** | CIE Marks | 50 |
| Course Type (Theory/Practical/Integrated) | Theory | SEE Marks | 50 |
| | | Total Marks | 100 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE | 3 Hours |
| Total Hours | 40 | Credits | 03 |

**Course Learning Objectives:**

1. To apply probability theory and random processes that serve as an essential tool for applications of electronics and communication engineering sciences.
2. Use propositional logic in knowledge representation.
3. Use graph theory in computer applications.

| Module-1 | 8 hours |
|---|---|

**Statistical Methods and Curve Fitting:**
Correlation and regression-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression -problems. Curve Fitting: Curve fitting by the method of least squares-fitting the curves of the form $y = ax + b$, $y = ax^2 + bx + c$ and $y = ax^b$

| Module-2 | 8 hours |
|---|---|

**Probability Distributions:**
Random variables (discrete and continuous), probability mass/density functions, cumulative density function. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation).

| Module-3 | 8 hours |
|---|---|

**Sampling theory:**
Introduction, sampling distributions, Testing of hypothesis for means, level of significance, confidence limits, Sampling of variables, central limit theorem, confidence limits for unknown mean, student's t-distribution, Chi-square distribution as a test of goodness of fit.

| Module-4 | 8 hours |
|---|---|

**Fundamentals of Logic**: Basic Connectives and Truth Tables, Logical Equivalence: The laws of logic, Rules of inference. Open Statement, Quantifiers.

| Module-5 | 8 hours |
|---|---|

**Graph Theory**
Graphs and sub graphs, Graph Isomorphism, Vertex degree, Planar Graphs, Graph Coloring, Trees and Sorting, and Prefix Codes.

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22CBS31.1** | Find correlation between two variables |
| **22CBS31.2** | Fit a suitable mathematical model for the statistical data. |
| **22CBS31.3** | Examine the given data for the probability distribution |
| **22CBS31.4** | Analyze sample to get conclusions |
| **22CBS31.5** | Apply knowledge of propositional logic in truth verification |
| **22CBS31.6** | Use graph theory in computer science |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Probability & Statistics for Engineers & Scientists | Ronald Walpole, R H Myers, S L Myers and K. Ye | Pearson Publication | 9th Edition,2016 |
| 2 | Higher Engineering Mathematics | B.S Grewal | Khana Publishers | 44th Edition |
| 3 | Discrete and Combinatorial Mathematics | Ralph P. Grimaldi and B V Ramana | Pearson Education, Asia, | 5th Edition – 2017 |
| **Reference Books** | | | | |
| 1 | A first look at Graph Theory | John Clark and D. A. Holton | World Scientific Publishers | 2nd Edition 2011 |
| 2 | Discrete Mathematics and its Applications | Kenneth H. Rosen | Tata – McGraw Hill Publications | 7th Edition, 2017 |
| 3 | Topics in Algebra | I N Herstein | Wiley Eastern Limited | 2nd Edition, 1993 |

**Web links and Video Lectures (e-Resources):**
- https://youtu.be/0VTapKh3qBw
- https://youtu.be/-UJr1XjyfME
- https://youtu.be/VWlqpstJ6Mc
- https://youtu.be/riXKFlSI-Kk
- https://youtu.be/6XlrvowuXdA
- https://youtu.be/fqYTiXaFwTE
- https://youtu.be/WkDxhfxLf-M
- https://youtu.be/yGC1weQ1n2o
- https://youtu.be/eHwjcRM6UhA

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CBS31.1** | 2 | | | | | | | | | | | 1 | | |
| **22CBS31.2** | 1 | 2 | | | | | | | | | | | | |
| **22CBS31.3** | 2 | 1 | | | | | | | | | | | | |
| **22CBS31.4** | 2 | | | | | | | | | | | 1 | | |
| **22CBS31.5** | 1 | 2 | | | | | | | | | | | | |
| **22CBS31.6** | 2 | | | | | | | | | | | 1 | | |

1: Low   2: Medium 3: High

| Digital Principles and Design | | | |
|---|---|---|---|
| Course Code | **22CBS32** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | (2:2:2) | SEE Marks | 50 |
| Credits | **04** | Exam Hours | 03 |

**Course Learning Objectives:**
1. Make use of basic gates and design the logic circuits.
2. Apply the simplifying techniques in the design of combinational circuits
3. Differentiate the combinational and sequential circuits
4. Demonstrate the use of flip-flops in the construction of registers and counters
5. Illustrate how to write simple HDL programs which describe the digital circuits

| Module-1 | 8 Hours |
|---|---|

**Digital Logic and Principles of combination logic :** Review of Basic gates, Universal gates, Positive and Negative logic , Boolean Laws and theorems, minimization of completely and incompletely specified switching functions, Simplifying Max term equations, Sum of product method, Product of sums method, Product of sums simplification.

| Module-2 | 8 Hours |
|---|---|

**Combinational logic circuit design:**, Karnaugh map simplification, Don't care conditions,Simplification by QuineMcCluskey method, Determination of Prime implicants, Simplification using map-entered variables, Gate delays and Timing diagrams, Hazard and Hazard covers, Introduction to HDL: Verilog HDL, Describing input/output, writing module body, HDL Implementation models.

| Module-3 | 8 Hours |
|---|---|

**Data Processing circuits :** Multiplexers, De-multiplexers, decoder, BCD to Decimal decoder, seven segment decoder, encoders, Ex-OR gates, Parity generators and checkers, Magnitude comparators, Read only memory, Programmable array logic(PAL), Programmable logic arrays(PLA) HDL implementation: HDL of data processing circuits, Arithmetic circuits using HDL.

| Module-4 | 8 Hours |
|---|---|

**Latches and Flip-Flops:** RS Flip-Flop, Gated Flip-Flops: Clocked RS and D Flip-Flops, Edgetriggered RS Flip-Flops, Edge triggered D Flip-Flops, Edge triggered JK Flip-Flops, JK masterslave Flip-Flop, switch contact bounce circuits, various representation of Flip- Flops, Analysis of sequential circuits.

| Module-5 | 8 Hours |
|---|---|

**Registers and Counters:** Registers: Types of registers, Application of shift registers HDL implementation: HDL implementation of Flip-Flops and registers, Asynchronous counters, Decoding gates, Synchronous counters, changing the counter modulus, decade counters, presettable counters, Sequential Parity checker.

| List of Laboratory Experiments related to above modules – 2 hours each |
|---|
| 1. Design and implementation of a Half adder, Half Substractor and a Full Adder using basic gates. Implement Full Substractor in Verilog HDL. |
| 2. Given a 4-variable logic expression, simplify it using appropriate technique and realize the simplified logic expression using 8:1 multiplexer IC and implement the same in Verilog HDL |
| 3. Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table. And implement JK Flip Flop in Verilog HDL |
| 4. Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working. |

| | |
|---|---|
| 5. | Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on a 7-segment display (using IC-7447). |
| 6. | Design and Testing Shift Register/Ring Counter/Johnson Counter |
| **7.** | **Open ended experiment covering the concept of entire syllabus** |
| | ● Design and Testing Sequence Generator |
| | ● Use Universal gates and IC's for code conversion and arithmetic Operations |
| | ● Design and Verify on Different Counters. |

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22CBS32.1** | Explain the usage of basic gates, universal gates and Boolean laws in designing various digital circuits. |
| **22CBS32.2** | Apply the simplification techniques like Karnaugh map and Quine Mc-clusky to design various combinational circuits. |
| **22CBS32.3** | Describe the operation and design of various data processing circuits and implement multiplexers circuit. |
| **22CBS32.4** | Identify the various types of flip-flops and use them in the design of Registers and Counters. |
| **22CBS32.5** | Differentiate between Moore and Mealy model and construct different types of counters using these models. |
| **22CBS32.6** | Develop Verilog HDL programs to implement simple combinational and sequential circuits. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Digital Principles and Application | Donald P Leach, Albert Paul Malvino& Goutam Saha | Tata McGraw Hill | 8th Edition, 2017 |
| 2 | Fundamentals of Logic Design | Charles H Roth and Larry L kinney | Cengage Learning | 7th Edition, 2019 |
| **Reference Books** | | | | |
| 1 | Fundamentals of Digital Logic Designwith VHDL | Stephen Brown, Zvonko Vranesic | Tata McGraw Hill | 2nd Edition 2005 |
| 2 | Illustrative Approach to Logic Design | R D Sudhaker Samuel | Pearson Education | 2010 |

**Web links/Video Lectures/MOOCs/papers**
1. **https://onlinecourses.nptel.ac.in/noc22_ee110/preview**
2. https://cse15-iiith.vlabs.ac.in/2

## Course Articulation Matrix

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| 22CBS32.1 | 3 | 1 | | | | | | | | | | | | 1 |
| 22CBS32.2 | 1 | 2 | 2 | | | | | | | | | | | 1 |
| 22CBS32.3 | 3 | | 1 | | | | | | | | | | | 1 |
| 22CBS32.4 | | 1 | | 2 | | | | | | | | | | 1 |
| 22CBS32.5 | | 1 | | 2 | | | | | | | | | | 1 |
| 22CBS32.6 | | 1 | | | 2 | | | | | | | | | 1 |

**1: Low   2: Medium 3: High**

| Data Structures and Applications | | | |
|---|---|---|---|
| Course Code | **22CBS33** | CIE Marks | 50 |
| Course Type (Theory/Practical/Integrated) | Integrated | SEE Marks | 50 |
| | | Total Marks | 100 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE | 3 Hours |
| Total Hours | 40 hours Theory + 10 Lab slots | Credits | 04 |

**Course Learning Objectives:** The objective of the course is to
- Understand the fundamentals of data structures and applications that are essential for programming and problem solving.
- Learn linear and non-linear data structures.
- Implement various basic and advanced data structures operations.
- Understand various sorting and searching techniques.
- Know the importance of Hashing.

| **Module-1** | **8 hours** |
|---|---|

**Basic Concepts:** Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions, Polynomials and Sparse Matrices in arrays.
**Strings:** Basic Terminology, Storing Operations and Pattern Matching algorithms.

| **Module-2** | **8 hours** |
|---|---|

**Stacks:** Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. Recursion.
**Queues:** Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues.

| **Module-3** | **8 hours** |
|---|---|

**Linked Lists:** Definition, Representation of linked lists in Memory, linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, header linked lists. Applications of Linked lists – Polynomials, Sparse matrix representation. ProgrammingExamples
**Graphs**: Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search.

| **Module-4** | **8 hours** |
|---|---|

**Trees:** Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Threaded Binary Trees, Binary Search Trees,
**Forests, Multi-way Search Trees:** Introduction, BTrees, B+ Trees.

| **Module-5** | **8 hours** |
|---|---|

**Searching and Sorting**: Jump Search, Insertion sort, Radix Sort, Shell Sort.
**Hashing and Collision:** Introduction, Hash Tables, hash Functions, Different Hash Functions, Collisions, Pros and Cons of Hashing, Applications of Hashing.

| **PRACTICAL MODULE** |
|---|
| 1. Design, Develop and Implement a menu driven Program for the following |
|     a) Demonstrate dynamic allocation of 2D array of integers (use suitable pointer) |
|     b) Read m×n sparse matrix into an array. |
|     c) Compute transpose of m×n sparse matrix using fast transpose algorithm |
|     d) Display sparse matrix. |
|     Support the program with functions for each of the above operations. |
| 2. Design, Develop and Implement a Program for the following operations on Strings. |
|     a) Read a main String (STR) and a Pattern String (PAT) |
|     b) Implement KMP algorithm to Perform Pattern Matching Operation: Find the |

occurrences of PAT in STR. Report suitable messages in case PAT does not exist in
STR.

Support the program with functions for each of the above operations. Don't use Built-in functions.

3. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +(add), -(sub), *(multiple), /(division), %(Remainder), ^(Power) and alphanumeric operands.

4. Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size (MAX)
   a. Insert an Element on to Circular QUEUE
   b. Delete an Element from Circular QUEUE
   c. Demonstrate *Overflow* and *Underflow* situations on Circular QUEUE
   d. Display the status of Circular QUEUE
   e. Exit

   Support the program with appropriate functions for each of the above operations.

5. Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: *USN, Name, Branch, Sem, PhNo*
   a. Create a SLL of N Students Data by using *front insertion*.
   b. Display the status of SLL and count the number of nodes in it
   c. Perform Insertion / Deletion at End of SLL
   d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack)
   e. Exit

6. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers
   a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2
   b. Traverse the BST in Inorder, Preorder and Post Order
   c. Search the BST for a given element (KEY) and report the appropriate message
   d. Exit

7. Design, develop and Implement a Program to sort n elements using Radix Sort Algorithm.

8. Design, develop and Implement a Program for the following operations on Hash Table. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers.

9. Open ended experiment covering the concept of entire syllabus: Online shopping application

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22CBS33.1** | Apply data structures (pointers, arrays, structures and strings) for data organization. |
| **22CBS33.2** | Make use of data structures such as Stacks, Queues for data organization. |
| **22CBS33.3** | Apply Linked Lists and Graphs for data representation, Insertion, Deletion and Search Operations. |
| **22CBS33.4** | Make use of Tree data structure for data ordering, data searching and evaluating expressions. |
| **22CBS33.5** | Analyze various Searching algorithms, Sorting algorithms and Hash table organization. |
| **22CBS33.6** | Analyze implementation of data structures to real life applications involving data storage, access and organization |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Data Structures in C | Ellis Horowitz and Sartaj Sahni | Universities Press | 2nd Edition, 2008. |
| 2 | Data Structures using C | Reema Thareja | Oxford Press | 2nd Edition, 2014 |
| **Reference Books** | | | | |
| 1 | Data Structures using C | Aaron M. Tenenbaum, Yedidyah Langsam , Moshe, J.Augenstein | Pearson Education | 1st Edition, 2019 |
| 2 | Data Structures: A Pseudocode Approach with C | Richard F. Gilberg and Behrouz A. Forouzan | Cengage Learning | 2nd Edition, 2005 |

**Web links and Video Lectures (e-Resources):**
- https://www.youtube.com/watch?v=CHhwJjR0mZA
- https://www.youtube.com/watch?v=xLetJpcjHS0&list=PLBlnK6fEyqRj9lld8sWIUNwlKfdUoPd1Y
- https://www.youtube.com/watch?v=B31LgI4Y4DQ
- https://masterraghu.com/subjects/Datastructures/ebooks/rema thareja.pdf
- https://archive.nptel.ac.in/courses/106/102/106102064/

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CBS33.1** | 1 | 2 | | | | | | | 2 | | | | | 1 |
| **22CBS33.2** | 1 | 2 | | | | | | | 2 | | | | | 1 |
| **22CBS33.3** | 1 | 2 | | | | | | | 2 | | | | | 1 |
| **22CBS33.4** | 1 | 2 | | | | | 1 | | 2 | | | | | 1 |
| **22CBS33.5** | 1 | 2 | | | | | 1 | | 2 | | | | | |
| **22CBS33.6** | | 2 | | | | | 1 | 2 | 2 | 2 | | | | |

1: Low    2: Medium 3: High

| Computer Organization and Architecture | | | | |
|---|---|---|---|---|
| Course Code | **22CBS34** | CIE Marks | 50 | |
| Teaching Hours/Week (L:T:P:S) | (3:0:0) | SEE Marks | 50 | |
| Credits | **03** | Exam Hours | 03 | |

**Course Learning Objectives:**

1. Explain the basic subsystems of a computer, their organization, structure and operations
2. Illustrate the concept of programs as sequences of machine instructions
3. Demonstrate different ways of communicating with I/O devices and standard I/O interfaces
4. Describe arithmetic operations with integer operands.
5. Appraise the Computer Architecture and instruction level parallelism

| Module-1 | 8 hours |
|---|---|

**Basic Structure of Computers:** Basic Operational Concepts, Bus Structures, Performance-Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.
**Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Subroutines and use of stack frames, Additional Instructions. **TB1**

| Module-2 | 8 hours |
|---|---|

**Input/Output Organization:** Basic Input and Output Operations, Accessing I/O Devices, Interrupts – Interrupt hardware, Enabling and disabling of interrupts, Handling multiple devices, Controlling device requests, exceptions, Interrupt Hardware, Direct Memory Access, Bus arbitration, Synchronous and Asynchronous bus. **TB1**

| Module-3 | 8 hours |
|---|---|

**Memory unit:** Memory Hierarchy, Basics of Cache memory, Cache mapping techniques, **Multiprocessor Architecture:** Centralized shared-memory architecture, Distributed memory architecture, **Basic scheme for enforcing coherence:** Snooping coherence protocols, Basic implementation techniques. **TB1, TB2**

| Module-4 | 8 hours |
|---|---|

**Integer arithmetic:** Numbers, Arithmetic operations and characters, Overflow in integer arithmetic, Multiplication of two numbers, Signed operand multiplication, Booth algorithm, Bit pair recoding and CSA, integer division. **Basic Processing unit:** Fundamental concepts, Execution of complete instruction, Multiple bus organization. **TB1**

| Module-5 | 8 hours |
|---|---|

**Instruction level parallelism (ILP):** Introduction and challenges, Data dependencies and Hazards: Data dependencies, Name dependencies, Control Dependencies, **Pipelining:** Introduction, A simple implementation of a RISC instruction set, The classic five-stage pipeline for a RISC processor, Basic performance issues in pipelining. **TB2**

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22CBS34.1** | Interpret the basic structure and operations of computers and demonstrate the significance of addressing modes and instruction sequencing. |
| **22CBS34.2** | Select the different ways of communicating with I/O devices and standard I/O interfaces. |
| **22CBS34.3** | Illustrate cache memory mapping techniques, various memory architectures and protocols for cache coherence. |
| **22CBS34.4** | Apply different algorithms to perform arithmetic operations. |
| **22CBS34.5** | Illustrate organization of a processor with single and multiple bus for instruction execution. |
| **22CBS34.6** | Appraise the importance of pipelining to achieve instruction level parallelism. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---------|-------------------|----------------------|----------------------|------------------|
| **Textbooks** | | | | |
| 1 | Computer Organization | C Hamacher, Z Vranesic | Tata McGraw Hill | 5$^{th}$ Edition 2011 |
| 2 | Computer Architecture: A Quantitative Approach | John L Hennessy, David A Patterson | Elsevier | 5$^{th}$ Edition 2012 |
| **Reference Books** | | | | |
| 1 | Computer Organization and Design | David A. Patterson, John L. Hennessy | M.K Publishers | 4$^{th}$ Edition 2010 |
| 2 | Computer Organization and Architecture | William Stallings | Pearson | 9$^{th}$ Edition 2014 |
| 3 | Computer Organization and Design MIPS Edition | Patterson | Elsevier | 6$^{th}$ Edition 2021 |
| 4 | Computer Organization and Architecture | J. S. Katre, Harish G.Narula, Khushboo Shah | Tech Knowledge Publications | 2020 |

**Web links/Video Lectures/MOOCs/papers**

1. https://www.coursera.org/learn/comparch
2. https://nptel.ac.in/courses/106103068
3. https://www.youtube.com/watch?v=leWKvuZVUE8&list=PL1A5A6AE8AFC187B7

## Course Articulation Matrix

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CBS34.1** | 2 | | | | | | | | | | | 2 | | |
| **22CBS34.2** | | | 3 | 2 | | | | | | | | | | |
| **22CBS34.3** | | | | | | | 2 | | | | | | | 2 |
| **22CBS34.4** | 3 | | | | | | | | | | | 2 | | |
| **22CBS34.5** | | | | | | 2 | | | | | | 3 | | |
| **22CBS34.6** | | | 1 | 2 | | | | | | | | | | |

1: Low    2: Medium 3: High

| Fundamentals of Economics | | | |
|---|---|---|---|
| Course Code | 22CBS351 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Credits | 3 | Exam Hours | 03 |

**Course Learning Objectives:** The objective of the course is
1. To introduce the fundamentals, tools, and theories of managerial economics.
2. To provide an understanding of the application of Economics in Business.
3. To introduce the basic economic concepts.
4. To have an understanding of Demand, Production, Cost, and Profit.
5. To explore the marketing world in real life.

| Module-1 | 8 hours |
|---|---|

Managerial Economics: The problem of scarcity and allocation of resources, Nature, Scope, & Significance of Managerial Economics, Role and Responsibilities of Managerial Economist, The circular flow of Economic activity, and The Basic process of decision making.
Fundamental concepts: Opportunity Costs, Marginal principle, Incremental Principle, Time perspective, Discounting and Equi-Marginal principles.

| Module-2 | 8 hours |
|---|---|

Market analysis, Market Equilibrium, Law of Demand, Demand Function, Exceptions to the Law of Demand, Elasticity of Demand –Classification of Price, Income & Cross elasticity, Advertising, and promotional elasticity of demand. Uses of elasticity of demand for Managerial decision making, Measurement of elasticity of demand. Law of supply, Supply Function, Elasticity of supply.

| Module-3 | 8 hours |
|---|---|

Concepts of Production, Indifference Curves, ISO-Quants & ISO-Cost line, least cost combination factor, Economies of scale, Diseconomies of scale. Technological progress and production function. Types of cost, Accounting, and Economic cost, Cost curves, Cost – Output Relationship in the short run and in the long run, LAC curve.

| Module-4 | 8 hours |
|---|---|

Perfect Competition, Features, Determination of price under perfect competition, Monopoly: Features, sources of Monopoly, Pricing under monopoly, Price Discrimination. Monopolistic Competition: Features, Pricing Under monopolistic competition, Product differentiation.

| Module-5 | 8 hours |
|---|---|

Basic Macro Economic Concepts: Open and Closed Economies, Primary, secondary and Tertiary sectors and their contribution to the economy. SWOT Analysis for the Indian economy. Measuring the Economy: Measuring GDP and GDP Growth rate, Components of GDP.
Business Cycles and Stabilization- Monetary and Fiscal Policy.

| **Course Outcomes:** At the end of the course, the student will be able to: | |
|---|---|
| **22CBS351.1** | Apply the fundamental concepts, tools, and theories of managerial economics. |
| **22CBS351.2** | Analyze the demand and elasticity of demand for a product. |
| **22CBS351.3** | Analyze the concepts in production and cost for optimization of production. |
| **22CBS351.4** | Evaluate the market structure and its impact on pricing policy. |
| **22CBS351.5** | Analyze the basic macroeconomic concepts. |
| **22CBS351.6** | Apply the skills they develop in their career. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Microeconomics | Pindyck, Robert S., and Daniel L. Rubinfeld | Pearson Education | 9th Edition, 2017 |
| 2 | Macroeconomics | Dornbusch, Fischer and Startz. | McGraw Hill Education | 10th Edition, 2012 |
| **Reference Books** | | | | |
| 1 | Intermediate Microeconomics: A Modern Approach | Hal R, Varian. | SPRINGER (INDIA) PVT. LTD. India | 8th Edition, 2010 |
| 2 | Principles of Macroeconomics | N. Gregory Mankiw | CENGAGE Learning Custom Publishing | 8th Edition, 2016 |

**Web links and Video Lectures (e-Resources):**
- https://www.youtube.com/watch?v=_OkTw766oCs&list=PLUl4u3cNGP62oJSoqb4Rf-vZMGUBe59G-
- https://www.youtube.com/watch?v=1UxA6JzoT-4&pp=ygUObWljcm9lY29ub21pY3M%3D
- https://www.youtube.com/watch?v=IFtOcNbej0o&list=PLFNFJbo2hfBGRTCMuroZGykNzacwmAH2L
- https://www.youtube.com/watch?v=MKO1icFVtDc&pp=ygUObWFjcm9lY29ub21pY3M%3D
- https://www.youtube.com/watch?v=d8uTB5XorBw&pp=ygUObWFjcm9lY29ub21pY3M%3D

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CBS351.1** | 2 | 2 | 2 | | 1 | | | | | | | 1 | | 1 |
| **22CBS351.2** | | | 1 | | 1 | | | | | 2 | | | | |
| **22CBS351.3** | | 2 | 1 | | 1 | | | | | 2 | | | | |
| **22CBS351.4** | | | | 2 | | | | | | | 2 | 2 | | |
| **22CBS351.5** | 2 | 2 | 2 | | | | | | | | | | | |
| **22CBS351.6** | | | | | 2 | | | | | | | | 2 | 2 |

1: Low 2: Medium    3: High

| Introduction to R Programming | | | |
|---|---|---|---|
| Course Code | **22CBS352** | CIE Marks | 50 |
| Course Type (Theory/Practical/Integrated) | Theory | SEE Marks | 50 |
| | | Total Marks | 100 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE | 3 Hours |
| Total Hours | 40 Hours | Credits | 03 |

**Course Learning Objectives:** The objective of the course is to
- Understand the basics of Fundamentals of R.
- Understands the loading, and retrieval techniques of data.
- Understand how data is analyzed and visualized using statistical functions.
- Understand how Data frames work.
- Work on built-in real-time cases for analysis and visualization

| Module-1 | 8 hours |
|---|---|

What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing an R Package, Few commands to get started: installed.packages(), package description (), help(), find.package(), library() - Input and Output – Entering Data from the keyboard – Printing fewer digits or more digits. Simple programs on R.

| Module-2 | 8 hours |
|---|---|

**R Data Types:** Vectors, Lists, Matrices, Arrays, Factors, Data Frames. **R - Variables:** Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables. **R Operators:** Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - **R Decision Making:** if statement, if – else statement, if – else if statement, switch statement – **R Loops**: repeat loop, while loop, for loop - Loop control statement: break statement, next statement.

| Module-3 | 8 hours |
|---|---|

**R-Function:** function definition, Built in functions: mean(), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, calling a function without an argument, calling a function with argument values - **R-Strings** – Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower() - **R Vectors** – Sequence vector, rep function, vector access, vector names, vector math, vector recycling, vector element sorting - **R List** - Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, Merging Lists, Converting List to Vector - **R Matrices** – Accessing Elements of a Matrix, Matrix Computations: Addition, subtraction, Multiplication and Division- **R Arrays**: Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements, Calculation Across Array Elements - R Factors – creating factors, generating factor levels gl()

| Module-4 | 8 hours |
|---|---|

**Data Frames** –Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, **Expand Data Frame:** Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge() – Melting and Casting data melt(), cast(). **Loading and handling Data in R:** Getting and Setting the Working Directory – getwd(), setwd(), dir() - **R-CSV Files** - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() - Writing into a CSV File **– R -Excel File** – Reading the Excel file

| Module-5 | 8 hours |
|---|---|

**Descriptive Statistics:** Data Range, Frequencies, Mode, Mean and Median: Mean Applying Trim Option, Applying NA Option, Median - Mode - Standard Deviation – Correlation - **Spotting Problems in Data with Visualization**: visually Checking Distributions for a single Variable - R –Pie Charts: Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – R Histograms – Density Plot - R – Bar Charts: Bar Chart Labels, Title and Colors.

**Course Outcomes:** At the end of the course the student will be able to:

| | |
|---|---|
| **22CBS352.1** | Use the functionalities offered by R packages. |
| **22CBS352.2** | Apply fundamentals of R for a given problem. |
| **22CBS352.3** | Utilize different data structures and organize data using functions. |
| **22CBS352.4** | Demonstrate data handling by creating, manipulating, and analyzing datasets using data frames or files. |
| **22CBS352.5** | Analyze descriptive statistics and produce data visualizations. |
| **22CBS352.6** | Implement RScript for analysis and visualization of real-world problems. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics using R | Seema Acharya | McGrawHill Education | 8th Edition, 2018 |
| **Reference Books** | | | | |
| 1 | R Programming for Beginners | Sandip Rakshith | McGrawHill Education | 1st Edition, 2017 |
| 2 | R for Dummies | Andrie de Vries, Joris Meys | A Wiley Brand | 2nd Edition, 2015 |

**Web links and Video Lectures (e-Resources):**
- https://jrnold.github.io/r4ds-exercise-solutions/index.html
- https://www.r-project.org/
- https://cran.r-project.org/
- https://youtu.be/yZ0bV2Afkjc
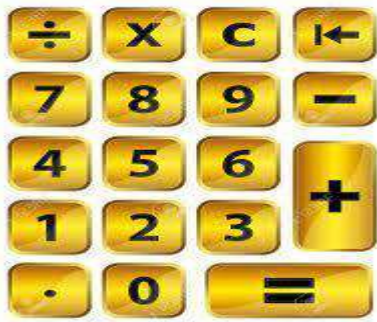
**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CBS352.1** | | | 2 | | | | | | | | | | | |
| **22CBS352.2** | | 2 | | | | | | | | | 2 | 2 | | |
| **22CBS352.3** | | 2 | | | | | | | | | | 1 | | 1 |
| **22CBS352.4** | | | | 2 | | | | | 1 | | | 2 | | 2 |
| **22CBS352.5** | 2 | | | | | | | | | | | | | |
| **22CBS352.6** | 3 | | | | 1 | | | | | | | | | |

1: Low    2: Medium    3: High

| Object Oriented Programming with Java Laboratory | | | |
|---|---|---|---|
| Course Code | **22CBS36L** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | (0:0:2) | SEE Marks | 50 |
| Credits | **01** | Exam Hours | 02 |

**Course Learning Objectives:**
1) To understand and define classes, use packages to write object-oriented programming.
2) To apply the concepts of overloading and overriding in object-oriented programming.
3) To apply the concepts of access specifiers and exception handling.
4) To develop applications using generic programming and event handling.
5) To build software development skills using java programming for real-world applications.

**Laboratory Programs:**

### PART- A

| 1. | Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff. |
|---|---|
| | If the type of the EB connection is domestic, calculate the amount to be paid as follows: |
| | First 100 units  - Rs. 1 per unit |
| | 101-200 units          - Rs. 2.50 per unit |
| | 201 -500 units  - Rs. 4 per unit |
| | > 501 units   - Rs. 6 per unit |
| | If the type of the EB connection is commercial, calculate the amount to be paid as follows: |
| | First 100 units  - Rs. 2 per unit |
| | 101-200 units  - Rs. 4.50 per unit |
| | 201 -500 units  - Rs. 6 per unit |
| | > 501 units - Rs. 7 per unit |
| 2. | Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary |
| 3. | Write a program to demonstrate run-time polymorphism of overriding by implementing Rectangle and Triangle classes extended from an abstract class Figure. |
| 4. | Write a program to demonstrate usage of multilevel inheritance by implementing Box, BoxWeight and Shipment classes with overloaded constructors. |
| 5. | Write a program to demonstrate all combinations of the access control modifiers. |
| 6. | a.  Write a program to catch IllegalAccessException thrown inside a called method.<br>b.  Write a program to demonstrate finally block in case of<br>  i)  No exception<br>  ii)  Exception<br>  iii)  return statement |
| 7. | Implement a Java based program to handle all the mouse based events with appropriate display. |

| 8. | Implement a calculator using event-driven programming paradigm of Java having the following operation:  |
|---|---|
| 9. | Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number. |
| 10. | Write a Java Program to implement producer consumer problem using interthread communication. |
| | **PART B – Problem Based Learning** |
| **Case Study:** Develop any GUI based application using Java concepts. | |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Java: The Complete Reference | Herbert Schildt | TATA McGraw-Hill Publications | 7th Edition, 2009 |
| **Reference Books** | | | | |
| 1 | The Java^TM Programming Language | Ken Arnold, James Gosling, David Holmes | Addison Wesley | 4th Edition, 2005 |
| 2 | Java Puzzlers: Traps, Pitfalls, and Corner Cases | Joshua Bloch, Neal Grafter | Pearson India Education Services Pvt. Ltd. | 1st Edition 2005 |

**Web links/Video Lectures/MOOCs/papers**

1. https://www.youtube.com/watch?v=-HafzawNlUo
2. https://www.youtube.com/watch?v=7GwptabrYyk
3. https://www.geeksforgeeks.org/object-oriented-programming-oops-concept-in- java/

| **Course Outcomes:** | |
|---|---|
| At the end of the course the student will be able to: | |
| **22CBS36L.1** | Understand and make use of classes, strings and basic data types in writing object-oriented programming. |
| **22CBS36L.2** | Implement java programs with constructors and method overloading  concepts. |
| **22CBS36L.3** | Implement applications using inheritance and method overriding concepts. |
| **22CBS36L.4** | Implement applications using packages and interfaces enforcing access controls. |

| 22CBS36L.5 | Implement programs using multithreading and exception handling constructs. |
|---|---|
| 22CBS36L.6 | Design and develop simple java applications for real world problems. |

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CBS36L.1** | 3 | | 1 | | | | | | | | | | | |
| **22CBS36L.2** | | | 2 | | | | | | | | | | 2 | |
| **22CBS36L.3** | 3 | | | | | 2 | | | | | | | | |
| **22CBS36L.4** | 3 | | | | | 1 | | | | | | | 1 | |
| **22CBS36L.5** | 3 | 2 | 3 | | | | | | | | | | | |
| **22CBS36L.6** | 1 | 2 | 3 | 3 | 3 | 3 | | | | | 2 | 2 | | |

1: Low    2: Medium 3: High

| Universal Human Values- II | | | |
|---|---|---|---|
| Course Code | **22UHV37** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | (2:0:0) | SEE Marks | 50 |
| Credits | **02** | Exam Hours | 02 |

**Course Learning Objectives:**

This introductory course input is intended:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement toward value-based living in a natural way.

3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

**Module-1 Introduction to Value Education**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Activities: Sharing about Oneself, Exploring Human Consciousness and Exploring Natural Acceptance. **5 Hours**

**Module-2 – Harmony in the Human Being**

Understanding Human beings as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

Activities: Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body and Exploring the difference of Needs of Self and Body. **5 hours**

**Module 3 – Harmony in the Family and Society**

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Activities: Exploring the Feeling of Trust, Exploring the Feeling of Respect and Exploring the Feeling systems to fulfil Human Goal. **5 hours**

**Module-4 – Harmony in the Nature/Existence**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Activities: Exploring the Four Orders of Nature and Co-existence in Existence. **5 hours**

**Module-5 – Implications of the Holistic Understanding – a Look at Professional Ethics**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Activities: Exploring Ethical Human Conduct**,** Humanistic Models in Education and steps of Transition towards Universal Human Order. **5 hours**

| Course Outcomes: At the end of the course the student will be able to: ||
|---|---|
| **22UHV37.1** | Practice the method of self-exploration to understand the basic human aspiration. |
| **22UHV37.2** | Distinguish between needs of self and body. |
| **22UHV37.3** | Evolve a program for self-regulation and health. |
| **22UHV37.4** | Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them. |
| **22UHV37.5** | Realize sustainable solutions to the problems in society and nature. |
| **22UHV37.6** | Develop competence in professional ethics and strategies for the transition towards a value-based life/profession. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** ||||| 
| 1 | Foundation Course in Human Values and Professional Ethics | R R Gaur, R Asthana, G P Bagaria | Excel Books, New Delhi | 2nd Revised Edition, 2019 |
| 2 | Teachers' Manual for A Foundation Course in Human Values and Professional Ethics | R R Gaur, R Asthana, G P Bagaria | Excel Books New Delhi | 2nd Revised Edition, 2019 |
| **Reference Books** |||||
| 1 | Jeevan Vidya: Ek Parichaya | A Nagaraj | Jeevan Vidya Prakashan Amarkantak | 1999 |
| 2 | Human Values | A.N. Tripathi | New Age Intl. Publishers, New Delhi | 2004 |

**Additional Resources/Web links/Video Lectures**

1. The Story of Stuff (Book).
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3. Small is Beautiful - E. F Schumacher.
4. Slow is Beautiful - Cecile Andrews
4. Economy of Permanence - J C Kumarappa
5. Bharat Mein Angreji Raj – Pandit Sunderlal
6. Rediscovering India - by Dharampal
7. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
8. India Wins Freedom - Maulana Abdul Kalam Azad
9. Vivekananda - Romain Rolland (English)
10. Gandhi - Romain Rolland (English)
11. UHV-I Teaching material (Presentations, Pre & Post Surveys etc.)
https://fdp-si.aicte-india.org/AicteSipUHV_download.php
12. Details of UHV-II: Universal Human Values – Understanding Harmony and Ethical Human Conduct
https://drive.google.com/file/d/1cznDaqDwKy__EKWmqJLWF94MeY4AXcsU/view?usp=sharing

13. Recorded FDP (Refresher 1 Part 1: Preparing to teach UHV-I in SIP)
https://www.youtube.com/watch?v=kejuD4faDDE&list=PLWDeKF97v9SOjS4RanhaYj4YLiImqm5pj&index=1

14. Resources, including the class notes and presentations
https://drive.google.com/drive/folders/1nh9m5ibEtvMyqekeiexAJtfbdNtmtt6-?usp=sharing

15. Hindi Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SMRfe5PK1HPYnEcrrJOL6K7

16. English Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4

## Course Articulation Matrix

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| 22UHV37.1 | | | | | | 3 | | 2 | | | | | | |
| 22UHV37.2 | | | | | | 2 | | | 3 | | | | | |
| 22UHV37.3 | | | | | | 2 | | 3 | | | | | | |
| 22UHV37.4 | | | | | | | 3 | | | | | | | |
| 22UHV37.5 | | | 3 | | | | | 2 | | | | | | |
| 22UHV37.6 | | | | | | | | 3 | | | | 2 | | |

1: Low    2: Medium 3: High

| Biology for Engineers | | | | |
|---|---|---|---|---|
| Course Code | **22BFE37** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | (2:0:0) | SEE Marks | 50 |
| Credits | **02** | Exam Hours | 02 |

**Course Learning Objectives:**
1. To bring awareness of biological concepts to engineering students
2. To introduce the building blocks of life and their complexity
3. To encourage interdisciplinary studies and projects
4. To appreciate the discoveries that mimic nature and its working
5. To inculcate nature-inspired design and operational principles

| Module-1 | 5 Hours |
|---|---|

**Basic Cell Biology:** Introduction to Biology, The cell: the basic unit of life, Expression of genetic information-protein structure and function, Cell metabolism; Cells respond to their external environments, Cells grow and reproduce, Cellular differentiation.

| Module-2 | 5 Hours |
|---|---|

**Biochemistry and Molecular Aspects of Life:** Biodiversity-Chemical bonds in Biochemistry; Biochemistry and Human biology, Protein synthesis -DNA; RNA, Transcription and translation factors play key roles in protein synthesis, Differences between eukaryotic and prokaryotic protein synthesis, Stem cells and their applications.

| Module-3 | 5 Hours |
|---|---|

**Bioinspired Engineering based on human physiology**: Circulatory system (artificial heart, pacemaker, stents), Nervous system (Artificial neural network), Respiratory system, sensory system (electronic nose, electronic tongue), Visual and auditory prosthesis (Bionic eye and cochlear implant).

| Module-4 | 5 Hours |
|---|---|

**Relevance of Biology as an interdisciplinary approach:** Biological observation that led to major discoveries, Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Bird flying (aircraft), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro).

| Module-5 | 5 Hours |
|---|---|

**Bioinspired Algorithms and Applications:** Genetic algorithm, Gene expression modelling, Parallel Genetic Programming: Methodology, History, and Application to Real-Life Problems, Dynamic Updating DNA Computing Algorithms, Bee-Hive: New Ideas for Developing Routing Algorithms Inspired by Honey Bee Behaviour.

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22BFE37.1** | Discuss how the cell forms the basic building block of life |
| **22BFE37.2** | Distinguish between transcription and translation |
| **22BFE37.3** | Describe the role played by proteins within the cell |
| **22BFE37.4** | Analyze the role of bioinspired design in novel applications |
| **22BFE37.5** | Apply bioinspired design principles to other domains |
| **22BFE37.6** | Implement a simple genetic algorithm |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Text Books** | | | | |
| 1 | Biology for Engineers | Thyagarajan.S., Selvamurugan. N., Rajesh.MP, Nazeer RA, Richard W. Thilagaraj, Barathi.S., and Jaganthan.M.K | Tata McGraw Hill | 2012 |
| 2 | Molecular Biology | Robert Weaver | McGraw-Hill | 5$^{th}$ Edition, 2012 |
| **Reference books** | | | | |
| 1 | Lewin's Genes XII | Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick | Jones and Bartlett Learning | 2017 |
| 2 | Bioinspired Engineering | Jenkins, C.H. | Momentum Press | 2012 |
| 3 | Bio mimetics: Nature-Based Innovation | Yoseph Bar-Cohen | CRC Press | 1$^{st}$ Edition, 2016 |
| 4 | A Practical Guide to Bio-inspired Design | Hashemi Farzaneh, Helena, Lindemann, Udo | Springer | 2019 |

**Web links/Video Lectures/MOOCs**

1. https://books.google.co.in/books?id=-2LNBQAAQBAJ&printsec=frontcover#v=onepage&q&f=false
2. https://www.aminotes.com/2017/02/biology-for-engineers-module-1-cocepts.html

## Course Articulation Matrix

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22BFE37.1** | 2 | | | | | 1 | | | | | | | | |
| **22BFE37.2** | | 1 | | | | 1 | | | | | | | | |
| **22BFE37.3** | 2 | | | | | 2 | | | | | | | | |
| **22BFE37.4** | | 2 | | | | | | | | | | 2 | | |
| **22BFE37.5** | 2 | | | | | | | | | | | 2 | | |
| **22BFE37.6** | | 2 | | | | | | | | | | 2 | | |

1: Low 2: Medium 3: High

| IOT ENABLED PROTOTYPING | | | |
|---|---|---|---|
| Course Code: | **22IEP38** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | (0:0:2) | SEE Marks | 50 |
| Credits | **01** | Exam Hours | 02 |

**Course Learning Objectives:**
1. Understand the IoT concepts such as sensing, actuation, and communication.
2. Development of Internet of Things (IoT) prototypes—including devices for sensing, actuation, processing, and communication and Protocols
3. Understand the significance of Project Management and the different techniques of planning
4. To introduce fundamental aspects of intellectual property rights, Govt. policies on IPR, and patentability search techniques.

| Module 1 |
|---|

**Internet of Things – Hardware / System Design**
Introduction to IoT fundamentals, Introduction to sensors, Difference between analog and Digital sensors, Interfacing Temperature, Light and Humidity sensor with Arduino, Interfacing Motors with Arduino, A simple program to control actuator based on the analog sensor.                                                                                                    **6 Hours**

| Module 2 |
|---|

**Internet of Things**
**Networking in IoT:**
Introduction to wireless communication, Wifi Module ESP8266 interface with Arduino, Machine to Machine (M2M) communication using WiFi module. A simple demonstration of sensing temperature from one device and control actuator on a second device (M2M)
**IoT in Web/ Cloud Platform:**
Introduction to a web server - XAMPP(windows), A simple interactive web page using HTML5, Bootstrap (or CSS), and Javascript. Interfacing ESP8266 with webserver, ThingSpeak API, and MQTT protocol, A simple project to demonstrate the status of two IoT devices communicating with a Web Server.
**6 Hours**

| Module 3 |
|---|

**Project Planning and Management**
Project initiation, Project charter, Project planning, and implementation, Scheduling and costing, Project monitoring and control, Project closure and reports.
                                                                                                    **6 Hours**

| Module 4 |
|---|

**Intellectual Property Rights**
Introduction and the need for intellectual property right (IPR) – Kinds of Intellectual Property Rights, Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application, Non - Patentable Subject Matter, Registration Procedure, Patentability search methods, Patent landscape, Freedom-to-market, National IPR Policy, Govt. initiatives and scheme in promoting IPR.                                          **6 Hours**

**Course Project**
Develop IoT-based prototypes (solutions) to solve any industrial or societal problems. The prototype building is teamwork of 3-5 students. The goals should be clearly defined and should use robust technologies and rigorous testing.                                  **6 Hours**

**Course Outcomes:** At the end of the course, the student will be able to:

| 22IEP38.1 | Analyze the basics of IoT and protocols. |
|---|---|
| 22IEP38.2 | Develop IoT-based prototypes to solve industrial and societal problems. |

| 22IEP38.3 | Apply appropriate approaches to plan a new project and develop a project schedule. |
| --- | --- |
| 22IEP38.4 | Discuss the ethical aspects in IPR, Govt. policies on IPR, and conducting patentability searches. |
| 22IEP38.5 | Inculcate the teamwork and communication skills. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
| --- | --- | --- | --- | --- |
| **Reference Books** | | | | |
| 1 | Internet of Things (A Hands-on-Approach) | Vijay Madisetti and Arshdeep Bahga | Orient Blackswan Private Limited | 1st Edition, 2015 |
| 2 | Fundamentals of Intellectual Property | Dr. Kalyan C. Kankanala | Asia Law House | 1st Edition, 2012 |
| 3 | Project Management Absolute Beginner's Guide | Greg Horine | Pearson Education (US) | 4th Edition, 2017 |

## Course Articulation Matrix

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22IEP38.1** | | | 2 | | 2 | | | | 2 | 2 | | | | |
| **22IEP38.2** | | | 2 | | | | | | | | 3 | | | |
| **22IEP38.3** | | | | | 2 | | | | | | 2 | | | |
| **22IEP38.4** | | | | | | | | 1 | | 2 | | | | |
| **22IEP38.5** | | | | | | | | 1 | 2 | 2 | | | | |

1: Low     2: Medium 3: High

| Industry Oriented Training - Business Etiquettes | | | | |
|---|---|---|---|---|
| Course Code | **22ITB39A** | CIE Marks | 50 | |
| Teaching Hours/Week (L:T:P) | (0:0:2) | SEE Marks | - | |
| Credits | - | Exam Hours | 2 | |

**Course Learning Objectives:**
6. Know the components of self-introduction
7. Develop a resume with the inclusion of core competencies
8. Involve and contribute to group discussions
9. Develop effective communication to succeed in the professional career
10. Know the etiquettes of digital communication

## Module-1

**Self-Introduction &Essentials of grooming**
**Self-Introduction:** Learn the secret to introducing Yourself, Things to avoid when introducing yourself. Activity: Video record the self-introduction. **Essentials of grooming:** Creating the first impression, what does the well-dressed man wear? What does the well-dressed woman wear? Personal hygiene and habits. **4 Hours**

## Module-2

**Resume Writing**
Purpose, Identifying Relevant Competencies, Understanding Applicant Tracking Systems, Lists of Competencies, Writing Accomplishment/ Objective Statements, Finding the Right Words- Action verbs, The Most Popular Resume Format, Other Popular Resume Formats, Do's and Don'ts. Activity: Students have to submit a copy of their resume.
**4 Hours**

## Module-3

**Group Discussion**
Types, process, Evaluation criteria, Do's and Don'ts Activity: Group discussions have to be held during the training sessions. **4 Hours**

## Module-4

**Communicate effectively**
Build a Story, Just a Minute, Group Activities, Team building activities, Role Play, Presentation Skills. **4 Hours**

## Module-5

**Digital right and wrong**
Virtual Communication: Agenda, being prepared, Dressing appropriately, background, Use Microphone and camera the right way, restraining from off tasks during virtual meetings, protecting confidential data during online presentations, time management. **4 Hours**

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22ITB39A.1** | Articulate the essential components required for self-introduction in any business or a networking event and also recognize the need to dress appropriately for a successful career in the corporate |
| **22ITB39A.2** | Develop a resume inclusive of core competencies, and action verbs which are compatible with Applicant Tracking Systems |
| **22ITB39A.3** | Demonstrate the types, process and evaluation process of Group Discussion and carry out effective group discussions |
| **22ITB39A.4** | Develop skills required for effective communication |
| **22ITB39A.5** | Associate and be accustomed to the etiquette to be followed during online meetings |

| Sources |
|---|
| 1. English for Common Interactions in the Workplace: Basic Level: Coursera: https://www.coursera.org/learn/english-common-interactions-workplace-basic-level |
| 2. Personal Communication-Introduce Yourself With Confidence: https://www.udemy.com/course/how-to-introduce-yourself/ |
| 3. Professionalism, Grooming and Etiquette: https://www.edx.org/course/professionalism-grooming-and-etiquette |
| 4. How to Write a Resume: https://www.coursera.org/learn/how-to-write-a-resume#syllabus |
| 5. Group Discussion Strategies: https://www.udemy.com/course/group-discussion-strategies/ |
| 6. Communication Strategies for a Virtual Age: https://www.coursera.org/learn/communication-strategies-virtual-age#syllabus |

| References |
|---|
| 1. https://simplifytraining.com/course/personal-hygiene-and-good-grooming/ |
| 2. https://www.udemy.com/course/group-discussion-strategies/ |
| 3. https://www.educba.com/course/group-discussion/ |
| 4. https://getrafiki.ai/meetings/rules-of-virtual-meeting-etiquette-every-sales-professional-should-follow/ |
| 5. https://thedigitalworkplace.com/articles/online-meeting-etiquette-for-attendees/ |
| 6. https://rigorousthemes.com/blog/virtual-meeting-etiquette-guidelines-ground-rules/ |

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22ITB39A.1** | | | | | | | | | 2 | 3 | | 1 | | |
| **22ITB39A.2** | | | | | | | | | | 3 | | 1 | | |
| **22ITB39A.3** | | | | | | | | | 2 | 3 | 1 | 1 | | |
| **22ITB39A.4** | | | | | | | | | 2 | 3 | 1 | 1 | | |
| **22ITB39A.5** | | | | | | | | | 2 | 3 | 1 | 1 | | |

1: Low    2: Medium    3: High

| Industry Oriented Training - Computing Skills | | | | |
|---|---|---|---|---|
| Course Code | **22ITC39B** | CIE Marks | 50 | |
| Teaching Hours/Week (L:T:P) | (0:0:2) | SEE Marks | - | |
| Credits | **-** | Exam Hours | 02 | |

**Course Learning Objectives:**

1. Use logical conditions for problem-solving and also introduce the concepts of arrays
2. Know functions, function calls, and parameter passing
3. Introduce algorithms and appreciate their importance in problem-solving
4. Introduce the core concepts of OOP's
5. Differentiate between front-end & back-end development and recognize the use of database management

| Module-1 |
|---|

**Introduction to computing constructs**

Logical conditions: For Loops, Nested For Loops, While Loops, Do-While Loops, Nesting and Boxes, and combine/negate several logical conditions using logic operations AND, OR, and NOT.

Arrays & strings: Create arrays of characters (strings), use the null terminator, and manipulate strings.                                                                                                 **4 Hours**

| Module-2 |
|---|

**Functions & Pointers**
Introduction to Functions, Returning Data From a Function, Passing Data Into a Function, Getting Valid User Input, Changing Parameter Values, Pointer Basics, Changing the Pointed to Value, Walking an Array with Pointers, Dynamic Memory Allocation, Getting More Memory, Pointers to Structure.                                                                                           **4 Hours**

| Module-3 |
|---|

**Algorithm analysis**
Introduction to Algorithm Analysis, Big-O, Big-O Examples, Dynamic Array Operations, Bubble Sort, Selection Sort, Insertion Sort, Recursion, Recursive Binary Search, Merge Sort.
                                                                                                                                     **4 Hours**

| Module-4 |
|---|

**Object-oriented programming**
Designing for Object-Oriented Programming, Core Concepts of OO Programming: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, procedural and object-oriented programming paradigm.                                            **4 Hours**

| Module-5 |
|---|

**Frontend and backend development**
UI, Database management: DBMS overview, Relational Data Model and the CREATE TABLE Statement, Basic Query Formulation with SQL.                                                      **4  Hours**

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22ITC39B.1** | Illustrate the use of logical conditions, declare and manipulate data into arrays |
| **22ITC39B.2** | Implement functions, function calls, and parameter passing |
| **22ITC39B.3** | Design, implement, and evaluate an algorithm to meet desired needs |
| **22ITC39B.4** | Describe the core concepts of OOP's |
| **22ITC39B.5** | Recognize the concepts of front-end development and database management |

| Sources |
|---|
| 1. Computational Thinking with Beginning C Programming Specialization: https://www.coursera.org/learn/simulation-algorithm-analysis-pointers?specialization=computational-thinking-c-programming#syllabus |
| 2. Simulation, Algorithm Analysis, and Pointers: https://www.coursera.org/lecture/simulation-algorithm-analysis-pointers/big-o-examples-pdCan |
| 3. Programming Fundamentals: https://www.coursera.org/learn/programming-fundamentals?specialization=c-programming#syllabus |
| 4. Object-Oriented Programming Concepts: https://www.coursera.org/learn/concepts-of-object-oriented-programming#syllabus |
| 5. Introduction to Back-End Development: https://www.coursera.org/learn/introduction-to-back-end-development |

## Course Articulation Matrix

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22ITC39B.1** | 2 | 1 | 1 | | | | | | | | | | | |
| **22ITC39B.2** | 2 | 1 | 1 | | | | | | | | | | | |
| **22ITC39B.3** | 1 | 1 | 2 | | | | | | | | | | | |
| **22ITC39B.4** | 2 | | 1 | | | | | | | | | | | |
| **22ITC39B.5** | 2 | 1 | 1 | | | | | | | | | | | |

1: Low 2: Medium 3: High

# IV Semester

| Computational Statistics | | | |
|---|---|---|---|
| Course Code | **22CBS41** | CIE Marks | 50 |
| Course Type (Theory/Practical/Integrated) | Theory | SEE Marks | 50 |
| | | Total Marks | 100 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE | 3 Hours |
| Total Hours | 40 | Credits | 03 |

**Course Learning Objectives:**

1. To apply the knowledge of Analysis of variance and covariance in Experimental designs.
2. To study the mean, variance, linear regression models and error term for use in Multivariate data analysis.
3. To understand the relationship of the data collected for decision making.
4. To study statistical analysis by using discriminant analysis.
5. To know the concept of principal components, and factor analysis for profiling and interpreting
6. To study different models used for estimating data.

| Module-1 | 8 hours |
|---|---|

**Analysis of variance:** The basic concept of Anova, One way and Two way Anova with and without repetitions, Analysis of Ancova.

| Module-2 | 8 hours |
|---|---|

**Multivariate Normal Distribution:** Joint Probability distribution of continuous random variable Multivariate Normal Distribution Functions, Marginal and conditional distribution and properties. Independence of sample mean vector and sample covariance matrix. Conditional Distribution and its relation to regression model, Estimation of parameters.

| Module-3 | 8 hours |
|---|---|

**Discriminant Analysis:** Statistical background, concepts of separation and classification, Fisher linear discriminant function analysis, Estimating linear discriminant functions and their properties.

| Module-4 | 8 hours |
|---|---|

**Principal Component Analysis:** Definition and properties, graphing the principal components, sample principal components, interpretation of zero, small and repeated eigenvalues, component loadings and component correlations, the problem of scaling.

| Module-5 | 8 hours |
|---|---|

**Factor Analysis:** orthogonal factor model, factor loadings, estimation of factor loadings, factor scores. Cluster Analysis: distances and similarity measures, hierarchical clustering methods, K – means method.

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22CBS41.1** | Understand the role of between-group and within-group variability in testing differences between group means |
| **22CBS41.2** | Analyze means and variances of the individual variables in a multivariate set And also the correlations between those variables. |
| **22CBS41.3** | Analyze the relationship between multiple normally distributed variables and apply in real life problems. |
| **22CBS41.4** | Assess the adequacy of classification, given the group memberships of the objects under study. |

| 22CBS41.5 | Reduce the dimensionality of datasets by increasing interpretability with minimal information loss. |
|---|---|
| 22CBS41.6 | Simplify set of complex variables using statistical procedures to explore the relationships between the multiple variables. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | An Introduction to Multivariate Statistical Analysis | T.W. Anderson | Wiley | 3$^{rd}$ Edition, 2009 |
| 2 | Applied Multivariate Data Analysis, Vol I & II, | J.D. Jobson | Springer New York, NY | 1$^{st}$ Edition, 2012 |
| 3 | Statistical Tests for Multivariate Analysis | H. Kris | Springer New York, NY | 1$^{st}$ Edition, 2012 |
| **Reference Books** | | | | |
| 1 | Probability and Statistics, Schaum's Outline | Murray R.S, John S, R.A. Srinivasan | Mc Graw Hills | 4th Edition, 2010 |
| 2 | Engineering Mathematics | N.P Bali, Dr Manish Goyal | Miller and Freund's | 6th Edition, 2001 |
| 3 | Research Methodology Methods and Techniques | C R Kothari, Gaurav Garg | New age International Publisher | 4th Edition, 2020 |

**Web links and Video Lectures (e-Resources):**
- https://www.youtube.com/watch?v=x_gHAly3mJo
- https://www.youtube.com/watch?v=h4jvu8PW8YE
- https://www.youtube.com/watch?v=vnHkTnRFdAU
- https://www.youtube.com/watch?v=ZtS6sQUAh0c
- https://www.youtube.com/watch?v=NHrNVEIHPBY

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CBS41.1** | | | | | 2 | | | | | | | | | |
| **22CBS41.2** | | | 2 | 1 | | | | | | | | | | |
| **22CBS41.3** | 2 | | 2 | | | | | | | | | | | |
| **22CBS41.4** | 1 | | 2 | | | | | | | | | | | |
| **22CBS41.5** | | | 2 | | | | | | | | | | | |
| **22CBS41.6** | | 2 | 3 | | | | | | | | | | | |

1: Low     2: Medium 3: High

| Operating Systems | | | |
|---|---|---|---|
| Course Code | **22CBS42** | CIE Marks | 50 |
| Course Type (Theory/Practical/Integrated) | Integrated | SEE Marks | 50 |
| | | Total Marks | 100 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE | 3 Hours |
| Total Hours | 40 hours Theory + 10 Lab slots | Credits | 04 |

**Course Learning Objectives:** The objective of the course is to
- Learn basics of operating system and concept of virtual machine
- Understand the concepts of process, scheduling and synchronization
- Use Processor, Memory, Storage and File system commands.
- Demonstrates the use of Memory and Virtual memory management.
- Analyze the concept of Deadlock and Process synchronization.

| **Module-1: Introduction** | **8 hours** |
|---|---|

**Introduction:** Concept of Operating Systems (OS) - Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls- Basic architectural concepts of an OS, Concept of VirtualMachine - Resource Manager view, process view, hierarchical view of an OS.
**TB1**: Ch 1, 2

| **Module-2: Process Management** | **8 hours** |
|---|---|

Processes Concept - Process Scheduling, Threads – Types, Concept of multithreads – CPU Scheduling, Scheduling algorithms- FCFS, SJF, RR, Multiprocessor scheduling – Real Time scheduling, RM and EDF , Inter-process Communication, Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems, Reader's & Writer Problem, Dinning Philosopher Problem, Barber's shop problem.
**TB1:** Ch 3, 4, 5

| **Module-3: Deadlock and Concurrent Programming** | **8 hours** |
|---|---|

Deadlocks – Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance, Banker's algorithm, Deadlock detection and Recovery, Concurrent Programming, Critical region - Conditional critical region, Monitors, Concurrent languages, Communicating Sequential Process (CSP).
**TB1: Ch 7**

| **Module-4: Memory Management** | **8 hours** |
|---|---|

Memory Management – Basic concept, Logical and Physical address maps, Memory allocation, Contiguous Memory allocation, Fixed and variable partition, Internal and External fragmentation and Compaction, Virtual Memory, Basics of Virtual Memory, Hardware and control structures, Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms- Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU), Least Recently used (LRU).
**TB1: Ch 8 , 9**

| **Module-5: File and I/O Management** | **8 hours** |
|---|---|

I/O Hardware -I/O devices, Device controllers, Direct Memory Access, Principles of I/O Concept of File - Access methods , File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management(bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance, Disk structure - Disk scheduling, FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks, Case Study: Unix File System.
**TB1: Ch 11, 12 , 13**

| **List of Laboratory Experiments related to above modules – 2 hours each** |
|---|
| 1.  Implement shell scripts with filters and pipes (grep, sort, uniq, cut, tr) |

2. Implement shell script for system monitoring with email alert
3. Inter-process communication using shared memory
4. Write C programs to implement the various CPU Scheduling – FCFS, SJF, Priority andRR.
5. Producer Consumer problem solution using semaphores
6. Implement Bankers algorithm for deadlock avoidance
7. Implementation of the following Memory Allocation Methods for fixed partition
   a) First Fit    b) Worst Fit    c)    Best Fit
8. Implementation of the following Page Replacement Algorithms
   FIFO    b)    LRU    c)    LFU

9. **Open ended experiment covering the concept of entire syllabus**
   **CASE STUDY:** Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

**Course Outcomes:** At the end of the course the student will be able to:

| | |
|---|---|
| **22CBS42.1** | Explain the understanding of operating system design and its impact on system performance |
| **22CBS42.2** | Describe the role of multi-threading and process scheduling in increasing the throughput of the system |
| **22CBS42.3** | Investigate the processes used by operating systems to synchronize process, handle deadlocks and manage memory. |
| **22CBS42.4** | Discuss the performance issues of storage management and describe the algorithms and structures introduced to resolve the same |
| **22CBS42.5** | Compare and contrast the various disk scheduling algorithms. |
| **22CBS42.6** | Work individually or in teams to analyze a given operating system problem and develop solutions to solve it. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Operating System Concepts | Abraham Silberschatz, Peter Baer Galvin | John Wiley and Sons Inc | 9th Edition, 2012 |
| **Reference Books** | | | | |
| 1 | Operating Systems: Internals and Design Principles | William Stallings | Pearson | 6th Edition, 2012 |
| 2 | Modern Operating Systems | Andrew S. Tanenbaum | Pearson Education | 4th Edition, 2015 |
| 3 | Understanding the Linuxkernel | Daniel P Bovet and MarcoCesati | O'Reilly | 3rd Edition, 2005 |

**Web links and Video Lectures (e-Resources):**
- https://www.geeksforgeeks.org/operating-systems
- https://www.codingninjas.com/courses/operating-system
- https://www.udacity.com/course/introduction-to-operating-systems--ud923

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CBS42.1** | 2 | | | 1 | | | | | | | | | | |
| **22CBS42.2** | | | 2 | | | | | | | | | | | |
| **22CBS42.3** | | | 2 | | | | | | | | | | | |
| **22CBS42.4** | | | | 2 | | | | | | | | | | |
| **22CBS42.5** | | | | | 1 | | | | | | | | | |
| **22CBS42.6** | | | | | | | | | 2 | | | | | 1 |

1: Low    2: Medium 3: High

| Design and Analysis of Algorithms | | | |
|---|---|---|---|
| Course Code | **22CBS43** | CIE Marks | 50 |
| Course Type (Theory/Practical/Integrated) | Integrated | SEE Marks | 50 |
| | | Total Marks | 100 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE | 3 Hours |
| Total Hours | 40 hours Theory + 10 Lab slots | Credits | 04 |

**Course Learning Objectives:** The objective of the course is to
- Apply appropriate methods to solve a given problem and validate its correctness solving.
- Analyze time complexity of the algorithms.
- Implement various algorithmic techniques like Greedy strategy, Divide and Conquer approach, Dynamic Programming and Backtracking.
- Understand Synthesizing efficient algorithms in common engineering design situations.
- Know the limitations of algorithmic power.

| **Module-1** | **8 hours** |
|---|---|

**Introduction:** What is an Algorithm? Fundamentals of Algorithmic Problem Solving, Important Problem Types. **Analysis:** Analysis Framework, Asymptotic Notations and Basic Efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples. Empirical Analysis of Algorithms**.**

| **Module-2** | **8 hours** |
|---|---|

**Divide and Conquer:** General method, Recurrence equation, Master Theorem, Merge sort, Quick sort, Strassen's matrix multiplication. **Decrease and Conquer:** Binary search. **Transform and Conquer:** AVL Trees, Heaps and Heap sort.

| **Module-3** | **8 hours** |
|---|---|

**Greedy method:** General method. **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm. **Single source shortest paths:** Dijkstra's Algorithm. **Optimal Tree Problem:** Huffman Trees and Codes. **Space and Time Tradeoffs:** Sorting by Counting, B-Trees.

| **Module-4** | **8 hours** |
|---|---|

**Dynamic programming:** Knapsack problem with memory functions, Optimal Binary Search Trees, Transitive Closure-Warshall's Algorithm, All Pairs Shortest Paths-Floyd'sAlgorithm.
**Limitations of Algorithm Power:** P, NP and NP- Complete Problems.

| **Module-5** | **8 hours** |
|---|---|

**Backtracking:** N-Queens problem, Hamiltonian circuit Problem, Sum of subsets problem.
**Branch and Bound:** Assignment problem, Knapsack problem, Travelling Sales Personproblem.

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**PRACTICAL MODULE**

Implement the specified algorithms for the following problems using Java. IDE's such as NetBeans / Eclipse can be used for development and demonstration.
1. Binary Search: To search a key in the list of n integers.
2. Merge Sort: To sort n randomly generated integers.
3. Quick Sort: To sort n randomly generated integers.
4. Prim's algorithm: To find the Minimum Spanning Tree of an undirected graph.
5. Kruskal's Algorithm: To find the Minimum Spanning Tree of an undirected graph.
6. Floyd's Algorithm: To find all pairs shortest distance in a graph.
7. Knapsack Problem: To solve 0/1 Knapsack problem using dynamic programming
8. Subset problem: To solve the sum of subset problem using branch and bound method
9. Open ended experiment covering the concept of entire syllabus: Online shopping application

| Course Outcomes: | At the end of the course the student will be able to: |
|---|---|
| 22CBS43.1 | Interpret the time and space complexity of algorithms which provides solutions to the given problem. |
| 22CBS43.2 | Identify the problems from the set that can be solved using divide and conquer techniques and apply the technique to obtain the solutions. |
| 22CBS43.3 | Apply the technique of greedy algorithms in real life applications to get the optimal solution. |
| 22CBS43.4 | Apply the dynamic programming design technique to solve various problems. |
| 22CBS43.5 | Differentiate the problems that can be solved using backtracking method and other general design techniques for given set of problems. |
| 22CBS43.6 | Analyze the limitations of algorithm power. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to the Design and Analysis of Algorithms | Anany Levitin | Pearson | 3rd Edition, 2012. Reprint 2023 |
| **Reference Books** | | | | |
| 1 | Introduction to Algorithms | Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein | Prentice Hall India | 3rd Edition, 2010 |
| 2 | Computer Algorithms | Ellis Horowitz, Satraj Sahni and Rajasekaran | Galgotia Publications P Ltd | 2013 |

**Web links and Video Lectures (e-Resources):**
- NPTEL Design and Analysis of Algorithms by Prof. Madhavan Mukund, https://nptel.ac.in/courses/106106131
- NPTEL Fundamental Algorithms: Design and Analysis by Prof. Sourav Mukhopadhyay, https://onlinecourses.nptel.ac.in/noc22_cs01/preview
- GeekforGeeks, Algorithms https://www.geeksforgeeks.org/fundamentals-of-algorithms/
- Turorialspoint, Design and Analysis of Algorithms Tutorial https://www.tutorialspoint.com/design_and_analysis_of_alg orithms/index.htm
- https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rrl48XKpZkf03iYFl-O29szjTrs_O

## Course Articulation Matrix

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| 22CBS43.1 | | 2 | | 3 | | | | | | | | | | 3 |
| 22CBS43.2 | | 3 | 3 | | | | | | | | | | 2 | |
| 22CBS43.3 | | | 3 | | | | | | | | | | 2 | |
| 22CBS43.4 | | | 3 | | | | | | | | | | 2 | |
| 22CBS43.5 | | | | 3 | | | | | | | | | 2 | |
| 22CBS43.6 | | | | 3 | | | | | | | | | | 3 |

1: Low    2: Medium 3: High

| Financial Management | | | |
|---|---|---|---|
| Course Code | **22CBS44** | CIE Marks | 50 |
| Course Type (Theory/Practical/Integrated) | Theory | SEE Marks | 50 |
| | | Total Marks | 100 |
| Teaching Hours/Week (L: T: P) | 3:0:0 | SEE | 3 Hours |
| Total Hours | 40 Hours | Credits | 03 |

**Course Learning Objectives:** The objective of the course is
- To analyze the basic concepts of Financial Management.
- To summaries the future and the present value of cash flow.
- To devise investment on a larger scale.
- To appraise investment proposals and determine working capital.
- To estimate the working capital requirements of an organization.

| Module-1 | 8 hours |
|---|---|

**Introduction to Financial Management** – Meaning, Scope and Objectives of Financial Management Financial Environments. Indian Financial System: Financial markets, Financial Instruments, Financial institutions, and financial services. Emerging issues in Financial Management: Risk Management.
**Time Value of Money:** Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity & Perpetuity, Annuity Factor.

| Module-2 | 8 hours |
|---|---|

**Valuation of Securities:** Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield, and YTM.
Cost of Capital: Factors affecting Cost of Capital, Concept, Computation of Specific Cost of Capital for Equity - Preference – Debt, Weighted Average Cost of Capital.

| Module-3 | 8 hours |
|---|---|

**Capital Budgeting:** The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques- Sums on Payback period, discounted payback period, accounting rate of return Net present value, Internal rate of return, Modified internal rate of return, Profitability index.

| Module-4 | 8 hours |
|---|---|

**Capital structure and dividend decisions** – Planning the capital Structure-Governance of Equity and Debt, Operating & Financial Leverage: Operating Leverage, Financial Leverage, Total Leverage. EBIT and EPS analysis. ROI & ROE analysis

| Module-5 | 8 hours |
|---|---|

**Working Capital Management:** Factors influencing working capital requirements - Current asset policy and current asset finance policy-Estimation of Working Capital. A brief explanation of cash management and accounts receivable management.

| Course Outcomes: At the end of the course the student will be able to: | |
|---|---|
| **22CBS44.1** | Explain the basic concepts of financial management. |
| **22CBS44.2** | Discover various valuation methods. |
| **22CBS44.3** | Describe the concept of capital budgeting and how cash flow is carried out. |
| **22CBS44.4** | Appraise investment proposals and determine the working capital. |
| **22CBS44.5** | Estimate the working capital requirements of an organization |
| **22CBS44.6** | Enhancing, evaluating and making judgment skills based on financial information |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Financial Management - Theory & Practice | Chandra, Prasanna | Pearson | 16th Edition, 2019 |
| **Reference Books** | | | | |
| 1 | Financial Management | Srivastava, Misra | Oxford University Press | 2nd Edition, 2011 |
| 2 | Fundamentals of Financial Management | Van Horne and Wachowicz | Prentice Hall/ Pearson Education | 13th Edition, 2008 |

**Web links and Video Lectures (e-Resources):**
- https://youtu.be/Yf-VmsLc40k?list=PLiaygP8qeQGUfaP0v6NEIyeY6dEmQJ7RJ
- https://www.youtube.com/watch?v=wvXDB9dMdEo&pp=ygUUZmluYW5jaWFsIG1hbmFnZW1lbnQ%3D
- https://www.coursera.org/articles/finance-management
- https://www.wallstreetmojo.com/financial-management/

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CBS44.1** | 1 | 1 | 1 | | | | | | 1 | | 2 | | | 1 |
| **22CBS44.2** | | 1 | | | 1 | | | 1 | | | | | | |
| **22CBS44.3** | | | | | 2 | | | | | | | | | |
| **22CBS44.4** | | | | 2 | | | | 2 | | | 1 | | | |
| **22CBS44.5** | | | 1 | | | | | | | | 2 | | 1 | |
| **22CBS44.6** | | | | | | 1 | | | | | | | | 1 |

1: Low   2: Medium   3: High

| Design Thinking | | | |
|---|---|---|---|
| Course Code | **22CBS451** | CIE Marks | 50 |
| Course Type (Theory/Practical/Integrated) | Theory | SEE Marks | 50 |
| | | Total Marks | 100 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE | 3 Hours |
| Total Hours | 40 Hours | Credits | 03 |

**Course Learning Objectives:** The objective of the course is to
- Provide an understanding of the need of design thinking
- Explore the students for the design thinking process
- Make students understand the process of converting an idea to innovation as per the business demands
- Provide a platform to discover need of design thinking and modelling for product design.
- Develop students' professional skills in client management and communication while marketing their products.

| Module-1 | Design Thinking for Innovation | 8 hours |
|---|---|---|

**Design Thinking for Innovation:** What is of Design Thinking, Really? Is design Thinking a science or an art? Design thinking oversimplified, Building to Think, or The Power of Prototyping Converting Need into Demand, or Putting People First.
**Text Book**: **TB1, TB2**

| Module-2 | Design Thinking Process | 8 hours |
|---|---|---|

**Design Thinking Process:** Applied Design thinking in business and strategy, Design Thinking to the Rescue, Every Future Business Leader Needs to Be a Good Design Thinker, The 10 Design Thinking Principles That Redefine Business Management. Design Activism, or Inspiring Solutions with Global Potential. **Text Book**: **TB1, TB2**

| Module-3 | Innovation | 8 hours |
|---|---|---|

**Innovation:** Art of innovation, Business Challenge: Growth, Predictability, change, Maintaining Relevance, extreme competition, Standardization, creative culture, strategy and organization.
Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation. Design Thinking Meets the Corporation or Teaching to Fish.
**Text Book**: **TB1, TB2**

| Module-4 | Product Design | 8 hours |
|---|---|---|

**Product Design**: Hiring Design Thinkers Is Not Enough; We Need to Create Design Thinking Companies, The New Social Contract, or We're All in This Together.
Activity: Importance of modelling, how to set specifications, Explaining their own product design. **Text Book**: **TB1, TB2**

| Module-5 | Design Thinking in Business Processes | 8 hours |
|---|---|---|

**Design Thinking in Business Processes:** Design Activism, or Inspiring Solutions with Global Potential. Changing Management Paradigms, Designing Tomorrow—Today
Activity: How to market our own product, About maintenance, Reliability and plan for startup.
**Text Book**: **TB1, TB2**

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22CBS451.1** | Develop an understanding of the design thinking process and its significance. |
| **22CBS451.2** | Identify the implication of design thinking in business processes for better performance. |
| **22CBS4513** | Model innovative ideas by considering unique needs of a company around specific challenges. |
| **22CBS451.4** | Discover the need of design thinking and modelling as per the specifications for a product design. |

| 22CBS451.5 | Develop an ability to market a product by considering maintenance and change management factors to make it reliable. |
|---|---|
| 22CBS451.6 | Create physical prototypes / visual representation of an innovative idea by highlighting its business benefits. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Change by design: How Design Thinking Transforms Organizations and Inspires Innovation | Tim Brown | Harper Collins Publishers Ltd | 2009 |
| 2 | Design Thinking for Strategic Innovation | Idris Mootee | John Wiley & Sons Inc. | 2013 |
| **Reference Books** | | | | |
| 1 | Design Thinking in the Classroom | David Lee | Ulysses Press | 2018 |
| 2 | Design the Future | Shrrutin N Shetty | Norton Press | I$^{st}$ Edition 2018 |
| 3 | Universal Principles of Design | William lidwell, kritinaholden, Jill butter | Rockport Publishers | 2$^{nd}$ Edition 2010 |

**Web links and Video Lectures (e-Resources):**
- https://online.hbs.edu/courses/design-thinking-innovation/
- https://www.roitraining.com/course-315-introduction-to-design-thinking/
- https://www.amrita.edu/course/design-thinking/
- https://www.coursera.org/learn/uva-darden-design-thinking-innovation
- https://dschool.stanford.edu/resources/design-thinking-bootleg
- Stanford Webinar - Design Thinking = Method, Not Magic
- https://www.youtube.com/watch?v=vSuK2C89yjA
- Rise of Design Thinking in India | Ankur Grover Kunal Gupta | TEDxTISS
- https://www.youtube.com/watch?v=VuedtXtyCjs
- http://quicksand.co.in/

## Course Articulation Matrix

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CBS451.1** | 2 | 2 | 2 | | | | | | | | | | | |
| **22CBS451.2** | 2 | 2 | 1 | | | | | | | | | | | |
| **22CBS451.3** | | 3 | 2 | | | | 1 | | | 1 | 1 | 1 | 2 | |
| **22CBS451.4** | | 2 | 1 | | | | 1 | | | 1 | 1 | 1 | 2 | |
| **22CBS451.5** | 2 | | 2 | | | | 1 | | | 1 | 1 | 1 | 2 | |
| **22CBS451.6** | | | 2 | | 2 | | 1 | | | 1 | 1 | 1 | 2 | |

1: Low   2: Medium 3: High

| C# Programming with DotNet | | | |
|---|---|---|---|
| Course Code | **22CBS452** | CIE Marks | 50 |
| Course Type (Theory/Practical/Integrated) | Theory | SEE Marks | 50 |
| | | Total Marks | 100 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE | 3 Hours |
| Total Hours | 40 Hours | Credits | 03 |

**Course Learning Objectives:** The objective of the course is to
- Understand .NET framework and its runtime environment
- Gain the major aspects of C# language
- Know object-oriented programming concepts implementation
- Understand working of Exceptions and Object Lifetime

| Module-1 | 8 hours |
|---|---|

Understanding the Previous State of Affairs, The.NET Solution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries (aka Assemblies), the Role of the Common Intermediate Language, The Role of .NET Type Metadata, The Role of the assembly Manifast, Compiling CIL to Platform – Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime A tour of the .NET Namespaces, Increasing Your Namespace Nomenclature, Deploying the .NET Runtime.

| Module-2 | 8 hours |
|---|---|

The Role of the Command Line Compiler(csc.exe), Building C# Application using csc.exe ,Working with csc.exe Response Files, Generating Bug Reports, Remaining g C# Compiler Options, The Command Line Debugger (cordbg.exe) Using the, Visual studio .NET IDE, Other Key Aspects of the VS.NET IDE, C# "Preprocessor:" Directives, an Interesting Aside: The System. Environment Class

| Module-3 | 8 hours |
|---|---|

The Anatomy of Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# Application, Default assignment and Variable Scope, The C# Member Initialisation Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node: System, Object, The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types: Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C#, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining Custom Namespaces.

| Module-4 | 8 hours |
|---|---|

Forms Defining of the C# Class, Definition the "Default Public Interface" of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields, The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The " Protected" Keyword, Nested Type Definitions,The Third Pillar: C #'s Polymorphic Support, Casting Between

| Module-5 | 8 hours |
|---|---|

Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, the System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception(System. System Exception), Custom Application-Level Exception(System. System Exception), Handling Multiple Exceptions, The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System Exception Using VS. NET, Understanding Object Lifetime, the CIT of "new', The Basics of Garbage Collection,, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

| Course Outcomes: At the end of the course the student will be able to: | |
|---|---|
| 22CBS452.1 | Identify introductory programming concepts using C#. |
| 22CBS452.2 | Understand Command Line Compiler and Preprocessor Directives. |
| 22CBS452.3 | Determine logical alternatives with C# decision structures utilizing iteration, class methods, fields, and string manipulation. |
| 22CBS452.4 | Demonstrate knowledge of object-oriented concepts. |
| 22CBS452.5 | Understand ways of exception handling within the .NET application environment. |
| 22CBS452.6 | Design and Implement Windows Applications using Windows Forms, Control Library. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Pro C# with .NET 3.0 | Andrew Troelsen | HarperCollins Publishers Ltd | Special Edition 2007 |
| Reference Books | | | | |
| 1 | Programming in C# | E. Balagurusamy | Tata McGraw Hill | 2004 |
| 2 | C# and .Net Platform | Andrew Troelsen | APress | 1st Edition, 2001 |
| 3 | Programming C# | J. Liberty | O.Reilly | 2002 |

**Web links and Video Lectures (e-Resources):**
- http://www.tutorialspoint.com/csharp/index.htm
- https://www.sanfoundry.com/csharp-programming-examples
- https://learn.microsoft.com/en-us/previous-versions/visualstudio/visual-studio-2012/67ef8sbd(v=vs.110)
- https://csharp-station.com/Tutorial

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| 22CBS452.1 | 1 | 2 | | | | | | | 2 | | | | | 1 |
| 22CBS452.2 | 1 | 2 | | | | | | | 2 | | | | | 1 |
| 22CBS452.3 | 1 | 2 | | | | | | | 2 | | | | | 1 |
| 22CBS452.4 | 1 | 2 | | | | | 1 | | 2 | | | | | 1 |
| 22CBS452.5 | 1 | 2 | | | | | 1 | | 2 | | | | | |
| 22CBS452.6 | | 2 | | | | | 1 | 2 | 2 | 2 | | | | |

1: Low    2: Medium 3: High

| **Web Programming Laboratory** | | | | |
|---|---|---|---|---|
| Course Code | **22CBS46L** | CIE Marks | 50 | |
| Teaching Hours/Week (L:T:P) | (0:0:2) | SEE Marks | 50 | |
| Credits | **01** | Exam Hours | 03 | |

**Course Learning Objectives:**

• To gain knowledge on designing static and dynamic web pages.

• Able to validate web pages at client-side.

• Gain knowledge on server-side scripting.

• Understand the basics of React and create components and lifecycle.

• Develop applications using JSX and React.

• Develop application using server session handling technique.

## PART-A

1. i Create a table to show your class time-table.(CSS and HTML)

    ii Include course name, instructors, days of week and time slots .Include at least 5 courses and make sure the table is properly formatted with appropriate table headers, rows and  cells.

    iii. Write an HTML page that contains a selection box with a list of 5 countries, when the
      user select a country its capital should be printed next to the list;Add CSS to
      Customize the properties of font of the capital(color,bold,and font size)

2. Write a JavaScript to design a simple calculator to perform the following operations: sum,
    product, difference and quotient (Java Script)

3. i. Build your own Button component and render it three times. On user click, it should
      alert which button was clicked.(React JS).

    ii.Use the useState React hook to track how many times a button is clicked, and display the
      number

4. create a custom component that displays each item from
    ['dog', 'cat', 'chicken', 'cow', 'sheep', 'horse']
    Instead of using the <ul> and <li> HTML tags, create a custom component that accepts
    a list as its prop, and renders it accordingly.

5. Build a form that accepts a first name and a last name. And instead of a boring "Submit"
    button, make a button that says "Greet Me" that when clicked, will alert "Hello [first
    name] [last  name]!".

6. Create a custom component for rendering each joke present in an array. Using the map
    function, map through each object in the array. Use the custom component to render each
    object.

 1. i) Create an HTTP server listening on port 1337, which sends Hello, World! to the
      browser.

    ii) Create an HTTP server listening on port 3000, which sends Hello, World! to the
        browser using Express.

8. Create a server which send the response as listed below.

    i) Send response using status() function.

    ii) Send some particular data to the client using send() function

    iii) Sending the JSON response from the server to the client using json()

9. Store and retrieve the data with Node.js, Express and MongoDB.

10. Implement a node.js and MongoDB application using the express framework and mongoose ORM that supports pagination for retrieving and displaying posts from the database.

| PART-B (any two) |
|---|
| B1. Create a Tic Tac Toe game using React JS |
| B2. Create a simple CRUD application using Node.js, Express.js and MongoDB |
| B3. Create TODO app |
| B4. E-commerce website |
| B5. Social Media Application |
| B6. Job board application B7. Blog application |
| B8. Chat application. |
| B9. Create a website which reports the weather for a specific city using NodeJS to send API requests to Accuweather, and pug and CSS to present the weather to the users. |

| Course Outcomes: | |
|---|---|
| At the end of the course the student will be able to: | |
| 22CBS46L.1 | Apply HTML and CSS syntax and semantics to build web pages. |
| 22CBS46L.2 | Construct and visually format forms using HTML and CSS. |
| 22CBS46L.3 | Develop Client-Side Scripts using JavaScript. |
| 22CBS46L.4 | Apply the concepts of React to create Components. |
| 22CBS46L.5 | Develop applications using React JSX. |
| 22CBS46L.6 | Design applications using the Lifecycle methods and Component. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Web Development | Randy Connolly, Ricardo Hoar | Pearson Education India | 4th Edition, 2016 |
| 2 | React: Up & Running: Building Web Applications | Stoyan Stefanov | O'Reilly Media, Inc. | 2nd Edition, 2021 |
| **Reference Books** | | | | |
| 1 | Murach's HTML5 and CSS3 | Zak Ruvalcaba Anne Boehm | Murachs/Shroff Publishers & Distributors Pvt Ltd, | 3rd Edition, 2016 |
| 2 | Professional JavaScript forWeb Developers | Nicholas C Zakas | Wrox/WileyIndia | 3rd Edition, 2012 |
| 3 | JavaScript & jQuery: TheMissing Manual | David Sawyer Mcfarland | O"Reilly/Shroff Publishers & Distributors Pvt Ltd | 1st Edition, 2014 |
| 4 | Murach's HTML5 and CSS3 | Zak Ruvalcaba Anne Boehm | Murachs/Shroff Publishers & Distributors Pvt Ltd, | 3rd Edition, 2016 |

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| 22CBS46L.1 | | | 1 | | 2 | | | | | | | | | 1 |
| 22CBS46L.2 | | | 3 | 1 | | | | | | | | | | 1 |
| 22CBS46L.3 | | | 3 | 1 | | | | | | | | | | |
| 22CBS46L.4 | | | 3 | 1 | | | | | | | | | | |
| 22CBS46L.5 | | 1 | | 2 | | | | | | | | | | 1 |
| 22CBS46L.6 | | | | | | | | | 3 | 1 | 2 | | 1 | |

1: Low 2: Medium 3: High

| Universal Human Values- II | | | |
|---|---|---|---|
| Course Code | **22UHV47** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | (2:0:0) | SEE Marks | 50 |
| Credits | **02** | Exam Hours | 02 |

**Course Learning Objectives:**

This introductory course input is intended:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement toward value-based living in a natural way.

3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

**Module-1 Introduction to Value Education**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Activities: Sharing about Oneself, Exploring Human Consciousness and Exploring Natural Acceptance.                                                                                         **5 Hours**

**Module-2 – Harmony in the Human Being**

Understanding Human beings as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

Activities: Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body and Exploring the difference of Needs of Self and Body.          **5 hours**

**Module 3 – Harmony in the Family and Society**

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Activities: Exploring the Feeling of Trust, Exploring the Feeling of Respect and Exploring the Feeling systems to fulfil Human Goal.                                          **5 hours**

**Module-4 – Harmony in the Nature/Existence**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Activities: Exploring the Four Orders of Nature and Co-existence in Existence.     **5 hours**

**Module-5 – Implications of the Holistic Understanding – a Look at Professional Ethics**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Activities: Exploring Ethical Human Conduct, Humanistic Models in Education and steps of Transition towards Universal Human Order.                                           **5 hours**

| Course Outcomes: At the end of the course the student will be able to: | |
|---|---|
| **22UHV47.1** | Practice the method of self-exploration to understand the basic human aspiration. |
| **22UHV47.2** | Distinguish between needs of self and body. |
| **22UHV47.3** | Evolve a program for self-regulation and health. |
| **22UHV47.4** | Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them. |
| **22UHV47.5** | Realize sustainable solutions to the problems in society and nature. |
| **22UHV47.6** | Develop competence in professional ethics and strategies for the transition towards a value-based life/profession. |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Foundation Course in Human Values and Professional Ethics | R R Gaur, R Asthana, G P Bagaria | Excel Books, New Delhi | 2nd Revised Edition, 2019 |
| 2 | Teachers' Manual for A Foundation Course in Human Values and Professional Ethics | R R Gaur, R Asthana, G P Bagaria | Excel Books New Delhi | 2nd Revised Edition, 2019 |
| **Reference Books** | | | | |
| 1 | Jeevan Vidya: Ek Parichaya | A Nagaraj | Jeevan Vidya Prakashan Amarkantak | 1999 |
| 2 | Human Values | A.N. Tripathi | New Age Intl. Publishers, New Delhi | 2004 |

**Additional Resources/Web links/Video Lectures**

1. The Story of Stuff (Book).
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3. Small is Beautiful - E. F Schumacher.
4. Slow is Beautiful - Cecile Andrews
4. Economy of Permanence - J C Kumarappa
5. Bharat Mein Angreji Raj – Pandit Sunderlal
6. Rediscovering India - by Dharampal
7. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
8. India Wins Freedom - Maulana Abdul Kalam Azad
9. Vivekananda - Romain Rolland (English)
10. Gandhi - Romain Rolland (English)
11. UHV-I Teaching material (Presentations, Pre & Post Surveys etc.)
https://fdp-si.aicte-india.org/AicteSipUHV_download.php
12. Details of UHV-II: Universal Human Values – Understanding Harmony and Ethical Human Conduct
https://drive.google.com/file/d/1cznDaqDwKy__EKWmqJLWF94MeY4AXcsU/view?usp=sharing

13. Recorded FDP (Refresher 1 Part 1: Preparing to teach UHV-I in SIP)
https://www.youtube.com/watch?v=kejuD4faDDE&list=PLWDeKF97v9SOjS4RanhaYj4YLiImqm5pj&index=1

14. Resources, including the class notes and presentations
https://drive.google.com/drive/folders/1nh9m5ibEtvMyqekeiexAJtfbdNtmtt6-?usp=sharing

15. Hindi Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SMRfe5PK1HPYnEcrrJOL6K7

16. English Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22UHV47.1** | | | | | | 3 | | 2 | | | | | | |
| **22UHV47.2** | | | | | | 2 | | | 3 | | | | | |
| **22UHV47.3** | | | | | | 2 | | 3 | | | | | | |
| **22UHV47.4** | | | | | | | 3 | | | | | | | |
| **22UHV47.5** | | | 3 | | | | 2 | | | | | | | |
| **22UHV47.6** | | | | | | | | 3 | | | | 2 | | |

1: Low    2: Medium 3: High

| Biology for Engineers | | | |
|---|---|---|---|
| Course Code | **22BFE47** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | (2:0:0) | SEE Marks | 50 |
| Credits | **02** | Exam Hours | 02 |

**Course Learning Objectives:**
1. To bring awareness of biological concepts to engineering students
2. To introduce the building blocks of life and their complexity
3. To encourage interdisciplinary studies and projects
4. To appreciate the discoveries that mimic nature and its working
5. To inculcate nature-inspired design and operational principles

| Module-1 | 5 Hours |
|---|---|

**Basic Cell Biology:** Introduction to Biology, The cell: the basic unit of life, Expression of genetic information-protein structure and function, Cell metabolism; Cells respond to their external environments, Cells grow and reproduce, Cellular differentiation.

| Module-2 | 5 Hours |
|---|---|

**Biochemistry and Molecular Aspects of Life:** Biodiversity-Chemical bonds in Biochemistry; Biochemistry and Human biology, Protein synthesis -DNA; RNA, Transcription and translation factors play key roles in protein synthesis, Differences between eukaryotic and prokaryotic protein synthesis, Stem cells and their applications.

| Module-3 | 5 Hours |
|---|---|

**Bioinspired Engineering based on human physiology**: Circulatory system (artificial heart, pacemaker, stents), Nervous system (Artificial neural network), Respiratory system, sensory system (electronic nose, electronic tongue), Visual and auditory prosthesis (Bionic eye and cochlear implant).

| Module-4 | 5 Hours |
|---|---|

**Relevance of Biology as an interdisciplinary approach:** Biological observation that led to major discoveries, Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Bird flying (aircraft), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro).

| Module-5 | 5 Hours |
|---|---|

**Bioinspired Algorithms and Applications:** Genetic algorithm, Gene expression modelling, Parallel Genetic Programming: Methodology, History, and Application to Real-Life Problems, Dynamic Updating DNA Computing Algorithms, Bee-Hive: New Ideas for Developing Routing Algorithms Inspired by Honey Bee Behaviour.

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22BFE47.1** | Discuss how the cell forms the basic building block of life |
| **22BFE47.2** | Distinguish between transcription and translation |
| **22BFE47.3** | Describe the role played by proteins within the cell |
| **22BFE47.4** | Analyze the role of bioinspired design in novel applications |
| **22BFE47.5** | Apply bioinspired design principles to other domains |
| **22BFE47.6** | Implement a simple genetic algorithm |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| | | **Text Books** | | |
| 1 | Biology for Engineers | Thyagarajan.S., Selvamurugan. N., Rajesh.MP, Nazeer RA, Richard W. Thilagaraj, Barathi.S., and Jaganthan.M.K | Tata McGraw Hill | 2012 |
| 2 | Molecular Biology | Robert Weaver | McGraw-Hill | 5th Edition, 2012 |
| | | **Reference books** | | |
| 1 | Lewin's Genes XII | Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick | Jones and Bartlett Learning | 2017 |
| 2 | Bioinspired Engineering | Jenkins, C.H. | Momentum Press | 2012 |
| 3 | Bio mimetics: Nature-Based Innovation | Yoseph Bar-Cohen | CRC Press | 1st Edition, 2016 |
| 4 | A Practical Guide to Bio-inspired Design | Hashemi Farzaneh, Helena, Lindemann, Udo | Springer | 2019 |

**Web links/Video Lectures/MOOCs**

1. https://books.google.co.in/books?id=-2LNBQAAQBAJ&printsec=frontcover#v=onepage&q&f=false
2. https://www.aminotes.com/2017/02/biology-for-engineers-module-1-cocepts.html

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22BFE47.1** | 2 | | | | | 1 | | | | | | | | |
| **22BFE47.2** | | 1 | | | | 1 | | | | | | | | |
| **22BFE47.3** | 2 | | | | | 2 | | | | | | | | |
| **22BFE47.4** | | 2 | | | | | | | | | | 2 | | |
| **22BFE47.5** | 2 | | | | | | | | | | | 2 | | |
| **22BFE47.6** | | 2 | | | | | | | | | | 2 | | |

1: Low 2: Medium 3: High

| COMPUTATIONAL TOOLS FOR ENGINEERS | | | |
|---|---|---|---|
| Course Code: | **22CTE48** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | (0:0:2) | SEE Marks | 50 |
| Credits | **01** | Exam Hours | 02 |

**Course Learning Objectives:**
1. Apply modeling and simulation tools for a wide range of engineering problems.
2. Understand the analysis of data in Excel with statistics.
3. Use MATLAB and Simulink to perform engineering system analysis.

The engineering design process heavily relies on modeling and simulation. Modern simulation techniques enable the development of multi-physical, holistic system models that account for all system interactions. These digital models speed up the design and testing processes, saving time and money.

### Module 1

**Engineering Design Analysis**

Need for engineering design analysis. Product and system design. Introduction to analysis parameters – stress, deformation, acceleration, internal force and stability. Static structural analysis of engineering design using finite element method (case studies). Heat transfer and fluid dynamics modeling and simulation using CFD software (case studies).

**10** Hours

### Module 2

**Data Analysis with EXCEL**

Calculate Mean, Median, Mode, Minimum, Maximum, Quartiles, Variance and Standard Deviation from some numbers. Analyze a population using data samples. Group data, build XY charts, apply Logarithmic Scale and Trend Line on a chart, forecast from some data, and calculate running averages. Normal Distribution, Exponential Distribution, Uniform Probabilities, Binomial Distribution, and Poisson Distribution.

**4** Hours

### Module 3

**MATLAB and Simulink for Engineers**

Applications of MATLAB and Simulink in electrical engineering, electrical machines and power system projects, simulation of rectifiers, inverters, choppers, and cycloconverters.

**10** Hours

**Course Project**

Solve complex engineering problems via modeling and simulation. The project work is teamwork of 3-5 students. The goals should be clearly defined, use any software tool, and rigorous validation of the mathematical model should be done (experimental or theoretical).

| **Course Outcomes:** At the end of the course, the student will be able to: | |
|---|---|
| **22CTE48.1** | Apply the Finite Element Method to solve engineering problems |
| **22CTE48.2** | Solve statistical problems using Excel |
| **22CTE48.3** | Perform system-level analysis using MATLAB and Simulink |
| **22CTE48.4** | Build mathematical models for any given engineering problem. |
| **22CTE48.5** | Demonstrate teamwork and communication skills |

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---------|-------------------|----------------------|----------------------|------------------|
| **Reference Books** | | | | |
| 1 | **MATLAB and Simulink for Engineers** | Agam Kumar Tyagi | Oxford University Press | 2012 |
| 2 | **Practical Finite Element Analysis** | Nitin S.Gokhale | Finite to Infinite | 2020 |
| 3 | **Excel Crash Course for Engineers** | Eklas Hossain | Springer | 2021 |

**Course Articulation Matrix**

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|-----------------------|------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22CTE48.1** | 1 | | | | 1 | 1 | | | | | | | | |
| **22CTE48.2** | | 1 | | | 2 | | | | 2 | | | | | |
| **22CTE48.3** | | 1 | | | 2 | | | | | | | | | |
| **22CTE48.4** | | | | | 2 | 2 | | | | | | | | |
| **22CTE48.5** | 1 | | | | | | | | 2 | | | | | |

1: Low    2: Medium   3: High

| Industry Oriented Training - Business Etiquettes | | | |
|---|---|---|---|
| Course Code | **22ITB49A** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | (0:0:2) | SEE Marks | - |
| Credits | **-** | Exam Hours | 2 |

**Course Learning Objectives:**

11. Know the components of self-introduction
12. Develop a resume with the inclusion of core competencies
13. Involve and contribute to group discussions
14. Develop effective communication to succeed in the professional career
15. Know the etiquettes of digital communication

## Module-1

**Self-Introduction &Essentials of grooming**

**Self-Introduction:** Learn the secret to introducing Yourself, Things to avoid when introducing yourself. Activity: Video record the self-introduction. **Essentials of grooming:** Creating the first impression, what does the well-dressed man wear? What does the well-dressed woman wear? Personal hygiene and habits. **4 Hours**

## Module-2

**Resume Writing**

Purpose, Identifying Relevant Competencies, Understanding Applicant Tracking Systems, Lists of Competencies, Writing Accomplishment/ Objective Statements, Finding the Right Words-Action verbs, The Most Popular Resume Format, Other Popular Resume Formats, Do's and Don'ts. Activity: Students have to submit a copy of their resume.
**4 Hours**

## Module-3

**Group Discussion**

Types, process, Evaluation criteria, Do's and Don'ts Activity: Group discussions have to be held during the training sessions. **4 Hours**

## Module-4

**Communicate effectively**

Build a Story, Just a Minute, Group Activities, Team building activities, Role Play, Presentation Skills. **4 Hours**

## Module-5

**Digital right and wrong**

Virtual Communication: Agenda, being prepared, Dressing appropriately, background, Use Microphone and camera the right way, restraining from off tasks during virtual meetings, protecting confidential data during online presentations, time management. **4 Hours**

| **Course Outcomes:** At the end of the course the student will be able to: | |
|---|---|
| **22ITB49A.1** | Articulate the essential components required for self-introduction in any business or a networking event and also recognize the need to dress appropriately for a successful career in the corporate |
| **22ITB49A.2** | Develop a resume inclusive of core competencies, and action verbs which are compatible with Applicant Tracking Systems |
| **22ITB49A.3** | Demonstrate the types, process and evaluation process of Group Discussion and carry out effective group discussions |
| **22ITB49A.4** | Develop skills required for effective communication |
| **22ITB49A.5** | Associate and be accustomed to the etiquette to be followed during online meetings |

| **Sources** |
| --- |
| 1. English for Common Interactions in the Workplace: Basic Level: Coursera: https://www.coursera.org/learn/english-common-interactions-workplace-basic-level |
| 2. Personal Communication-Introduce Yourself With Confidence: https://www.udemy.com/course/how-to-introduce-yourself/ |
| 3. Professionalism, Grooming and Etiquette: https://www.edx.org/course/professionalism-grooming-and-etiquette |
| 4. How to Write a Resume: https://www.coursera.org/learn/how-to-write-a-resume#syllabus |
| 5. Group Discussion Strategies: https://www.udemy.com/course/group-discussion-strategies/ |
| 6. Communication Strategies for a Virtual Age: https://www.coursera.org/learn/communication-strategies-virtual-age#syllabus |
| **References** |
| 1. https://simplifytraining.com/course/personal-hygiene-and-good-grooming/ |
| 2. https://www.udemy.com/course/group-discussion-strategies/ |
| 3. https://www.educba.com/course/group-discussion/ |
| 4. https://getrafiki.ai/meetings/rules-of-virtual-meeting-etiquette-every-sales-professional-should-follow/ |
| 5. https://thedigitalworkplace.com/articles/online-meeting-etiquette-for-attendees/ |
| 6. https://rigorousthemes.com/blog/virtual-meeting-etiquette-guidelines-ground-rules/ |

## Course Articulation Matrix

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| 22ITB49A.1 | | | | | | | | | 2 | 3 | | 1 | | |
| 22ITB49A.2 | | | | | | | | | | 3 | | 1 | | |
| 22ITB49A.3 | | | | | | | | | 2 | 3 | 1 | 1 | | |
| 22ITB49A.4 | | | | | | | | | 2 | 3 | 1 | 1 | | |
| 22ITB49A.5 | | | | | | | | | 2 | 3 | 1 | 1 | | |

1: Low    2: Medium 3: High

| Industry Oriented Training - Computing Skills | | | |
|---|---|---|---|
| Course Code | **22ITC49B** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | (0:0:2) | SEE Marks | - |
| Credits | **-** | Exam Hours | 02 |

**Course Learning Objectives:**

6. Use logical conditions for problem-solving and also introduce the concepts of arrays
7. Know functions, function calls, and parameter passing
8. Introduce algorithms and appreciate their importance in problem-solving
9. Introduce the core concepts of OOP's
10. Differentiate between front-end & back-end development and recognize the use of database management

| Module-1 |
|---|

**Introduction to computing constructs**

Logical conditions: For Loops, Nested For Loops, While Loops, Do-While Loops, Nesting and Boxes, and combine/negate several logical conditions using logic operations AND, OR, and NOT.

Arrays & strings: Create arrays of characters (strings), use the null terminator, and manipulate strings.                                                                                                                      **4 Hours**

| Module-2 |
|---|

**Functions & Pointers**

Introduction to Functions, Returning Data From a Function, Passing Data Into a Function, Getting Valid User Input, Changing Parameter Values, Pointer Basics, Changing the Pointed to Value, Walking an Array with Pointers, Dynamic Memory Allocation, Getting More Memory, Pointers to Structure.                                                                                                                      **4 Hours**

| Module-3 |
|---|

**Algorithm analysis**

Introduction to Algorithm Analysis, Big-O, Big-O Examples, Dynamic Array Operations, Bubble Sort, Selection Sort, Insertion Sort, Recursion, Recursive Binary Search, Merge Sort.
                                                                                                                      **4 Hours**

| Module-4 |
|---|

**Object-oriented programming**

Designing for Object-Oriented Programming, Core Concepts of OO Programming: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, procedural and object-oriented programming paradigm.                                                                      **4 Hours**

| Module-5 |
|---|

**Frontend and backend development**

UI, Database management: DBMS overview, Relational Data Model and the CREATE TABLE Statement, Basic Query Formulation with SQL.                                                                      **4  Hours**

| Course Outcomes: At the end of the course the student will be able to: | |
|---|---|
| **22ITC49B.1** | Illustrate the use of logical conditions, declare and manipulate data into arrays |
| **22ITC49B.2** | Implement functions, function calls, and parameter passing |
| **22ITC49B.3** | Design, implement, and evaluate an algorithm to meet desired needs |
| **22ITC49B.4** | Describe the core concepts of OOP's |
| **22ITC49B.5** | Recognize the concepts of front-end development and database management |

| Sources |
|---|
| 1. Computational Thinking with Beginning C Programming Specialization: https://www.coursera.org/learn/simulation-algorithm-analysis-pointers?specialization=computational-thinking-c-programming#syllabus |
| 2. Simulation, Algorithm Analysis, and Pointers: https://www.coursera.org/lecture/simulation-algorithm-analysis-pointers/big-o-examples-pdCan |
| 3. Programming Fundamentals: https://www.coursera.org/learn/programming-fundamentals?specialization=c-programming#syllabus |
| 4. Object-Oriented Programming Concepts: https://www.coursera.org/learn/concepts-of-object-oriented-programming#syllabus |
| 5. Introduction to Back-End Development: https://www.coursera.org/learn/introduction-to-back-end-development |

## Course Articulation Matrix

| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **22ITC49B.1** | 2 | 1 | 1 | | | | | | | | | | | |
| **22ITC49B.2** | 2 | 1 | 1 | | | | | | | | | | | |
| **22ITC49B.3** | 1 | 1 | 2 | | | | | | | | | | | |
| **22ITC49B.4** | 2 | | 1 | | | | | | | | | | | |
| **22ITC49B.5** | 2 | 1 | 1 | | | | | | | | | | | |

1: Low    2: Medium 3: High

***

# Core Values of the Institution

### SERVICE

A Josephite will keep service as the prime goal in everything that is undertaken. Meeting the needs of the stakeholders will be the prime focus of all our endeavors.

### EXCELLENCE

A Josephite will not only endeavor to serve, but serve with excellence. Preparing rigorously to excel in whatever we do will be our hallmark.

### ACCOUNTABILITY

Every member of the SJEC Family will be guided to deliver on assurances given within the constraints set. A Josephite will always keep budgets and deadlines in mind when delivering a service.

### CONTINUOUS ADAPTATION

Every member of the SJEC Family will strive to provide reliable and continuous service by adapting to the changing environment.

### COLLABORATION

A Josephite will always seek to collaborate with others and be a team-player in the service of the stakeholders.

# Objectives

- Provide Quality Technical Education facilities to every student admitted to the College and facilitate the development of all round personality of the students.

- Provide most competent staff and excellent support facilities like laboratory, library and internet required for good education on a continuous basis.

- Encourage organizing and participation of staff and students in in-house and outside Training programmes, seminars, conferences and workshops on continuous basis.

- Provide incentives and encouragement to motivate staff and students to actively involve in research-innovative projects in collaboration with industry and R&D centres on continuous basis

- Invite more and more number of persons from industry from India and abroad for collaboration and promote Industry-Institute Partnership.

- Encourage consultancy and testing and respond to the needs of the immediate neighbourhood.

# St Joseph Engineering College

## AN AUTONOMOUS INSTITUTION

Affiliated to VTU, Belagavi | Recognised by AICTE, New Delhi
Accredited by NAAC with A+ Grade
B.E. (CSE, ECE, EEE, ME, CIV), MBA & MCA Accredited by NBA, New Delhi

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