| Mathematics for Electronics & Computers | | Semester | III |
|---|---|---|---|
| Course Code | **BMATELCE301** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Course objectives:**

- To acquaint the students with differential equations and their applications in Electronics & CS engineering.
- Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis and to enable the student to express non-periodic functions to periodic functions using the Fourier series and Fourier transforms.
- To find the association between attributes and the correlation between two variables
- To learn the basic ideas of the theory of probability and random signals.

**Teaching-Learning Process**

**Pedagogy (General Instructions):**

These are sample Strategies, teachers can use to accelerate the attainment of the various course Outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity)

**Module-1: Ordinary Differential Equations of Higher Order (8 hours)**

**Importance of higher-order ordinary differential equations in Electrical & Electronics Engineering applications.**

Higher-order linear ODEs with constant coefficients - Inverse differential operator, method of variation of parameters, problems. Linear differential equations with variable Coefficients- Cauchy's and Legendre's differential equations - Problems.

**Applications:** Application of linear differential equations to L-C circuit and L-C-R circuit.

**Self-Study:** Finding the solution by the method of undetermined coefficients.

**(RBT Levels: L1, L2 and L3)**

**Module-2: Fourier series.**

Periodic functions, Dirchlet's condition, conditions for a Fourier series expansion, Fourier series of functions with period $2\pi$ and with arbitrary period. Half rang Fourier series. Practical harmonic analysis.

**Application to variation of periodic current.**

**Self-study:** Typical waveforms, complex form of Fourier series.

**Module-3: Fourier transforms and Z –transforms**

**Infinite Fourier transforms**: Definition, Fourier sine, and cosine transform. Inverse Fourier transforms Inverse Fourier cosine and sine transforms. Problems.

**Z-transforms:** Definition, Standard z-transforms, Damping, and shifting rules, Problems. Inverse z-transform and applications to solve difference equations.

**Self-study**: Convolution theorems of Fourier and z-transforms

**Module-4: Curve fitting, Correlation, and Regressions**

Principles of least squares, Curve fitting by the method of least squares in the form $y = a + bx$ , $y = a + bx + cx^2$, and $y = ax^b$. Correlation, Co-efficient of correlation, Lines of regression, Angle between regression lines, standard error of estimate, rank correlation.

**Self-study:** Fitting of curves in the form $y = a\, e^{bx}$

**Module-5: Probability distributions**

Review of basic probability theory, Random variables-discrete and continuous Probability distribution function, cumulative distribution function, Mathematical Expectation, mean and variance, Binomial, Poisson, and Normal distribution (without proofs for mean and SD) – Problems.

**Joint probability distribution**: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

**Self-study:** Exponential distribution.

**Course outcome (Course Skill Set)**

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

1. Understand that physical systems can be described by differential equations and solve such equations
2. Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing, and field theory.
3. To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations
4. Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data. Make use of correlation and regression analysis to fit a suitable mathematical model for the statistical data.
5. Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field. Construct joint probability distributions.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

**Suggested Learning Resources:**

**Text Books:**


1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

**Reference Books:**


1. **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N.P Bali and Manish Goyal**: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co., New York, 6th Ed., 2017.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", McGraw Hill Education (India) Pvt. Ltd 2015.
6. **H.K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
7. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.


**Web links and Video Lectures (e-Resources):**

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.

**Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning**

- Quizzes
- Assignments
- Seminar

| Data Structures with C | | | |
|---|---|---|---|
| Course Code | **BUE302** | CIE Marks | 50 |
| Teaching Hours/Week (L:P: SDA) | 3:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 hours Theory + 10-12 Lab slots | Total Marks | 100 |
| Credits | 04 | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Course Learning objectives:** This course will enable students:

1. To describe the principles of data structures and their applications, which are necessary for putting problem-solving techniques into practice.
2. To illustrate representation of data structures: Stack, Queues, Linked Lists, Trees and Graphs.
3. To create and Implement Problem-Solving Solutions Using Arrays, Structures, Stacks, Queues, and Linked Lists
4. To examine the use of trees and graphs in the creation of applications.
5. To apply the Hashing techniques in mapping key value pairs.

**MODULE-1**

**Basic Concepts:** Pointers and Dynamic Memory Allocation. Arrays and Structures: Arrays, Dynamically Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, Representation of Multidimensional Arrays, Strings.

Textbook 1 : Chapter 2 (2.3,2.4) Textbook 2: chapter 1: (1.1,1.2)
Textbook2: Chapter 1(1.1), Chapter 3: (3.1,3.2,3.5) Chapter 5: (5.1,5.6)

**RBT Level: L1, L2, L3**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method, Power Point Presentation, You tube videos, Brain storming, Activity based method, Seminar, Demonstration |

**MODULE-2**

**Stacks and Queues:** Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Multiple Stacks and Queues.
Stack Applications: Infix to postfix conversion, Infix to prefix conversion, evaluation of postfix expression, recursion.

Textbook 1 : Chapter 3 (3.1,2.4) Textbook 2: Chapter 7: (7.7)

**RBT Level: L1, L2, L3**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method, Power Point Presentation, You tube videos, Brain storming, Activity based method, Seminar, Demonstration |

**MODULE-3**

**Linked List:** Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Doubly Linked Lists.

**RBT Level: L1, L2, L3, L4**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method, Power Point Presentation, You tube videos, Brain storming, Activity based method, Seminar, Demonstration. |

**MODULE 4**

**Trees:** Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Threaded Binary Trees, Heaps, Binary Search Trees, Selection Trees, Forests, Representation of Disjoint Sets, Counting Binary Trees, AVL trees and Splay trees.

Textbook 1: Chapter:5 (5.1,5.3,5.6,5.8,5.9)
Textbook 2:Chapter:10,12(,10.1,10.2 10.4,10.6, 12.1)

**RBT Level: L1, L2, L3**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method, Power Point Presentation, You tube videos, Brain storming, Activity based method, Seminar, Demonstration |

**MODULE 5**

**Case Studies and Industry Applications:** These case studies and applications provide practical examples of how data structures and algorithms are applied in various industries. By studying real-world scenarios, students can gain insights into the challenges and solutions encountered in the industry, enhancing their understanding and readiness for real-world applications.

**Stack:**

1. Expression Evaluation: Use a stack to evaluate arithmetic expressions. Push operands onto the stack and perform operations when encountering operators.
2. Function Call Stack: Simulate the function call stack during program execution, allowing for the tracking of nested function calls and their return addresses.

**Queue:**

1. Job Scheduling: Use a queue to schedule and process jobs in the order of their arrival time. New jobs are enqueued at the end, and the first job in the queue is processed.
2. Breadth-First Search (BFS): Implement BFS using a queue to traverse a graph or tree level by level, visiting all nodes at a given level before moving to the next level.

**Linked List:**

1. Linked List Implementation: Implement a singly linked list or a doubly linked list to store and manipulate a collection of data elements, such as a linked list of students or employees.
2. Dynamic Memory Allocation: Use a linked list to dynamically allocate and deallocate memory blocks, maintaining a list of available memory chunks and their sizes.

**Trees:**

1. File System Organization: Represent a file system hierarchy using a tree structure, where directories are represented by nodes and files are represented as leaves.
2. Binary Search Tree (BST): Implement a BST to efficiently store and search for data in a sorted manner, such as maintaining a dictionary of words or a database of records.

**RBT Level: L3, L4, L5, L6**

| | |
|---|---|
| **Teaching-Learning Process** | You tube videos, Brain storming, Activity based method, Demonstration, Implementation. |

**PRACTICAL COMPONENT OF IPCC: Conduct the experiments using MATLAB/Scilab/TMS 320 C5X DSP Processors**

| Sl. No | Experiments |
|---|---|
| 1 | Write a C program to implement iterative and recursive binary search algorithms. Define and use a macro to compare two integers in your program. |
| 2 | Write a C program to find the fast transpose of a sparse matrix. |
| 3 | Write a C program to implement a circular queue using dynamically allocated array and perform the following operations on it.<br>(i)Insert an item (ii) Delete an item (iii) Display a circular queue |
| 4 | Design, Develop and Implement a Program in C for the following Stack Applications<br>a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^<br>b. Solving Tower of Hanoi problem with n disks. |
| 5 | Write a C program to implement a doubly linked circular list with a header node and perform the following operations on it.<br>(i) Insert a node (iii) Display a doubly linked circular list in forward direction<br>(ii) Delete a node (iv) Display a doubly linked circular list in reverse direction |
| 6 | Write a C program to implement multiple linked queues (at least 5) and perform the following operations on them.<br>(i) Add an item in ith queue (ii) Delete an item from ith queue (iii) Display ith queue |
| 7 | Write a C program to implement a binary search tree using linked representation and perform the following operations on it.<br>(i) Insert an item (ii) Search an item (iii) Inorder Traversal |
| 8 | Write a C program to implement Red black tree.<br>(i) Insert an item (ii) delete an item (iii) display the elements |
| 9 | Write a C program to perform depth first search of a graph represented as an adjacency list. |
| 10 | Design and develop a program in C that uses Hash Function H:K->L as H(K)=K mod m(reminder method) and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing |
| | |

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Recall and explain fundamental data structures, such as arrays, linked lists, stacks, queues, and trees. | Understand |
| CO2 | Implement data structures in C programming language, including operations and algorithms associated with them. | Apply |
| CO3 | Analyse and evaluate the efficiency of different data structures and algorithms, considering their time and space complexities for specific scenarios. | Analyze |
| CO4 | Compare and contrast different data structures and select the most appropriate one for solving a given problem based on the analysis of requirements and constraints | Evaluate |
| CO5 | Design and develop efficient algorithms and solutions using appropriate data structures to solve complex problems, considering factors like | Create |

**Program Outcome of this course**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Engineering Knowledge | 1 |
| 2 | Problem Analysis | 2 |
| 3 | Design/Development of solutions | 3 |
| 4 | Modern tool usage | 5 |
| 5 | Individual and team work | 9 |
| 6 | Life-long learning | 12 |

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**CIE for the theory component of the IPCC (maximum marks 50)**

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

**CIE for the practical component of the IPCC**

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

**SEE for IPCC**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.

2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

**Suggested Learning Resources:**

**Text Book(S):**

1. Horowitz, Sahni, and Anderson Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2008.

**Reference Book(S):**

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
2. Data Structures, SeynourLipschutz and GAV Pai, Schaum's Outlines, McGraw Hill, 2008.

**Web links and Video Lectures (e-Resources):**

- nptel.ac.in

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Quizzes
- Assignments
- Group Discussion
- Seminars

| Analog and Digital Electronics | | Semester | III |
|---|---|---|---|
| Course Code | **BUE303** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 hours Theory + 8-10 Lab slots | Total Marks | 100 |
| Credits | 04 | Exam Hours | |
| Examination nature (SEE) | Theory | | |

**Course objectives:**

- To Illustrate simplification of Algebraic equations using Karnaugh Maps and Quine-Mc Clusky Techniques.
- To know design of Decoders, Encoders, Digital Multiplexers, Adders, Subtractors, Look ahead carry, Binary Comparators.
- To Describe Latches, Flip-flops, Registers and Counters.
- To Understand concept of signal generators such as Phase Shift Oscillators, Colpitts Oscillators, Hartley Oscillators, Wein Bridge Oscillator.

**Teaching Learning Process (General Instructions)**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Explain the fundamental concepts required for the module in the introduction phase of the module.
2. Conducting quiz after completion of every module in class and evaluate.
3. Asking questions about completed previous topic, will aid to assess the student understanding.
4. Evaluate the internals answer booklet by correcting the mistakes if any.
5. Modules revision at the end as well use practical lab sessions and demonstrate the concepts if applicable and feasible.

In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students theoretical and programming skills.

**MODULE-1**

**BJT Biasing :** DC Load Line and Bias Point, Base Bias, Collector-to- Base Bias, Voltage-Divider Bias, Comparision of Basic Bias Circuits, Troubleshooting BJT Bias Circuits, Bias Circuit Design, More Bias Circuits, Thermal Stability of Bias Circuits, Biasing BJT Switching Circuits.**(Text 1- Chapter5)**

**MODULE-2**

**Signal Generators :** Phase Shift Oscillators, Colpitts Oscillators, Hartley Oscillators, Wein Bridge Oscillator, Oscillator Amplitude Stabilization, Square Wave Generator, 555 Pulse Generator, Triangular Wave Generator, Oscillator Frequency Stabilization.**(Text 1- Chapter16)**

**MODULE-3**

**Principles of Combinational Logic :** Introduction ,Definition of Combinational Logic, Canonical Forms, Generation of Switching Equations from Truth Tables, Karnaugh Maps, Quine-Mc Clusky Minimization Techniques(3,4 variables).**(Text 2- 3.1, 3.2, 3.3, 3.4, 3.5)**

| MODULE-4 |
|---|
| **Analysis and Design of Combinational Logic:** Decoders, Encoders, Digital Multiplexers, Adders and Subtractors, Cascading Full Adder, Look ahead carry, Binary Comparators**.**<br>**(Text 2- 4.3, 4.4, 4.5, 4.6(4.6.1, 4.6.2), 4.7)**<br>**Flip-Flops and its Applications:** Basic Bistable elements, Latches, Timming Considerations**.**<br>**(Text 3 - 6.1, 6.2, 6.3)** |
| **MODULE-5** |
| **Flip-Flops and its Applications :** The master slave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, 0's and 1's Catching, Additional Types of Master-Slave Flip-Flops, Edge –Triggered Flip-Flops, Characteristics equations, Registers, Counters, Design of Synchronous Counters.<br>**(Text 3 - 6.4, 6.5, 6.6, 6.7, 6.8, 6.9)** |

**PRACTICAL COMPONENT OF IPCC**

| Sl.NO | Experiments |
|---|---|
| 1 | Half wave rectifier and Full wave rectifier with and without filter and measure the ripple factor. |
| 2 | Characteristics of Zener diode and design a Simple Zener voltage regulator determine line and load. |
| 3 | Design and set up the BJT common emitter voltage amplifier with and without feedback and determine the gain- bandwidth product, input and output impedances. |
| 4 | Design and set-up BJT/FET<br>i)Colpitts Oscillator, ii)RC Phase shift Oscillator |
| 5 | Design and set up the circuits using Opamp:<br>i)Inverting, ii)Non Inverting, iii)Differentiator and iv)Integrator |
| 6 | Design and implement<br>(a) Half Adder & Full Adder using basic gates and NAND gates,<br>(b) Half subtractor & Full subtractor using NAND gates |
| 7 | Realize the following<br>i) Realize a decoder circuit using basic gates<br>ii) Verify 8:1 encoder using 74LS148.<br>iii) Realize 4:1 Multiplexer using NAND gates<br>iv) Realization of 7485 magnitude comparator |
| 8 | Realize using NAND Gates:<br>i) Master-Slave JK Flip-Flop, ii) D Flip-Flop and iii) T Flip-Flop |
| 9 | b) Realize the shift registers using IC7474/7495:<br>(i) SISO (ii) SIPO (iii) PISO (iv) PIPO |
| 10 | Design Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop. |
| 11 | **Demo Experiment:** Design and simulation of Regulated power supply. |
| 12 | **Demo Experiment:** Design and test Monostable and Astable Multivibrator using 555 Timer. |

**Course outcomes (Course Skill Set):**

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

- Explain the concept of combinational logic circuits.
- Describe and characterize flip-flops and its applications.
- Analyze and Design of ALUs, Multiplexers, adders and subtractors, look ahead carry, binary Comparators.
- Generation of Square Wave Generator, 555 Pulse Generator, Triangular Wave Generator, Oscillator Frequency Stabilization,555 Timers.
- Describe Latches, Flip-flops, Registers and Counters.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**CIE for the theory component of the IPCC (maximum marks 50)**

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

**CIE for the practical component of the IPCC**

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the

IPCC.

**SEE for IPCC**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

**The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component**.

**Suggested Learning Resources:**

**Books**


1. DAVID A. BELL "Electronic Devices and Circuits" 5th Edition, OXFORD University Press.
2. JOHN M.YARBROUGH., Digital logic applications and Design, Thomson Learning.
3. Donald D.Givone., Digital Principles and Design, Tata McGraw-Hill Edition-2002.


**Web links and Video Lectures (e-Resources):**

- nptel.ac.in

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Quizzes
- Assignments
- Group Discussion
- Seminars

| MICROCONTROLLER & COMPUTER ORGANIZATION | | Semester | III |
|---|---|---|---|
| Course Code | **BUE304** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Course objectives:**

- Understand the 8051 Architecture, Instruction set and Assembly Language Programming.
- Understand the organisation and architecture of computer systems, their structure and operation.
- Illustrate the concept of machine instructions and programs.
- Demonstrate different ways of communication with I/O devices and also about memory system.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

**Module-1**

**Microprocessors and Microcontrollers:** Introduction, Microprocessors and Microcontrollers, The Z80 and the 8051, Four-Bit to Thirty-two-bit Microcontroller, Development studies for Microcontroller

**The 8051 Architecture:** Introduction, 8051 Microcontroller Hardware, Input/Output Pins, Ports, and Circuits, External Memory, Counter and Timers, Serial Data Input/Output.

| Module-2 |
| --- |
| **Interrupts:** Timer Flag Interrupt, Serial Port Interrupt, External Interrupts, Reset, Interrupt Control, Interrupt Priority, Interrupt Destinations, Software-Generated Interrupts<br>**Basic Assembly Language Programming Concepts:** The forest and the trees, A Generic Computer, The mechanics of Programming, The Assembly Language Programming Process, The PAL Practice CPU Programming Tools and Techniques, Programming the 8051.<br>**Moving Data:** Introduction, Addressing Modes, External Data Moves, Code Memory Read-Only Data Moves, Push and Pop Opcodes, Data Exchanges. |
| **Module-3** |
| **Logical Operations**: Introduction, Byte-Level Logical Operations, Bit-Level Logical Operations, Rotate and Swap Operations, Example Programs<br>**Arithmetic Operations**: Introduction, Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic<br>**Jump and Call Instructions**: Introduction, The Jump and Call Program Range, Jumps, Calls and Subroutines, Interrupts and Returns. |
| **Module-4** |
| **Basic Structure of Computers:** Basic Operational Concepts, Bus Structure, Performance-Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.<br>**Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes.<br>Text book 2: Chapter 1: - 1.3, 1.4, 1.6 (1.6.1-1.6.4, 1.6.7). Chapter 2:- 2.2-2.5 |
| **Module-5** |
| **Input /Output Organisation:** Accessing I/O Devices, Interrupts-Interrupt Hardware, Direct Memory Access, Buses.<br>Memory System: Basic Concepts, Semiconductor RAM memories.<br>Text book 2: chapter 4- 4.1, 4.2, 4.4, 4.5. chapter 5 – 5.1,5.2 ( only 5.2.1) |
| **Course outcome (Course Skill Set)**<br><br>At the end of the course, the student will be able to :<br>1. Write the Assembly Language programs<br>2. Explain the organisation and architecture of computer systems with machine instructions and programs.<br>3. Analyse the input/output devices communication with computer systems.<br>4. Demonstrate the function of memory devices. |

**Assessment Details (both CIE and SEE) :**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

**Suggested Learning Resources:**

**Books**


1. Ayala, The 8051 Microcontroller, 3rd Edition, Cengage Learning.
2. Carl Hamcher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5TH Edition, Tata McGraw Hill.


**Web links and Video Lectures (e-Resources):**

- nptel.ac.in

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Quizzes
- Assignments
- Seminar

| PYTHON PROGRAMMING LABORATORY | | Semester | III |
|---|---|---|---|
| Course Code | **BUEL305** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 0:0:2:0 | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 100 |
| Examination Type (SEE) | Practical | | |

**Course objectives:**

- Demonstrate the use of IDLE or PyCharm IDE to create Python Applications.
- Using Python programming language to develop programs for solving real-world problems.
- Implement the Object-Oriented Programming concepts in Python.
- Appraise the need for working with various documents like Excel, PDF, Word and Others.
- Demonstrate regular expression using python programming.

| Sl. No. | Experiments |
|---|---|
| 1. | a) Develop a Python program to count the number of occurrences of each digit in the given input number.<br>b) Write a Python program to compute the GCD of two numbers. |
| 2. | a) Write a Python program to print the Fibonacci sequence.<br>b) Develop a python program to convert a given Decimal number to Binary, Octal and Hexadecimal using functions. |
| 3. | a) Develop a python program to print the following pattern:<br>A<br>B C<br>D E F<br>G H I J<br>K L M N O<br>b) Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters. |
| 4. | a) Write a python program to swap two elements in a list.<br>b) Write a program to convert roman numbers into integer values using dictionaries. |
| 5. | a) Develop a python program that could search the text in a file for phone numbers (+919900889977) and email addresses (sample@gmail.com).<br>b) Write a Python program to extract year, month and date from an URL. |
| 6. | Write a python program to create a ZIP file of a particular folder which contains several files inside it. |
| 7. | Write a python program by creating a class called Employee to store the details of Name, Employee_ID, Department and Salary, and implement a method to update salary of employees belonging to a given department. |
| 8. | Write a python program to find the whether the given input is palindrome or not (for both string and integer) using the concept of polymorphism and inheritance. |
| | **Demonstration Experiments ( For CIE )** |
| 9. | Demonstrate read and write operation on spreadsheet. |

| | |
|---|---|
| 10. | Develop a python program to combine selected pages from many PDFs. |
| 11. | Generate a QR Code using Python. |
| 12. | Create a Quiz game using Python. |

**Course Outcomes (Course Skill Set):**

At the end of the course the student will be able to:

1. Understand the basic syntax, data types, and control structures in Python programming language.(L2)
2. Apply object-oriented programming principles to design and create Python classes and objects. (L3)
3. Analyse and evaluate programming errors using advanced debugging techniques to identify and resolve them effectively. (L4)
4. Critically assess and optimize complex Python programs, applying advanced algorithms, data structures, and software design principles to enhance efficiency and performance. (L5)
5. Design and develop innovative and advanced Python applications, integrating multiple technologies and frameworks, to address complex real-world problems, demonstrating mastery of Python programming language. (L6)

**Assessment Details (both CIE and SEE):**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are**50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.

- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

**Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours.

**Suggested Learning Resources:**

- Al Sweigart, “Automate the Boring Stuff with Python”,1stEdition, No Starch Press, 2015.
- Reema Thareja “Python Programming Using Problem Solving Approach” Oxford University Press.
- Python Installation: https://www.youtube.com/watch?v=Kn1HF3oD19c
- Datatypes: https://www.youtube.com/watch?v=gCCVsvgR2KU
- Operators: https://www.youtube.com/watch?v=v5MR5JnKcZI
- For loop: https://www.youtube.com/watch?v=0ZvaDa8eT5s
- While loop: https://www.youtube.com/watch?v=HZARImviDxg
- Exceptions: https://www.youtube.com/watch?v=6SPDvPK38tw
- Functions: https://www.youtube.com/watch?v=BVfCWuca9nw
- Strings: https://www.youtube.com/watch?v=lSItwlnF0eU
- Lists: https://www.youtube.com/watch?v=Eaz5e6M8tL4
- Tuples: https://www.youtube.com/watch?v=bdS4dHIJGBc
- Dictionary: https://www.youtube.com/watch?v=4Q0pW8XBOkc
- Regular expressions: https://www.youtube.com/watch?v=LnzFnZfHLS4
- File organization: https://www.youtube.com/watch?v=MRuq3SRXses
- OOP’s concepts: https://www.youtube.com/watch?v=qiSCMNBIP2g
- Excel: https://www.youtube.com/watch?v=nsKNPHJ9iPc
- Word files: https://www.youtube.com/watch?v=ZU3cSl51jWE
- **Python (Full Course):** https://www.youtube.com/watch?v=_uQrJ0TkZlc

| SENSORS AND INSTRUMENTATION | | Semester | III |
|---|---|---|---|
| Course Code | **BUE305A** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Course objectives:**

- To provide the fundamental knowledge about sensors and measurement system.
- Acquire knowledge about types of sensors used in modern digital systems.
- Get acquainted about material properties required to make sensors.
- Describe principle of operation of Digital Measuring Instruments and bridges.
- Understand the operation of Transducers, Instrumentation Amplifiers.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

**Module-1**

**Introduction to Sensor Based Measurement System:** General Concepts and Terminology, Sensor Classification, Primary Sensors, Material for sensor, Magneto resistors, Light Dependent Resistors, Resistive Hygrometers, resistive gas sensors, liquid conductivity sensors**.**
**( Section 1.1,1.2,1.7,1.8,2.5,2.6,2.7,2.8,2.9 of Text 1)**

**Module-2**

**Reactance variation and Electromagnetic Sensors:** Capacitive Sensors, Inductive Sensors, Electromagnetic Sensors.

**Self-Generating Sensors:** Thermoelectric Sensors, Piezoelectric Sensors, Photovoltaic Sensors, Pyroelectric Sensors.

| Module-3 |
| --- |
| **Digital and Intelligent Sensors:** Position Encoders, Resonant Sensors, Sensors Based On Quartz Resonators, SAW Sensors, Vibrating Wire Strain Gages, Vibrating Cylinder Sensors, Digital Flow Meters.<br>**(Section 8.1 and 8.2 of Text1).** |
| **Module-4** |
| **Digital voltmeters:** Ramp Techniques, Dual Slope Integrating Type DVM, Direct Compensation, Type and Successive Approximation Type DVM.<br>**Digital multimeter:** Digital Frequency Meter and Digital Measurement of Time, Function Generator.<br>**Bridges:** measurement of resistance, wheatstone's bridge, AC Bridges- capacitance and inductance comparison bridge, wien's bridge.<br>Text book 2 : 5.1-5.3,5.5,5.6, 6.2,6.3 up to 6.3.2,6.4 up to 6.4.2,8.2,11.2,11.8-11.10,11.14 |
| **Module-5** |
| **Transducers:** Introduction, Electrical Transducer, Resistive Transducer, Resistive Position Transducer, Resistor Wire Strain Gauges, Resistance Thermometer. Thermistor, LVDT.<br>Instrumentation amplifier using Transducer Bridge, Temperature Indicators using thermometer, Analog weight scale.<br>Text Book 2: 13.1-13.3,13.5,13.6 up to 13.6.1,13.7,13.8,13.11, 14.3.3, 14.4.1,14.4.3) |
| **Course outcome (Course Skill Set)**<br><br>At the end of the course, the student will be able to :<br>1. Discuss the fundamental concepts related to sensors and measurement, functional elements of measurement system, I/O characteristics of measurement system.<br>2. Interpret and analyse the static and dynamic characteristics of instruments.<br>3. Elucidate the working principle and usage of different transducers for temperature, displacement and level measurement.<br>4. Describe the principle of operation and develop circuits for multirange ammeters, voltmeters and bridges to measure passive component values and frequency.<br>5. Explain the principle, design and analyse the transducers for measuring physical parameters. |
| **Assessment Details (both CIE and SEE)**<br>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. |

**Continuous Internal Evaluation(CIE):**

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

**Suggested Learning Resources:**

**Books**


1. Ramon Palas, Areny, John G, "Sensors and Signal conditioning", 2nd edition. John Wiley and sons, 2000.
2. H.S.Kalasi, " Electronic Instrumentation" , McGraw Hill, 3 rd edition,2012, ISBN : 9780070702066


**Web links and Video Lectures (e-Resources):**

nptel.ac.in

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Quizzes
- Assignments
- Seminar

| Signal Processing | | Semester | 3 |
|---|---|---|---|
| Course Code | **BUE306B** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Course objectives:**

1. Preparation: To prepare students with fundamental knowledge/ overview in the field of Signal Processing
2. Core Competence: To equip students with a basic foundation of Signal Processing by delivering the basics of Linear Transformations, the mathematical description of discrete time signals and systems, analyzing the signals in time domain using convolution sum, classifying signals into different categories based on their properties, analyzing Linear Time Invariant (LTI) systems in time and transform domains Discrete Fourier Transforms & their properties, design of filters.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Show Video/animation films to explain the functioning of various signals systems
2. Encourage collaborative (Group discussion) Learning in the class
3. Solving more problems on each topic

**Module-1**

**Introduction and Classification of signals:** Definition of signal and systems with examples, Elementary signals/functions: Exponential, sinusoidal, step, impulse and ramp functions

**Basic Operations on signals:** Amplitude scaling, addition, multiplication, time scaling, time shift and time reversal. Expression of triangular, rectangular and other waveforms in terms of elementary signals.

**System Classification and properties:** Linear-nonlinear, Time variant -invariant, causal-non causal, static dynamic, stable-unstable, invertible.

**Module-2**

**Time domain representation of LTI System:** Impulse response, convolution sum. Computation of convolution sum using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular.

**LTI system Properties in terms of impulse response:** System interconnection, Memory less Causal, Stable, Invertible and Deconvolution and step response.

**Module-3**

**Introduction to DFT:** Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering and Correlation.

| Module-4 |
| --- |
| **FIR Filters:** Design of FIR filters **–** Symmetric and Antisymmetric FIR filters, Design of Linear phase FIR filters by Rectangular Hamming & Hanning windows. Summary of window function characteristics (window shape, transition bandwidth, stop band attenuation, etc.). Implementation of FIR filters by direct form and Single-stage lattice structure only. |
| **Module-5** |
| **IIR Filters:** Characteristics of practical frequency selective filters. Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - Direct form I, Direct form II, Cascade, parallel realizations. |

**Course outcome (Course Skill Set)**

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

1. Analyse different types of signals and systems, Analyse the properties of discrete time signals & systems
2. Determine response of LTI systems using time domain and DFT techniques.
3. Compute DFT using FFT algorithms
4. Design of FIR Filters
5. Design of FIR Filters

**Assessment Details (both CIE and SEE) :**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

**Suggested Learning Resources:**

**Books**


1. Simon Haykin and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, Wiley India. ISBN9971-51-239-4.
2. Proakis & Manolakis, "Digital Signal Processing - Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317-1000-9.
3. Oppenheim & Schaffer, "Discrete Time Signal Processing", PHI, 2003.


**Web links and Video Lectures (e-Resources):**

- VTU e-Shikshana Program
- VTU EDUSAT Program
- https://nptel.ac.in/courses
- https://www.mooc-list.com/tags/digital-signal-processing

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Giving assignments on each module
- Conducting Quiz programs in each module
- Give Programming Assignments on signal processing
- Design and implement the various filters

| Operating Systems | | Semester | III |
|---|---|---|---|
| Course Code | **BUE306C** | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P: S) | 3:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Course objectives:**

- Demonstrate the need for OS and different types of OS.
- Apply suitable techniques for management of different resources.
- Use processor, memory, storage and file system commands.
- Realize the different concepts of OS in platform of usage through case studies.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

**Module-1**

**Introduction to operating systems, System structures:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.

**Operating System Services:** User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.

**Process Management:** Process concept; Process scheduling; Operations on processes; Inter process communication.
Textbook 1: Chapter - 1,2,3

**Module-2**

**Multi-threaded Programming:** Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling.

**Process Synchronization:** Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.
Textbook 1: Chapter - 4,5

**Module-3**

**Deadlocks:** Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.
Textbook 1: Chapter - 7,8

**Module-4**

**Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

**File System, Implementation of File System:** File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.
Textbook 1: Chapter - 9,10,11

**Module-5**

**Secondary Storage Structures, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems.

**Case Study: The Linux Operating System:** Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.
Textbook 1: Chapter - 2,21

**Course outcome (Course Skill Set)**

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

1. Identify the structure of an operating system and its scheduling mechanism.
2. Demonstrate the allocation of resources for a process using scheduling algorithm.
3. Identify root causes of deadlock and provide the solution for deadlock elimination.
4. Explore about the storage structures and learn about the Linux Operating system.
5. Analyze Storage Structures and Implement Customized Case study.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

4. Marks scored shall be proportionally reduced to 5.

**Suggested Learning Resources:**

**Books**

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006.

**Reference Books:**

1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition.
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.
4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.

**Web links and Video Lectures (e-Resources):**

- Operating Systems - NPTEL IITD https://www.youtube.com/watch?v=z3Nw5o9dS7Q&list=PLsylUObW5M3CAGT6OdubyH6FztKfJCcFB
- NPTEL Course on Operating Systems https://www.youtube.com/watch?v=jciGIvn7UfM&list=PLyqSpQzTE6M9SYI5RqwFYtFYab94gJpWk
- Operating Systems NPTEL IIT MADRAS https://www.youtube.com/watch?v=783KAB-tuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_f

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Real world problem solving using group discussion.
- Role play for process scheduling.
- Present animation for Deadlock.
- Real world examples of memory management concepts.

| Forensic Science | | Semester | III |
|---|---|---|---|
| Course Code | **BUE306D** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Course objectives:**

The following are the objectives of this course.

1. To emphasize the importance of scientific methods in crime detection.
2. To disseminate information on the advancements in the field of Forensic Science.
3. To highlight the importance of Forensic Science for perseverance of the society.
4. To review the steps necessary for achieving highest excellence in Forensic Science.
5. To generate talented human resource with latest requirements of Forensic Science.
6. To provide a platform for students and Forensic Scientists to exchange views, chalk- out collaborative programs and work in a holistic manner for the advancement of Forensic Science.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Show Video/animation films to explain the functioning of various forensic science methods
2. Encourage collaborative (Group discussion) Learning in the class on various forensic test
3. Discuss the different ways to detect the criminals using forensic tests

**Module-1**

**Crime:** Definition of crime, history and development, victimology, criminological perspective, characteristics of crime, classification of crimes: atrocity, seriousness, motive, statistical, situational & systematic. White collar crime, professional crime, organized crime, present scenario of crime in India.

**Criminal and Criminology**: Definition of criminal, classification of criminals. Definition of criminology, growth of criminology in India, conservative criminology, liberal criminology, radial criminology.

**History and development of Forensic Science- Specific** contribution of scientists in the field of Forensic Science. Development of Forensic Science in India. National and international scenario of teaching and research institution in Forensic Science

**Module-2**

**Basic of Forensic Science:** Introduction, Definition, need, signification and scope of Forensic Science. Principles of Forensic Science, multi professional and multi personal aspects of forensic science. Domains in Forensic Science: Forensic Biology, Forensic Medicine, Forensic Toxicology, Forensic Osteology and Odontology, Forensic Physics, Forensic Photography, Ballistics, Fingerprint, Questioned Documents, Forensic Psychology, Forensic Anthropology, Wild life Forensic, DNA profiling, Computer Forensic etc., Functions of Forensic Scientist, Police officers,

Prosecution , Judicial Officers and Medico legal expert etc. Problem of proof in Forensic Science, corpus delicti, modus operandi. Ethical issue in Forensic Science: Definition of ethics, professional standards for practice of Criminalistics, sanction against expert for unethical conduct.

**Module-3**

**Organization set up of Forensic Science Laboratory:** Structure and function of State and regional Forensic Science Laboratory, Central Forensic Science Laboratory and facility provided, Mobile Forensic Science Laboratory. Directorate of Forensic Science Service. Police and Forensic scientist relationship, role of FSL in criminal investigation, relationship between forensic expert and judiciary officer, Importance of FSL, National and International scenario of FSL, facilities provided in forensic science laboratory. Ethical issue in FSL.

**Criminal behavior:** Introduction of criminal behavior, theories of criminal behavior: classical and non-classical theories, biological theories, physiological theories, psychogenic theory, economic theory, geographical theories, and sociological theories

**Module-4**

**Crime detection agency :** Organization set up and functioning of Government Examine of Questioned Document, Central Forensic Institute, Fingerprint Bureau, National Crime record Bureau, National Institute of Criminology and Forensic science, Crime Investigation department, Central Bureau of Investigation, National Police Academy, National Investigation Agency , World Anti-Doping Agency, National Drug Testing Laboratory, Centre for Cellular and Molecular Biology, Intelligence Bureau, Research Analysis Wing, Bureau of Police Research & Development, Defense Research and Development Organization, Central Police Organization, Central Detective Training School, Fingerprint Bureau Investigation, Crime Investigation Agency, Crime Scene Investigation, Drug Enforcement Administrator & Interpol, OCTOPUS etc.

**Module-5**

**Crime scene investigation:** Definition of crime scene, crimes without scene. Classification of crime scene: indoor & outdoor, primary & secondary, macroscopic & microscopic crime scene. Significance of crime scene, argument and ethics of crime scene. Definition of physical evidence, classification of physical evidence, types of physical evidences, sources of physical evidence, signification and value of physical evidence, linkage between crime scene, victim and criminal, study of some special crime scene such as mass disaster, terror attack, geological scene and explosive etc.

**Crime scene management:** Introduction to crime scene management, duties of first responding officer at the scene of crime, duties of crime scene investigator, specialized personnel at the crime scene: biological or chemical terrorist crime scene, processing of scene of crime: plan of action, protection of scene of crime, photography and video recording of crime scene, sketching of crime scene, searching, collection, preservation, packing of physical evidence, documentation of crime scene, forwarding or dispatch of exhibit in to the laboratory, chain of custody, collection of standard/reference samples.

**Course outcome (Course Skill Set)**

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

1. The significance of Forensic Science to human society.
2. The divisions in a Forensic Science laboratory.
3. The working of the Forensic establishments in India and abroad.
4. The fundamental principles and functions of Forensic Science.
5. To gain knowledge about law of evidence, different laws related to interrogation.
6. To understand about the criminal justice system and various sections under IPC, CrPC and Indian Evidence Act.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.

2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

**Suggested Learning Resources:**

**Books**

1. Henry Lee's Crime Scene Handbook**:** Henry C Lee
2. Shrikant H. Lade Forensic Biology
3. Patric Jones Crime Scene Processing and Laboratory Work Book
4. Stuart H. James Forensic Science: An Introduction to Scientific and Investigative Techniques 3rd ed
5. Richard Saferstein Criminalistics: An Introduction to Forensic Science, 9th edn
6. Dr. R.K. Tiwari Computer Crime and Computer Forensic
7. Brent E. Turvey Criminal Profiling: An Introduction to a Behavioral Evidence Analysis, 3rd edn
8. B.R. Sharma Forensic Science in Criminal Investigation and Trial, 4th edn

**Web links and Video Lectures (e-Resources):**

- https://forensicresources.org/view-resources/websites/
- https://www.forensicsciencesimplified.org/

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Giving assignments on each module
- Conducting Quiz programs in each module
- Visit forensic department or hospitals for procuring practical knowledge
- Conducting Seminars

| Applications of 8051 Microcontroller | | Semester | III |
|---|---|---|---|
| Course Code | **BUEL358A** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 0:0:2:0 | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 100 |
| Examination type (SEE) | Practical | | |

**Course objectives: This course enables the students to**

- Understand the basics of Microcontroller and its Applications.
- Have the knowledge of 8051 Assembly Language Programming
- Understand controlling the devices using C programming.
- The concepts of I/O interfacing for developing real time Embedded Systems.

| Sl.NO | Experiments |
|---|---|
| 1 | Data Transfer: Block Move, Exchange, Sorting, Finding largest element in an array. |
| 2 | Arithmetic Instructions – Addition/Subtraction, Multiplication and Division, Square, Cube- (16bits Arithmetic operations- bit addressable) |
| 3 | Counters. |
| 4 | Boolean & Logical Instructions (Bit manipulations). |
| 5 | Conditional CALL & RETURN. |
| 6 | Code Conversion: BCD-ASCII; ASCII- Decimal-ASCII; HEX-Decimal and Decimal-HEX. |
| 7 | Programs to generate delay, Programs using serial port and on-Chip timer/counter. |
| 8 | Program to blink LED, Program to work on Relay and Buzzer. |
| 9 | Program to display numbers from 000 to FFF on 7-segment Display. |
| 10 | Program to study Traffic Signal Controller and Elevator. |
| | **Demonstration Experiments ( For CIE )** |
| 11& 12 | Demonstration of 8051 Microcontroller Based Applications |

**Course outcomes (Course Skill Set):**

At the end of the course the student will be able to:

- Enhance the Programming skills using Assembly Language and C.
- Write Assembly Language Programs using 8051 for solving simple problems those manipulate input data using different instructions.
- Interface various input and output devices to 8051 and control them through Programming.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

**Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.

- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

**Suggested Learning Resources:**

- nptel.ac.in

| Risk Management in IoT Implementation | | Semester | III |
|---|---|---|---|
| Course Code | **BUE358B** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 1:0:0:0 | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 100 |
| Examination type (SEE) | Theory | | |

**Course objectives:**

- Understand the fundamental concepts and principles of the Internet of Things (IoT) and its relevance in various industries. Identify and assess potential risks and challenges associated with implementing IoT projects.
- Develop effective risk management strategies and mitigation plans specific to IoT implementations. Implement security controls and best practices to ensure the confidentiality, integrity, and availability of IoT systems.
- Comply with relevant regulations and standards to address data privacy, security, and ethical considerations in IoT implementations.

**Teaching-Learning Process(General Instructions) :**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Active Learning: Encourage students to actively engage in the learning process through hands-on activities, group discussions, case studies, and problem-solving exercises.
- Real-World Examples and Case Studies: Provide real-world examples and case studies related to IoT implementations and risk management.
- Collaborative Learning: Foster collaborative learning environments where students can work together in groups or teams to analyse and solve IoT-related challenges.
- Formative Assessments and Feedback: Implement regular formative assessments throughout the course to gauge students' progress and understanding of the course outcomes.

**Module-1**

**Introduction to IoT and Risk Management:**

Overview of the Internet of Things (IoT) and its applications; Understanding the importance of risk management in IoT implementation; Key components of risk management in IoT; Common risks and challengesin IoT implementation; Case studies and examples ofsuccessful and failed IoT implementations

**Module-2**

**Identifying and Assessing Risks in IoT:**

Identification of potential risks in IoT implementation; Risk assessment methodologies and techniques for IoT projects; Threat modelling and risk analysis in IoT systems; Assessing the impact and likelihood of identified risks; Prioritization of risks based on their significance.

| Module-3 |
| --- |
| **Mitigation Strategies for IoT Risks:**<br>Developing a risk mitigation plan for IoT projects; Security controls and best practices for IoT devices and networks; Data privacy and protection measures in IoT systems; Implementing secure communication protocols in IoT; Securing IoT gateways and cloud platforms. |
| **Module-4** |
| **Monitoring and Response to IoT:**<br>Risks Real-time monitoring of IoT devices and networks; Intrusion detection and prevention in IoT systems; Incident response planning for IoT security breaches; Continuous monitoring and vulnerability management in IoT; Data backup and disaster recovery strategies for IoT systems. |
| **Module-5** |
| **Compliance and Regulatory Considerations:**<br>Overview of relevant regulations and standards for IoT implementation; Compliance requirements for data privacy and security in IoT; Impact of industry-specific regulations on IoT projects; Role of audits and assessmentsin ensuring compliance; Ethical considerations and responsible use of IoT technologies. |
| **Course outcome (Course Skill Set):**<br><br>At the end of the course the student will be able to:<br>• Students will be able to explain the core concepts and applications of the Internet of Things and its impact on industries and society. Students will be able to identify and assess risks and challenges in IoT implementations, applying appropriate methodologies and techniques.<br>• Students will be able to develop comprehensive risk management strategies and mitigation plans tailored to specific IoT projects. Students will be able to implement security controls and best practicesto protect IoT devices, networks, and data from potential threats and vulnerabilities.<br>• Students will be able to analyse and comply with relevant regulations, standards, and ethical considerations to ensure responsible and secure IoT implementations. |

**Assessment Details (both CIE and SEE):**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous internal Examination (CIE)**

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered.
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

**The Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester End Examinations (SEE**):

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

OR

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

1. The question paper will have ten questions. Each question is set for 10 marks.
2. There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
3. The students have to answer 5 full questions, selecting one full question from each module.

**Suggested Learning Resources:**

**Books**


1. Russell, B., Van Duren, D., & Scharlau, J. R. (2019). Practical IoT Security: A Guide to Building Secure Connected Systems. Apress.
2. Buyya, R., Dastjerdi, A. V., & Venugopal, S. (2016). Internet of Things: Principles and Paradigms. Morgan Kaufmann Publishers.
3. Hanes,D., Salgueiro,G.,&Grossetete, P.(2017). IoT Fundamentals:Networking Technologies, Protocols, and Use Cases for the Internet of Things (1st ed.). Cisco Press.


**Web links and Video Lectures (e-Resources):**

- https://makes.mindmatrix.io/
- https://www.mobileum.com/solutions/iot-solutions/iot-risk-management/
- https://www.apdaga.com/2019/03/internet-of-things-security-iot.html/

| PCB DESIGN USING EDA TOOL | | Semester | III |
|---|---|---|---|
| Course Code | **BUEL358C** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 0:0:2:0 | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 100 |
| Examination type (SEE) | Practical | | |

**Course objectives:**

- To introduce students to industry-standard EDA tools used in PCB design.
- Develop students' skills in creating clear and accurate schematics using the EDA tools.
- Develop students' skills in designing PCB layouts using the EDA tools.
- Learn how to perform design rule checks using the EDA tools.
- Develop students' skills in using the simulation and analysis features provided by the EDA tools.

| Sl.No | Experiments |
|---|---|
| 1 | Simple LED Circuit: Start with a basic experiment by designing a PCB for an LED circuit. Create a schematic that includes an LED, current-limiting resistor, and a power source. Use the EDA tool to generate the PCB layout, place the components, and route the traces. Verify the design using the built-in design rule checks and simulate the circuit if possible. |
| 2 | Sensor Interfacing: Design a PCB that interfaces with sensors like temperature sensors, accelerometers, or proximity sensors. Create a schematic that includes the sensor, necessary conditioning circuitry, and the microcontroller interface. Use the EDA tool to create the PCB layout, place the components, route the traces, and ensure proper signal integrity. |
| 3 | High-Frequency Circuit: Explore the design of a high-frequency circuit, such as a radio frequency (RF) circuit or a microwave circuit. Design a PCB that includes RF components like antennas, RF amplifiers, or filters. Use the EDA tool's high-frequency simulation capabilities to analyze and optimize the circuit performance. |
| 4 | Mixed-Signal Circuit: Experiment with designing a mixed-signal circuit that incorporates both analog and digital components. Create a PCB layout that includes analog-to-digital converters (ADCs), digital-to-analog converters (DACs), and appropriate signal conditioning circuitry. Pay attention to ground plane design, analog and digital signal separation, and noise reduction techniques. |
| 5 | Power Electronics: Design a PCB for power electronics applications, such as motor control or power supply circuits. Create a schematic that includes power MOSFETs, gate drivers, and protection circuitry. Utilize the EDA tool's power analysis features to optimize the power distribution network and thermal management. |

| | |
|---|---|
| 6 | High-Density PCB: Experiment with designing a high-density PCB that requires careful attention to component placement, routing, and signal integrity. Challenge yourself to minimize the board size while ensuring efficient power delivery, controlled impedance, and high-speed signal integrity. |
| 7 | Multi-Layer PCB: Design a multi-layer PCB using the EDA tool's layer stackup and signal integrity analysis capabilities. Experiment with different stackup configurations to optimize signal integrity, minimize crosstalk, and ensure impedance matching for high-speed signals. |
| 8 | Design for Manufacturability: Pay attention to Design for Manufacturability (DFM) aspects while designing the PCB. Experiment with features like solder mask, silkscreen, panelization, and copper pours to optimize the fabrication and assembly processes. |
| | **Demonstration Experiments ( For CIE )** |
| 9 | Electromagnetic Compatibility (EMC) Analysis: Use the EDA tool's EMC analysis capabilities to evaluate and optimize the PCB design for electromagnetic compatibility. Experiment with shielding techniques, ground plane design, and component placement to minimize electromagnetic interference (EMI) and ensure compliance with EMC standards. |
| 10 | Flex PCB Design: Experiment with designing a flexible PCB (Flex PCB). Explore the unique considerations of flex circuit design, such as bend radius, routing techniques, and appropriate materials, to create a functional and reliable flexible PCB. |
| 11 | Thermal Analysis and Heat Dissipation: Design a PCB that requires efficient heat dissipation. Experiment with heat sink placement, copper pours, thermal vias, or other cooling techniques to ensure proper thermal management for power components or high-power applications. |
| 12 | Signal Integrity Analysis: Utilize the signal integrity analysis features of the EDA tool to investigate the impact of different design choices on signal integrity. Experiment with different termination schemes, via structures, or trace widths to optimize signal quality and minimize reflections or signal distortions. |

**Course outcomes (Course Skill Set):**

At the end of the course the student will be able to:

- Experience in using the software interface, creating schematics, generating PCB layouts, and generating manufacturing files.
- Choose appropriate symbols, assign footprints, make connections, and annotate components in the schematic design process.
- Learn techniques for managing signal integrity, minimizing noise, and ensuring proper grounding
- To simulate and analyze various aspects of their PCB designs, including signal integrity, power integrity, thermal analysis, and electromagnetic compatibility (EMC) issues.

- Identifying and resolving common PCB design issues, such as short circuits, open circuits, noise problems, or impedance mismatches.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.

**Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- **SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.

- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

**Suggested Learning Resources:**

- https://nptel.ac.in/courses/108108031
- https://onlinecourses.swayam2.ac.in/aic20_sp59/preview
- https://www.youtube.com/watch?v=f1soGt0uNqc
- https://www.youtube.com/watch?v=CFoMtRPRuCM

| DESIGN AND ANALYSIS OF ALGORITHMS | | Semester | IV |
|---|---|---|---|
| Course Code | **BUE401** | CIE Marks | 50 |
| Teaching Hours/Week (L: T :P: S) | 3:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 50 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Course Learning objectives:**

1. Explain the methods of analysing the algorithms and to analyze performance of algorithms.
2. State algorithm's efficiencies using asymptotic notations.
3. Solve problems using algorithm design methods such as the brute force method, greedy method, divide and conquer, decrease, and conquer, transform and conquer, dynamic programming, backtracking and branch and bound.
4. Choose the appropriate data structure and algorithm design method for a specified application.
5. Introduce P and NP classes.

**Teaching-Learning Process (General Instructions):**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

**Module-1**

**Introduction:** Algorithm, Performance analysis - Space complexity, Time complexity, Asymptotic Notations - Big oh notation, Omega notation, Theta notation and Little oh notation.

**Divide and Conquer:** General method, Applications - Binary search, Merge sort, Quick sort, Strassen's matrix multiplication. RBT Levels: L1, L2, L3

| |
|---|
| **Module-2** |
| **Disjoint Sets:** Disjoint set operations, Union and Find algorithms.<br>**Backtracking:** General method, Applications – The n-Queens problem, Sum of subsets problem, Graph coloring. RBT Levels: L1, L2, L3 |
| **Module-3** |
| **Dynamic Programming:** General method, Applications - All pairs shortest path problem, Optimal binary search trees, 0/1 Knapsack problem, Reliability design, Traveling salesperson problem. RBT Levels: L1, L2, L3 |
| **Module-4** |
| **Greedy Method:** General method, Applications - Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees, Single source shortest path problem.<br>RBT Levels: L1, L2, L3 |
| **Module-5** |
| **Branch and Bound:** General method, Applications - Travelling salesperson problem, 0/1 Knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.<br>**NP-Hard and NP-Complete Problems:** Basic concepts, Non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.<br>RBT Levels: L1, L2, L3 |
| **Course outcome (Course Skill Set)**<br><br>At the end of the course, the student will be able to:<br>1. Ability to analyze the performance of algorithms.<br>2. Ability to choose appropriate data structures and algorithm design methods for a specified application.<br>3. Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs. |
| **Assessment Details (both CIE and SEE)**<br>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. |

**Continuous Internal Evaluation:**

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

**Suggested Learning Resources:**

**Textbooks:**

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
2. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009. Pearson.

**Reference Books:**

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
2. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).

| **Web links and Video Lectures (e-Resources):** |
| --- |
| 1. http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html/<br>2. https://nptel.ac.in/courses/106/101/106101060/<br>3. http://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html/<br>4. http://cse01-iiith.vlabs.ac.in/<br>5. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms/ |
| **Activity Based Learning (Suggested Activities in Class)/ Practical Based learning.**<br><br>1. Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Peasant, wolf, goat, cabbage puzzle, Konigsberg bridge puzzle etc.,<br>2. Demonstration of solution to a problem through programming. |

| Network Analysis and Control Systems | | Semester | IV |
|---|---|---|---|
| Course Code | **BUE402** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 hours Theory + 8-10 Lab slots | Total Marks | 100 |
| Credits | 04 | Exam Hours | |
| Examination nature (SEE) | Theory | | |

**Course objectives:**

- To familiarize the basic laws, source transformations, theorems and the methods of analyzing electrical circuits and explain the use of network theorems.
- To familiarize the analysis of two port networks and to impart basic knowledge on network analysis using Laplace transforms.
- Understand basics of control systems and design mathematical models using block diagram reduction, SFG, etc.
- To utilize software package and discrete components in assessing the time and frequency domain analysis.
- To discuss stability analysis using Bode plots and Nyquist plots.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the topic in the succeeding classes.
10. Give Programming Assignments

**MODULE-1**

**Basic Circuit Elements:** Introduction, Circuit Components, Definitions, Sources of Electrical Energy, Source Transformation, General Network Transformation, Mesh and Node Analysis.

**Network Theorems:** Super Position theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem.

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and Talk, Demonstrate the concepts using circuits.<br>**RBT Levels:** L1, L2, L3 |
| **MODULE-2** | |
| **Two port networks:** One Port Network, Admittance parameters, Some equivalent networks, Impedance parameters, Transmission parameters, Hybrid parameters<br>**Laplace transform:** Laplace transformation, Basic theorems for Laplace transformation, Examples of the solution of problems with Laplace transformation | |
| **Teaching-Learning Process** | Chalk and Talk.<br>**RBT Levels:** L1, L2, L3 |
| **MODULE-3** | |
| **Basic Concepts and representation:**<br>Types of control systems, effect of feedback systems, Modelling of mechanical system elements, electrical systems, Analogous systems. Block diagram of a closed loop system, procedure for drawing block diagram and block diagram reduction to find transfer function. Construction of signal flow graphs, basic properties of signal flow graph, signal flow graph algebra, construction of signal flow graph for control systems. | |
| **Teaching-Learning Process** | Chalk and Talk.<br>**RBT Levels:** L1, L2, L3 |
| **MODULE-4** | |
| **Time Response analysis**: Time response of first order systems. Time response of second order systems, time response specifications of second order systems<br>**Stability Analysis:** Concepts of stability necessary condition for stability, Routh stability criterion, relative stability Analysis. | |
| **Teaching-Learning Process** | Chalk and Talk, Any simulation software tool to show time response.<br>**RBT Levels:** L1, L2, L3 |
| **MODULE-5** | |
| **Root locus Technique**: Introduction, root locus concepts, construction of root loci, rules for the construction of root locus.<br>**Frequency Response Analysis**: Co-relation between time and frequency response – 2nd order systems only.<br>**Bode Plots:** Basic factors G(iw)/H(jw), General procedure for constructing bode plots, computation of gain margin and phase margin.<br>**Nyquist plot:** Principle of argument, Nyquist stability criterion, assessment of relative stability using Nyquist criterion. | |
| **Teaching-Learning Process** | Chalk and Talk, Any simulation software tool plot Bode plots, Nyquist plot.<br>**RBT Levels:** L1, L2, L3 |

**PRACTICAL COMPONENT OF IPCC**

| Sl.NO | Experiments |
|---|---|
| 1 | Verification of Thevenin's and Norton's theorem. |
| 2 | Verification of Superposition theorem |
| 3 | Verification of Maximum Power Transfers theorem |
| 4 | Experiment to determine frequency response of a second order system |
| 5 | Experiment to draw the frequency response characteristics of the lag – lead compensator network. |
| 6 | Using suitable simulation package, determine step response and evaluate time response specifications of a second order system. |
| 7 | Using suitable simulation package, determine Evaluation of effect of pole location on stability. |
| 8 | Using suitable simulation package, draw Root locus, Bode plot and Nyquist plot of the given transfer functions. |
| **Demonstration Experiments (For CIE only, not for SEE)** | |
| 9 | Determination of frequency response of RC lead compensating network for the given specifications. |
| 10 | Determination of frequency response of RC lag compensating network for the given specifications. |
| 11 | Using suitable simulation package, study the effect of open loop poles and zeros on root locus contour. |
| 12 | Use suitable simulation package to perform Comparative study of Bode, Nyquist and root locus with respect to stability. |

**Course outcomes (Course Skill Set):**

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

1. Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and solve complex electric circuits using network theorems.
2. Evaluate the performance of two port networks and also synthesize typical waveforms using Laplace transformation.
3. Analyze and model electrical and mechanical system using analogous method, also formulate transfer functions using block diagram and signal flow graphs.
4. Analyze the stability of control system, ability to determine transient and steady state time response.
5. Illustrate the performance of a given system in time and frequency domains, stability analysis using Root locus, Bode plots and Nyquist plots

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each

subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**CIE for the theory component of the IPCC (maximum marks 50)**

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

**CIE for the practical component of the IPCC**

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

**SEE for IPCC**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

**The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component**.

**Suggested Learning Resources:**

**Text Books**

1. Engineering circuit analysis, William H Hayt, Jr, Jack E Kemmerly, Steven M Durbin, Mc Graw Hill
   Education, Indian Edition 8e.
2. Networks and Systems, D Roy Choudhury, New age international Publishers, second edition.
3. Network Analysis, M E Van Valkenburg, Pearson, 3e.
4. Control Systems Engineering, I J Nagrath, M. Gopal, New age international Publishers, Fifth edition.
5. Control Systems, Anand Kumar, PHI, 2ndEdition, 2014.

**Web links and Video Lectures (e-Resources):**

- **nptel.ac.in**

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- **Quizzes**
- **Seminars**
- **Assignments**

| Embedded System Design using Arm | | Semester | IV |
|---|---|---|---|
| Course Code | **BUE403** (Project Based Learning) | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:2:0 (Initial 7 weeks) and 8 Hours of Project Work (From 8th week till end of Semester) | SEE Marks | 50 |
| Total Hours of Pedagogy | 20 Hours Theory + 12 Hours of Lab + Course Related Project | Total Marks | 100 |
| Credits | 04 | | |
| Examination nature (SEE) | Theory/Practical | | |

**Course objectives:**

- To Understand the Basic Concepts Of Embedded Systems and to Understand the Design Of ARM.
- To Learn the Fundamentals of ARM Processor.
- To study the ARM Instruction Set and the Thumb Instruction Set.
- To get familiar with C Programming.
- To learn how to Write and Optimize the ARM Assembly Code
- To carry out the project and follow the concept of "Learning by Doing".

**Teaching-Learning Process (General Instructions)**

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk And Talk
2. Power Presentation and Videos
3. Flipped Classes
4. Practice Sessions
5. Project Work

**MODULE-1**

**Introduction to embedded systems**: What is Embedded System, Embedded System vs. General Computing Systems, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose Embedded Systems.

**ARM Processor Fundamentals:** Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions, Architecture Revisions, ARM Processor Families.

**Introduction To The ARM Instruction Set**: Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instruction.

RBT Levels : L1, L2, L3

**MODULE-2**

**Introduction To The ARM Instruction Set**: Program Status Register, Instructions Loading Constants, ARMv5E Extensions, Conditional Execution.

**Introduction To The Thumb Instruction Set**: Thumb Register Usage, ARM-Thumb Interworking, Other Branch Instructions, Data Processing Instructions, Single-Register Load-Store Instructions, Multiple-Register Load-Store Instructions, Stack Instructions, Software Interrupt Instruction.

**Efficient C Programming**: Overview of C Compilers and Optimization, Basic C Data Types ,C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing, Structure Arrangement, Bit- fields, Unaligned Data and Endianness, Division, Floating Point, Inline Functions and Inline Assembly, Portability Issues.

RBT Levels : L1, L2, L3

**PRACTICAL COMPONENT**

| Sl.NO | Experiments RBT Levels: L3, L4 |
|---|---|
| | **Arm LPC 2138/2148** |
| 1 | a. Write a program to find the sum of the first 10 integer numbers.<br>b. Write a program to find the factorial of a number.<br>c. Write a program to add an array of 16 bit numbers and store the 32 bit result in internal RAM. |
| 2 | a. Write a program to find the square of a number (1 to 10) using a look-up table.<br>b. Write a program to find the largest or smallest number in an array of 32 numbers. |
| 3 | Program to study GPIO using LEDs |
| 4 | Program to rotate stepper motor and DC motor |
| 5 | Program to test key pad with LCD display. |
| 6 | Program to work on PWM |
| 7 | Program to work on Interrupt. |
| 8 | Program to test ADC |

**COURSE RELATED PROJECT** RBT Levels : L3, L4, L5

**Course outcomes (Course Skill Set):**

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

- Understand hardware fundamentals of the actual ARM processor.
- Explain the various Processor Fundamentals and ARM Instruction Set.
- Analyse the ARM instruction set and Thumb Instruction.
- Execute the program using C language.
- Analyse the ARM Assembly Code
- Carry out the Projects related to real world problems.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Evaluation Procedure:**

**Continuous Internal Evaluation :**

| CIE No. | CIE Evaluation Particulars | | Maximum Marks |
|---|---|---|---|
| I | Theory Component | | 15 |
| | Project Idea Presentation | | 10 |
| II | Half Way Implementation of the Project | Presentation | 10 |
| | | Report | 05 |
| | Lab Test | | 10 |
| | | **Total** | **50** |

**Semester End Examination :**

| SEE Evaluation Particulars | Maximum Marks |
|---|---|
| Project Report | 25 |
| Project Presentation | 20 |
| Project Demonstration | 20 |
| Viva Voce | 10 |
| Lab Exam | 25 |
| **Total** | **100** |

**Suggested Learning Resources:**

**Books**


1. Shibu K. V, " Introduction to Embedded system" , Tata McGraw Hill Education PL second edition.
2. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide- Designing and Optimizing System Software", ELSEVIER.


**Web links and Video Lectures (e-Resources):**

1. https://www.youtube.com/watch?v=uFhDGagZzjs&t=1442s
2. https://www.youtube.com/watch?v=SUusup7FfJo
3. https://www.youtube.com/watch?v=3OmyM4-zuQw
4. https://www.youtube.com/watch?v=CuuIBvHrvtA

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Quizzes
- Seminars
- Assignments

| Algorithms Lab | | Semester | IV |
|---|---|---|---|
| Course Code | **BUEL404** | CIE Marks | 50 |
| Teaching Hours/Week (L: T: P: S) | 0: 0: 2: 0 | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 100 |
| Examination type (SEE) | Practical | | |

**Course objectives:**

- Design and implement various algorithms in C/C++/Python.
- Employ various design strategies for problem solving.
- Measure and compare the performance of different algorithms.

| Sl.NO. | Experiments |
|---|---|
| 1 | Sort a given set of n integer elements using Selection Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C/C++/Python how the brute force method works along with its time complexity analysis: worst case, average case and best case. |
| 2 | Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C/C++/Python how the divide-and-conquer method works along with its time complexity analysis: worst case, average case, and best case. |
| 3 | Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C/C++/Python how the divide-and-conquer method works along with its time complexity analysis: worst case, average case, and best case. |
| 4 | Write C/C++/Python programs to<br>1. Solve All-Pairs Shortest Paths problem using Floyd's algorithm.<br>2. Solve Travelling Salesperson problem using Dynamic programming. |
| 5 | Design and implement C/C++/Python Program to find a subset of a given set S = {S1, S2… Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S = {1, 2, 5, 6, 8} and d= 9, there are two solutions {1, 2, 6} and {1, 8}. Display a suitable message if the given problem instance doesn't have a solution. |
| 6 | Design and implement C/C++/Python Program to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle. |
| 7 | Implement in C/C++/Python, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method. |

| | |
|---|---|
| 8 | From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program in C/C++/Python. |
| | **Demonstration Experiments (For CIE)** |
| 9 | Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm. |
| 10 | Design and implement in C/C++/Python to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle. |
| 11 | Write a C/C++/Python program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number. |
| 12 | Write a C/C++/Python program to implement the Stack using arrays. Write Push (), Pop (), and Display () methods to demonstrate its working. |

**Course outcomes (Course Skill Set):**

At the end of the course the student will be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Implement a variety of algorithms such assorting, graph related, combinatorial, etc., in a high-level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structure to solve real-world problems.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.

- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks). Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

**Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- **SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in - 60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is **02 hours**.

**Suggested Learning Resources:**


1. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966.
2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop Ecosystem", 1st Edition, Pearson Education, 2016. ISBN13: 978-9332570351.

| Software Tools and Technologies | | Semester | IV |
|---|---|---|---|
| Course Code | **BUEL456A** | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P: S) | 0:0:2:0 | SEE Marks | 50 |
| Credits | 01 | Total Marks | 100 |
| Examination type (SEE) | Practical | | |

**Course objectives:**

- To make familiar with the modern tool usage
- To improve the verbal and written communication skills
- Explain the importance of problem solving and usage of various program design tools
- To get familiar with creation of professional accounts and usage of google drives.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

**Module-1**

**MS Word -** Quick styles, Template usage, Graphics use, Auto correction, Auto formatting, Translate documents, Compare documents, Document security, Set watermark, Report writing

**MS PowerPoint -** Presentation skills

**Module-2**

**MS Excel -** Filling, Logical functions, Functions and formulae, Sort and filters, Charts, Shortcuts**.**

**Module-3**

**MS Access -** Orientation to access, Working with table data, Querying a database

**Module-4**

**Building logic to improve programming skills -** Decision making and branching constructs, Looping statements

**Module-5**

Introduction to LinkedIn, GitHub, Kaggle, Google form, Google classroom, Google sheet, usage of google drive

**Course outcome (Course Skill Set):**

At the end of the course the student will be able to:

1. Get acquainted with the modern tool usage.
2. Improve the verbal and written communication skills.
3. Familiar with the importance of problem solving and usage of various program design tools.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

**Semester End Examinations (SEE)**

- SEE marks for the practical course are 50 Marks.
- **SEE shall be conducted by the two examiners. One from the same institute as an internal examiner and another from a different institute as an external examiner, appointed by the university.**
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

**Suggested Learning Resources:**

**Books**

1. The Art of Computer Programming by Donald E. Knuth.
2. How to solve it by Computer by R. G. Dromey.

**Web links and Video Lectures (e-Resources):**

- HackerEarth.com
- LeetCode.com

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- How to Create and Print Envelopes in Word
- How to Create and Print Envelopes in Word
- How to Mail Merge in Word
- How to Print Labels in Word
- Use the inbuilt functions in Microsoft Excel to calculate basic statistics from a list of data.
- Use MS Excel Pivot Tables to filter your data and generate statistics.
- Use Microsoft Excel 2007 to create simple calculations those can be quickly copied to other cells.
- Use Tables in Microsoft Excel 2007 to filter large amounts of data to retrieve specific information.
- Write a program using decision making and branching constructs
- Write a program using decision making and looping statements

| Electronic Circuit Application Lab | | Semester | IV |
|---|---|---|---|
| Course Code | **BUEL456B** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 0:0:2:0 | SEE Marks | 50 |
| Credits | 01 | Total Marks | 100 |
| Examination type (SEE) | Practical | | |

**Course objectives:**

- To provide hands-on experience in the design, analysis, testing, and comprehension of electronic circuits comprising of diodes, BJTs and FETs.
- To introduce principles of circuit design for practical applications.
- To identify the significance and inter-dependency of the circuit elements for each circuit application.
- To design and verify the expected outcomes as per the given specifications.

| Sl.NO | Experiments |
|---|---|
| 1 | Diode Clipping Circuits |
| 2 | Diode Clamping Circuits |
| 3 | Half Wave Rectifier with and without Capacitor Filter |
| 4 | Full Wave Bridge Rectifier with and without Capacitor Filter |
| 5 | Transistor biasing using Fixed bias and voltage divider bias circuit |
| 6 | RC coupled Single stage BJT Amplifier |
| 7 | JFET Characteristics |
| 8 | JFET Amplifier |
| | **Demonstration Experiments (For CIE)** |
| 9 | BJT Darlington Emitter Follower |
| 10 | Class B push Pull Amplifier |
| 11 | RC Phase Shift Oscillator |
| 12 | MOSFET Characteristics |

**Course outcomes (Course Skill Set):**

At the end of the course the student will be able to:

- Demonstrate a comprehensive understanding of the fundamental concepts, principles, and characteristics of diode circuits, rectifiers, transistors, and amplifiers.
- Design various electronic circuits, such as diode clipping and clamping circuits, rectifiers with and without filters, biasing circuits, amplifiers, and oscillators, to meet specific requirements.
- Analyse the behaviour and performance of electronic circuits using circuit analysis techniques, and evaluate the impact of different parameters on circuit behaviour.

**Assessment Details (both CIE and SEE):**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student’s performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

**Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours.

**Suggested Learning Resources:**

**Books**


- Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, PHI/Pearson Education, 9th Edition and onwards.
- David A. Bell, “Electronic Devices and Circuits”, PHI, 4th Edition, 2004and onwards.


**Reference Books**


- Jacob Millman & Christos C. Halkias, “Integrated Electronics”, Tata-McGraw Hill, 2nd Edition, 2010and onwards.
- Thomas L. Floyd, “Electronic devices”, Pearson Education, 2002and onwards

| Introduction to Raspberry Pi | | Semester | IV |
|---|---|---|---|
| Course Code | **BUEL456C** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 0:0:2:0 | SEE Marks | 50 |
| Credits | 01 | Total Marks | 100 |
| Examination Type (SEE) | Practical | | |

**Course objectives:**

- Demonstrate the use Raspberry Pi to create a fully functional computer.
- Using Python-based IDEs trace and debug Python code on the device.
- Measure physical parameter using sensors.
- Implement various communication protocols for wired and wireless communication.
- Demonstrate interfacing of different motors to create robots.

| Sl. No. | Experiments |
|---|---|
| 1. | Construct Raspberry Pi to work as desktop PC. |
| 2. | Setup a Raspberry Pi as motion detector. |
| 3. | Setup a Raspberry Pi to work as ADC/DAC. |
| 4. | Construct a digital weather station using Raspberry Pi. |
| 5. | Construct a Traffic Light Controller using Raspberry Pi. |
| 6. | Setup file server using Raspberry Pi. |
| 7. | Interface keyboard and mouse to the Raspberry Pi. |
| 8. | Create a portable wireless access point using Raspberry Pi. |
| 9. | Use Raspberry Pi to communicate with Arduino. |
| 10. | Construct a digital server based weather station using Raspberry Pi. |
| 11. | Create Keyboard Control Robot using Raspberry Pi. |
| 12. | Create Wireless Robot using Raspberry Pi. |

**Course Outcomes (Course Skill Set):**

At the end of the course the student will be able to:

- Wire Raspberry Pi and create a fully functional computer.
- Use Python-based IDE and trace and debug Python code on the device.
- Measure physical parameter using sensors.
- Implement various communication protocols for wired and wireless communication.
- Interfaces different motors and create robots.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are**50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

**Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours.

**Suggested Learning Resources:**

**Text Books:**


1. Raspberry Pi 3 : An Introduction to Using with Python, Scratch, Javascript and more, Gary Mitnick, Create Space Independent Publishing Platform, 2017.
2. Raspberry Pi for Python Programmers Cookbook, Tim Cox, Packt Publishing Limited; 2nd, Revised edition, 2016.
3. Raspberry Pi User Guide, Eben Upton and Gareth Halfacreee, John Wiley & Sons, 2016.


- Raspberry Pi Installation & Download:
  https://www.raspberrypi.com/software/operating-systems/
  https://youtu.be/NUHRhNB67F4

| Octave / Scilab for Signals | | Semester | IV |
|---|---|---|---|
| Course Code | **BUEL456D** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 0:0:2:0 | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 100 |
| Examination Type (SEE) | Practical | | |

**Course objectives:**

1. **Preparation:** To prepare students with fundamental knowledge/ overview in the field of signals and processing.
2. **Core Competence:** To equip students with a basic foundation in electronic engineering and mathematics fundamentals required for comprehending the operation and application of signal processing.
3. **Professionalism & Learning Environment**: To inculcate in students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

| Sl. No. | Experiments |
|---|---|
| 1. | Verify the Sampling theorem. |
| 2. | Determine linear convolution, Circular convolution and Correlation of two given sequences. Verify the result using theoretical computations. |
| 3. | Determine the linear convolution of two given point sequences using FFT algorithm. Verify the result using theoretical computations. |
| 4. | Determine the correlation using FFT algorithm. Verify the result using theoretical computations. |
| 5. | Determine the spectrum of the given sequence using FFT. Verify the result using theoretical computations. |
| 6. | Design and test FIR filter using Windowing method (Hamming, Hanning and Rectangular window) for the given order and cut-off frequency. |
| 7. | Design and test IIR Butterworth 1st and 2nd order low & high pass filter. |
| 8. | Design and test IIR Chebyshev 1st and 2nd order low & high pass filter. |
| 9. | Generation of an AM – Suppressed Carrier Wave & visualization of the time domain and frequency domain plots |
| 10. | Generation and visualization of standard test signals (both continuous and discrete time). |
| 11. | Generation and visualization of audio signal (pre-recorded) and generation of echo. |
| 12. | Generation and visualization of the STFT of a chirp (and other related) signal. |

**Course Outcomes (Course Skill Set):**

At the end of the course the student will be able to:

- Demonstrate the DSP concepts on signal generation and sampling using Scilab/Octave.
- Design and verify the computation of discrete signals using Scilab/Octave.
- Demonstrate and verify the application of FFT/DFT algorithm for a given signal using Scilab/Octave.
- Design and demonstrate programs to evaluate different types of low and high pass FIR filters using Scilab/Octave.
- Design, demonstrate and visualize different real world signals using Scilab/Octave programs.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

**Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The duration of SEE is 03 hours
- Rubrics suggested in Annexure-II of Regulation book

**Suggested Learning Resources:**

- Digital Signal Processing Using MATLAB, John G Proakis and Vinay K Ingle, Cengage Learning, 2011.

| LINEAR INTEGRATED CIRCUITS | | Semester | IV |
|---|---|---|---|
| Course Code: | **BUE405A** | CIE Marks | 50 |
| Teaching Hours/Week (L:P: SDA) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Course Objectives:**

- To understand the basic concepts of operational amplifier and its various applications.
- To understand the basics of PLL and its practical applications.
- To know about analog multipliers.
- To know about various analog switches and different A/D and D/A convertors.
- To understand the concepts of switched capacitor filters, Voltage regulator and various amplifiers

**Teaching Learning Process (General Instructions)**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Explain the fundamental concepts required for the module in the introduction phase of the module.
2. Conducting quiz after completion of every module in class and evaluate.
3. Asking questions about completed previous topic, will aid to assess the student understanding.
4. Evaluate the internals answer booklet by correcting the mistakes if any.
5. Modules revision at the end as well use practical lab sessions and demonstrate the concepts if applicable and feasible.

In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students theoretical and programming skills.

**Module-1**

**Operational Amplifier Fundamentals:** Basic Op-amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations.

**Op-Amps as DC Amplifiers:** Biasing OP-amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers, and Difference amplifiers. Interpretation of OP-amp LM741 & TL081 datasheet.

**RBT Level: L1, L2**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method, Power Point Presentation, You tube videos, Brain storming, Activity based method, Seminar |

**Module-2**

**Op-Amps as AC Amplifiers:** Capacitor coupled voltage follower, High input impedance –Capacitor ,

coupled voltage follower,Capacitor coupled non inverting amplifiers, High input impedance –Capacitor coupled Non-inverting amplifiers, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier.

**Op-Amp Applications:** Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers

**RBT Level: L1, L2,L3**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method, Power Point Presentation, You tube videos, Brain storming, Activity based method, Seminar |

**Module-3**

**More Applications :** Limiting circuits, Clamping circuits, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wien bridge oscillator, Crossing detectors, inverting Schmitt trigger. (Text 1) Log and antilog amplifiers, Multiplier and divider. (Text2)

**RBT Level: L1, L2, L3**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method, Power Point Presentation, You tube videos, Brain storming, Activity based method, Seminar |

**Module-4**

**Active Filters:** First order and second order active Low-pass and high pass filters, Band pass Filter, Band stop Filter. (Text 1)

**Voltage Regulators:** Introduction, Series Op-amp regulator, IC voltage regulators. 723 general purpose regulators. (Text 2)

**RBT Level: L1, L2**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method, Power Point Presentation, You tube videos, Brain storming, Activity based method, Seminar |

**Module-5**

**Phase locked loop:** Basic Principles, Phase detector/comparator, VCO.

**DAC and ADC convertor:** DAC using R-2R, ADC using Successive approximation.

**Other IC Application:** 555 timer, Basic timer circuit, 555 timer used as astable and monostable multivibrator. (Text 2)

**RBT Level: L1, L2, L3**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method, Power Point Presentation, You tube videos, Brain storming, Activity based method, Seminar |

**Course outcome**

At the end of the course the student will be able to:

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Explain Op-Amp circuit and parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate. | Understand |
| CO2 | Design Op-Amp based Inverting, Non-inverting, Summing & Difference Amplifier, and AC Amplifiers including Voltage Follower and test circuits of Op-Amp based Voltage/ Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers. | Apply |
| CO3 | Test circuits of Op-Amp based linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator/ Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider. | Apply |
| CO4 | Design first & second order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators using Op-Amps. | Understand |
| CO5 | Explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer. | Apply |

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

**Text Books:**


1. Operational Amplifiers and Linear IC's‖, David A. Bell, 2nd edition, PHI/Pearson, 2004. ISBN 978-81-203-2359-9.
2. Linear Integrated Circuits‖, D. Roy Choudhury and Shail B. Jain, 4thedition, Reprint 2006, New Age International ISBN 978-81-224-3098-1.


**Reference Books:**


1. Ramakant A Gayakwad, —Op-Amps and Linear Integrated Circuits‖, Pearson, 4th Ed, 2015. ISBN 81-7808-501-1.
2. B Somanathan Nair, —Linear Integrated Circuits: Analysis, Design & Applications,‖ Wiley India, 1st Edition, 2015.
3. James Cox, —Linear Electronics Circuits and Devices‖, Cengage Learning, Indian Edition, 2008, ISBN-13: 978-07-668-3018-7.
4. Data Sheet: http://www.ti.com/lit/ds/symlink/tl081.pdf.

| DISCRETE MATHEMATICAL STRUCTURES AND GRAPH THEORY | | Semester | IV |
|---|---|---|---|
| Course Code | **BUE405B** | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P: S) | 3:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | |
| Examination type (SEE) | Theory | | |

**Course objectives:**

- Get acquainted with fundamentals and all laws of logic and quantifiers.
- Get familiar with relations and their closures, Posets and Lattices.
- Understand the theory of recurrence relations and generating functions.

**Teaching Learning Process (General Instructions)**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Explain the fundamental concepts required for the module in the introduction phase of the module.
2. Conducting quiz after completion of every module in class and evaluate.
3. Asking questions about completed previous topic, will aid to assess the student understanding.
4. Evaluate the internals answer booklet by correcting the mistakes if any.
5. Modules revision at the end as well use practical lab sessions and demonstrate the concepts if applicable and feasible.

In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students theoretical and programming skills.

**Module-1**

**Fundamentals of Logic**: Basic connectives and Truth tables, Logical equivalence- Laws of Logic, Logical Implication-Rules of Inference. Quantifiers- Universal and Existential Quantifiers.

RBT Levels: L1, L2

**Module-2**

**Relations:** Types and Properties of Relations (revision), n-ary Relations and Their Applications. Computer Recognition-Zero One Matrices and Directed graphs, Transitive closure, Equivalence relation and Partitions, Posets and Hasse Diagrams, Lattices.

RBT Levels: L1, L2

**Module-3**

**Recurrence relations:** Definition, Homogeneous recurrence relations, Non Homogeneous recurrence relations. Solution of homogeneous and non-homogeneous recurrence relations. Generating functions. Solution of recurrence relation by generating function.

RBT Levels: L1, L2, L3

| Module-4 |
|---|
| **Introduction to Graph Theory:** Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree: Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles<br>RBT Levels: L1, L2, L3 |
| **Module-5** |
| **Trees:** Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes.<br>**Optimization and Matching:** Dijkstra's Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim's.<br>RBT Levels: L1, L2, L3 |

**Course outcome (Course Skill Set)**

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

1. Understand and Apply the Logic of mathematics in the field of Computer science.
2. Explain and Analyse different Relations and their closures. Posets and lattices.
3. Apply theory of solution of recurrence relations to solve them.
4. Apply the concepts related to graph theory.
5. Apply different algorithms for solving the problems related to trees.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

**Suggested Learning Resources:**

**Books**


1. Kolman, Busby, Ross "Discrete Mathematical Structures", 6th Edition Prentice Hall of India, 2010 onwards.
2. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2011.
3. Kenneth Rosen "Discrete Mathematics and Its Applications with Combinatorics and Graph Theory (SIE) | 7th Edition onwards.
4. D.S. Chandrasekharaiah: Discrete Mathematical Structures, Prism, 2005.
5. D.S. Chandrasekharaiah: Graph Theory and Combinatorics, Prism, 2005


**Web links and Video Lectures (e-Resources):**

1. https://archive.nptel.ac.in/courses/111/106/111106086/
2. https://onlinecourses.nptel.ac.in/noc22_ma10/preview

| Data Base Management Systems | | Semester | IV |
|---|---|---|---|
| Course Code | BUE405C | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Course objectives:**

- Provide a strong foundation in database concepts, technology, and practice.
- Practice SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database
- Design and build database applications for real world problems.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Show Video/animation films to explain the functioning of various computer systems
2. Encourage collaborative (Group discussion) Learning in the class
3. Arrange interactive session

**Module-1**

**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization.

RBT Levels : L1, L2

**Module-2**

**Relational Model**: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

**Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.

RBT Levels : L2, L3

**Module-3**

**SQL: Advances Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.

**Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop.

**Internet Applications:** The three-Tier application architecture, The presentation layer, The Middle Tier

RBT Levels : L2, L3

**Module-4**

**Normalization: Database Design Theory** – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

**Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate
Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms

RBT Levels : L2, L3

**Module-5**

**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

**Introduction to Database Recovery Protocols:** Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures

RBT Levels:L2, L3, L4

**Course outcome (Course Skill Set)**

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

1. Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS.
2. Use Structured Query Language (SQL) for database manipulation.
3. Design and build simple database systems
4. Develop application to interact with databases.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

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**Semester-End Examination:**

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2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

**Suggested Learning Resources:**

**Books**


1. RamezElmasri and Shamkant B. Navathe Fundamentals of Database Systems, , 7th Edition,2017, Pearson.
2. Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw HillDatabase management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill
3. SilberschatzKorth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill,2013.
4. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

| **Web links and Video Lectures (e-Resources):** |
| --- |
| • VTU e-Shikshana Program<br>• VTU EDUSAT Program<br>• https://onlinecourses.nptel.ac.in/noc22_cs91/preview<br>• https://www.mooc-list.com/tags/database-management |
| **Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**<br>• Giving assignments on each module<br>• Conducting Quiz programs in each module<br>• Give Programming Assignments<br>• Conducting Seminars |

| Web Technologies | | Semester | IV |
|---|---|---|---|
| Course Code | **BUE405D** | CIE Marks | 50 |
| Teaching Hours/Week(L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course Objectives :**

After finishing this subject, students will be able to develop web pages using HTML, JavaScript, XML and advanced concepts of web applications and server-side programming.

**Teaching Learning Process (General Instructions)**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Explain the fundamental concepts required for the module in the introduction phase of the module.
2. Conducting quiz after completion of every module in class and evaluate.
3. Asking questions about completed previous topic, will aid to assess the student understanding.
4. Evaluate the internals answer booklet by correcting the mistakes if any.
5. Modules revision at the end of each module.
6. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and programming skills.

**Module 1**

**Fundamentals**: Introduction to Internet, WWW, Web Browsers, Web Servers, URL, Multipurpose Internet Mail Extensions, Overview of different protocols: HTTP, POP,SMTP, FTP, WAP, Web Architecture, Web Standards , Domain name and hierarchy, domain name registration process, web hosting

**Introduction to WWW:** Protocols and programs, secure connections, application and development tools, the web browser, What is server, choices, setting up UNIX and Linux web servers, Logging users, dynamic IP.

**Web Design:** Web site design principles, planning the site and navigation.

RBT Levels: L1, L2

| Teaching-Learning Process | Chalk and board, Active Learning, Demonstration |
|---|---|

**Module 2**

**Introduction to HTML & XHTML :** Origins and evaluation of HTML, Basic Syntax, Standard HTML Document Structure and Basic Text Formatting, Images, Hypertext Links, Lists, Tables, Frames, Forms, Multimedia in HTML.

**Cascading Style sheets:** Introduction and Levels of Style Sheets, Style Specification Formats, Style classes, Properties and Property values, using CSS, background images, colours and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2.

RBT Levels: L1, L2, L3

| Teaching-Learning Process | Chalk and board, Active Learning, Demonstration |
|---|---|

| Module 3 | |
|---|---|
| **JavaScript:** Client side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition.<br>**Advance script:** JavaScript and objects, JavaScript own objects, the DOM and webbrowser environments, forms and validations.<br>**DHTML :** Combining HTML, CSS and JavaScript, events and buttons, controlling your browser,<br>**Ajax:** Introduction, advantages & disadvantages, Purpose of it, Ajax based web application, alternatives of Ajax.<br>RBT Levels: L1, L2, L3 | |
| Teaching-Learning Process | Chalk and board, Active Learning, Demonstration |
| **Module 4** | |
| **PHP :** Starting to script on server side, Arrays, function and forms, advance PHP<br>**Web Site Design, Deployment and Hosting Websites:** DNS (Domain name System), Website URL Registration.<br>**Database connectivity**: JDBC/MySQL/ JSON. Website Designing, development and hosting using WordPress, Google Web Designer etc. Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs.<br>RBT Levels: L1, L2, L3 | |
| Teaching-Learning Process | Chalk and board, Active Learning, Demonstration |
| **Module 5** | |
| **AJAX**: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods**; Web Services:** Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application – SOAP.<br>RBT Levels: L1, L2, L3 | |
| Teaching-Learning Process | Chalk and board, Active Learning, Demonstration |

**Course Outcomes (Course Skill Set)**

At the end of the course the student will be able to:

1. Outline the features of Internet and World Wide Web.
2. Develop web page using HTML, and learn to use CSS Styling features in designing a web page.
3. Integrate multimedia features into Web pages using advanced web designing tools, Make the web pages more dynamic and interactive.
4. Appraise the principles of object oriented development using PHP and database connectivity using PHP commands.
5. Illustrate AJAX client server architecture and introduction to web services, WSDL and SOAP.

**Suggested Learning Resources:**

**Text Book:**

- Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1stEdition, Pearson Education India. (ISBN: 978-9332575271).

**Reference Book:**


1. Robin Nixon, “Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5”, 4thEdition, O’Reilly Publications, 2015. (ISBN:978-9352130153).
2. Luke Welling, Laura Thomson, “PHP and MySQL Web Development”, 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736).
3. Nicholas C Zakas, “Professional JavaScript for Web Developers”, 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088).
4. David Sawyer Mcfarland, “JavaScript & jQuery: The Missing Manual”, 1st Edition, O’Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014 (ISBN:978- 9351108078)


**Web links:**

- https://onlinecourses.swayam2.ac.in/nou20_cs05/preview
- https://www.youtube.com/watch?v=JsbxB2l7QGY
- https://www.youtube.com/watch?v=Mavd2YwxuIk

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Quizzes
- Assignments
- Seminars