**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**

**B.E. in Computer Science and Design**

**Scheme of Teaching and Examinations 2021**

**Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)**

**(Effective from the academic year 2021 - 22)**

**IV SEMESTER**

| Sl. No | Course and Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self - Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | L | T | P | S | | | | | |
| 1 | BSC 21CS41 | Mathematical Foundations for Computing | Maths | 2 | 2 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC 21CS42 | Design and Analysis of Algorithms | Any CS Board Department | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC 21CS43 | Microcontroller and Embedded Systems | | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC 21CS44 | Operating Systems | | 2 | 2 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | AEC 21BE45 | Biology For Engineers | BT, CHE, PHY | 2 | 0 | 0 | | 02 | 50 | 50 | 100 | 2 |
| 6 | PCC 21CSL46 | Python Programming Laboratory | Any CS Board Department | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 7 | HSMC 21KSK37/47 | Samskrutika Kannada | HSMC | 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| | HSMC 21KBK37/47 | Balake Kannada | | | | | | | | | | |
| | OR | | | | | | | | | | | |
| | HSMC 21CIP37/47 | Constitution of India & Professional Ethics | | | | | | | | | | |
| 8 | AEC 21CS48X/21CSL48X | Ability Enhancement Course- IV | TD and PSB: Concerned department | If offered as theory Course: 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| | | | | If offered as lab. course: 0 | 0 | 2 | | 02 | | | | |
| 9 | UHV 21UH49 | Universal Human Values | Any Department | 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| 10 | INT 21INT49 | Inter/Intra Institutional Internship | Evaluation By the appropriate authorities | Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester. | | | | 3 | 100 | -- | 100 | 2 |
| | | | | | | | | **Total** | **550** | **450** | **1000** | **22** |

**Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | NCMC 21MATDIP41 | Additional Mathematics - II | Maths | 02 | 02 | -- | -- | -- | 100 | -- | 100 | 0 |

**Note:** BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.

L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical's of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from practical part of IPCC shall be included in the SEE question paper. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

**Non – credit mandatory course (NCMC):**

**Additional Mathematics - II:**

**(1)** Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfil the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.

**(2)** Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

**(3)** Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics II shall be indicated as Unsatisfactory.

**Ability Enhancement Course - IV**

| | | | |
|---|---|---|---|
| 21CSL481 | Web Programming | 21CSL483 | R Programming |
| 21CS482 | Unix Shell Programming | 21CS484 | |

**Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68 Innovation/ Entrepreneurship/ Societal based Internship.**

**(1)** All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.

**(2)** Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centers or Incubation centers. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.

Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are a preferred place to learn the business tack ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors, including technology, small and medium-sized, and the service sector.

**(3)** Societal or social internship.

Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship, is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.

As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

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## B.E COMPUTER SCIENCE AND ALLIED ENGINEERING BRANCHES

**Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)**

(Effective from the academic year 2022-2023)

**SEMESTER - IV**

**Mathematical Foundations for Computing, Probability & Statistics**

| | | | |
|---|---|---|---|
| Course Code | **21MATCS41** | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P) | 2:2:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 3 |

**Course Objectives:**

This course(21MATCS41) will enable students to:

1. Understand an intense foundational introduction to fundamental concepts in discrete mathematics.
2. Interpret, identify, and solve the language associated with logical structure, sets, relations and functions, modular arithmetic.
3. To have insight into Statistical methods, Correlation and regression analysis. Fitting of curves.
4. To develop probability distribution of discrete and continuous random variables. Joint probability distribution occurs in digital signal processing, design engineering and microwave engineering.

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

These are sample Strategies, which 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 also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for 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 for some exercises (post-lecture activity).

| Module - 1 | |
|---|---|
| **Fundamentals of Logic**: Basic connectives and truth tables, Logical equivalence – The laws of Logic, Logical implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions, and the Proofs of Theorems. **(8 Hours)**<br>**Self-study**: Problems on Logical equivalence.<br>**(RBT Levels: L1, L2 and L3)** | |
| **Pedagogy** | Chalk and Board, Problem based learning |
| **Module - 2** | |
| **Relations and Functions**: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. Function Composition, and Inverse Functions.<br>**Relations:** Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.<br>**Introduction to Graph Theory:** Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. **(8 Hours)**<br>**Self-study:** The Pigeon-hole Principle, problems and its applications<br>**(RBT Levels: L1, L2 and L3)** | |
| **Pedagogy** | Chalk and Board, Problem based learning |
| **Module - 3** | |
| **Statistical Methods:** Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression –problems.<br>**Curve Fitting:** Curve fitting by the method of least squares- fitting the curves of the form- $y = ax + b$, $y = ax^b$ *and* $y = ax^2 + bx + c$ **(8 Hours)**<br>**Self-study:** Angle between two regression lines, problems. Fitting of the curve $y = ab^x$<br>**(RBT Levels: L1, L2 and L3)** | |
| **Pedagogy** | Chalk and Board, Problem based learning |
| **Module - 4** | |
| **Probability Distributions**: Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples.<br>**Self-study:** exponential distribution. **(8 Hours)**<br>**(RBT Levels: L1, L2 and L3)** | |
| **Pedagogy** | Chalk and Board, Problem based learning |
| **Module - 5** | |
| **Joint probability distribution**: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.<br>**Sampling Theory**: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **(8 Hours)**<br>**Self-Study:** Point estimation and interval estimation.<br>**(RBT Levels: L1, L2 and L3)** | |
| **Pedagogy** | Chalk and Board, Problem based learning |

## B.E COMPUTER SCIENCE AND ALLIED ENGINEERING BRANCHES

**Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)**

(Effective from the academic year 2022-2023)

**SEMESTER – IV**

**Mathematical Foundations for Computing, Probability & Statistics**

| | | | |
|---|---|---|---|
| Course Code | **21MATCS41** | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P) | 2:2:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 3 |

**Course Objectives:**

This course(21MATCS41) will enable students to:

1. Understand an intense foundational introduction to fundamental concepts in discrete mathematics.
2. Interpret, identify, and solve the language associated with logical structure, sets, relations and functions, modular arithmetic.
3. To have insight into Statistical methods, Correlation and regression analysis. Fitting of curves.
4. To develop probability distribution of discrete and continuous random variables. Joint probability distribution occurs in digital signal processing, design engineering and microwave engineering.

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

These are sample Strategies, which 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 also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for 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 for some exercises (post-lecture activity).

**Textbooks:**


1. Ralph P. Grimaldi and B V Ramana, Discrete and Combinatorial Mathematics- An Applied Introduction, Pearson Education, Asia, Fifth edition – 2007. ISBN 978-81-7758-424-0.
2. Higher Engineering Mathematics B. S. Grewal Khanna Publishers 44th Edition, 2017


**References:**


3. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata – McGraw Hill, Sixth Edition, Sixth reprint 2008. ISBN-(13):978-0-07-064824-1.
4. C. L. Liu and D P Mohapatra, Elementary Discrete Mathematics, Tata- McGraw Hill, Sixth Edition, ISBN:10:0-07-066913-9.
5. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata – McGraw Hill, 35TH reprint 2008. ISBN 13:978-0-07-463113-3.
6. Advanced Engineering Mathematics C. Ray Wylie, Louis C.Barrett McGraw-Hill 6th Edition 1995
7. Higher Engineering Mathematics B. V. Ramana McGraw-Hill 11th Edition,2010
8. A Text-Book of Engineering Mathematics N. P. Bali and Manish Goyal Laxmi Publications 2014
9. Advanced Engineering Mathematics Chandrika Prasad and Reena Garg Khanna Publishing, 2018


List of NPTEL videos for various topics of Discrete Mathematical Structures

https://www.youtube.com/watch?v=9AUCdsmBGmA&list=PL0862D1A947252D20&index=10

https://www.youtube.com/watch?v=oU60TuGHxe0&list=PL0862D1A947252D20&index=11

https://www.youtube.com/watch?v=_BIKq9Xo_5A&list=PL0862D1A947252D20&index=13

https://www.youtube.com/watch?v=RMLR2JHHeWo&list=PL0862D1A947252D20&index=14

https://www.youtube.com/watch?v=nf9e0_ylGdc&list=PL0862D1A947252D20&index=15

https://www.youtube.com/watch?v=7cTWea9YAJE&list=PL0862D1A947252D20&index=24

https://www.youtube.com/watch?v=695iAm935cY&list=PL0862D1A947252D20&index=25

https://www.youtube.com/watch?v=ZECJHfsf4Vs&list=PL0862D1A947252D20&index=26

https://www.youtube.com/watch?v=Dsi7x-A89Mw&list=PL0862D1A947252D20&index=28

https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862D1A947252D20

https://www.youtube.com/watch?v=0uTE24o3q-o&list=PL0862D1A947252D20&index=2

https://www.youtube.com/watch?v=DmCltf8ypks&list=PL0862D1A947252D20&index=3

https://www.youtube.com/watch?v=jNeISigUCo0&list=PL0862D1A947252D20&index=4

## Course Outcomes

**Course Outcomes:** At the end of the courses, the students will be able to:

1. Apply the concepts of logic for effective computation and relating problems in the Engineering domain.
2. Analyse the concepts of functions and relations to various fields of Engineering. Comprehend the concepts of Graph Theory for various applications of Computational sciences.
3. Apply discrete and continuous probability distributions in analysing the probability models arising in the engineering field.
4. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
5. Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

## ASSESSMENT PATTERN (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 100%. The minimum passing mark for the CIE is 40% of the maximum marks (400 marks out of 100). A student shall be deemed to have satisfied the academic requirements if the student secures not less than 40% ( 40 Marks out of 100)in the CIE.

**Continuous Internal Evaluation:**

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of the 4th week of the semester
5. Second assignment at the end of the 9th week of the semester

Course Seminar suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

Or

Learning MATHS tools and solving a few problems from each module using MATHS tools (e.g. MATLAB, SciLab etc)

6. Conducting at least 05 labs sessions within the Academic Duration.

The sum of three tests, two assignments, and a seminar/Lab sessions using MATHS tools will be out of 100 marks.

The student shall secure minimum 40% of marks of course to qualify and become eligible for award of degree.

http://nptel.ac.in/courses.php?disciplineID=111

http://www.class-central.com/subject/math(MOOCs)

http://academicearth.org/

VTU EDUSAT PROGRAMME - 20

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

- Quizzes
- Assignments
- Seminars

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27.09.2022

**IV Semester**

| DESIGN AND ANALYSIS OF ALGORITHMS | | | |
|---|---|---|---|
| Course Code | 21CS42 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 T + 20 P | Total Marks | 100 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:**

CLO 1. Explain the methods of analysing the algorithms and to analyze performance of algorithms.
CLO 2. State algorithm's efficiencies using asymptotic notations.
CLO 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.
CLO 4. Choose the appropriate data structure and algorithm design method for a specified application.
CLO 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**: What is an Algorithm? It's Properties. Algorithm Specification-using natural language, using Pseudo code convention, Fundamentals of Algorithmic Problem solving, Analysis Framework-Time efficiency and space efficiency, Worst-case, Best-case and Average case efficiency.

**Performance Analysis**: Estimating Space complexity and Time complexity of algorithms.

**Asymptotic Notations**: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ) with examples, Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples.

**Brute force design technique**: Selection sort, sequential search, string matching algorithm with complexity Analysis.

**Textbook 1: Chapter 1 (Sections 1.1,1.2), Chapter 2(Sections 2.1,2.2,2.3,2.4), Chapter 3(Section 3.1,3.2)**

**Textbook 2: Chapter 1(section 1.1,1.2,1.3)**

***Laboratory Component:***

| | |
|---|---|
| 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++/Java how the brute force method works along with its time complexity analysis: worst case, average case and best case. | |
| **Teaching-Learning Process** | 1. Problem based Learning.<br>2. Chalk & board, Active Learning.<br>3. Laboratory Demonstration. |
| **Module-2** | |
| **Divide and Conquer**: General method, Recurrence equation for divide and conquer, solving it using Master's theorem. , Divide and Conquer algorithms and complexity Analysis of Finding the maximum & minimum, Binary search, Merge sort, Quick sort.<br><br>**Decrease and Conquer Approach**: Introduction, Insertion sort, Graph searching algorithms, Topological Sorting. It's efficiency analysis.<br><br>**Textbook 2: Chapter 3(Sections 3.1,3.3,3.4,3.5,3.6)**<br><br>**Textbook 1: Chapter 4 (Sections 4.1,4.2,4.3), Chapter 5(Section 5.1,5.2,5.3)** | |
| ***Laboratory Component:***<br><br>1. 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++/Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.<br><br>2. 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++/Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case. | |
| **Teaching-Learning Process** | 1. Chalk & board, Active Learning, MOOC, Problem based Learning.<br>2. Laboratory Demonstration. |
| **Module-3** | |
| **Greedy Method**: General method, Coin Change Problem, Knapsack Problem, solving Job sequencing with deadlines Problems.<br><br>**Minimum cost spanning trees**: Prim's Algorithm, Kruskal's Algorithm with performance analysis.<br><br>**Single source shortest paths**: Dijkstra's Algorithm.<br><br>**Optimal Tree problem**: Huffman Trees and Codes.<br><br>**Transform and Conquer Approach**: Introduction, Heaps and Heap Sort.<br><br>**Textbook 2: Chapter 4(Sections 4.1,4.3,4.5)**<br><br>**Textbook 1: Chapter 9(Section 9.1,9.2,9.3,9.4), Chapter 6( section 6.4)** | |
| ***Laboratory Component:*** | |

| |
|---|
| Write & Execute C++/Java Program<br>1. To solve Knapsack problem using Greedy method.<br>2. To find shortest paths to other vertices from a given vertex in a weighted connected graph, using Dijkstra's algorithm.<br>3. To find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.<br>4. To find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm. |

| | |
|---|---|
| **Teaching-Learning Process** | 1. Chalk & board, Active Learning, MOOC, Problem based Learning.<br>2. Laboratory Demonstration. |

**Module-4**

**Dynamic Programming**: General method with Examples, Multistage Graphs.

**Transitive Closure**: Warshall's Algorithm. **All Pairs Shortest Paths**: Floyd's Algorithm,

Knapsack problem, Bellman-Ford Algorithm, Travelling Sales Person problem.

**Space-Time Tradeoffs**: Introduction, Sorting by Counting, Input Enhancement in String Matching-Harspool's algorithm.

**Textbook 2: Chapter 5 (Sections 5.1,5.2,5.4,5.9)**

**Textbook 1: Chapter 8(Sections 8.2,8.4), Chapter 7 (Sections 7.1,7.2)**

***Laboratory Component:***

Write C++/ Java programs to

1. Solve All-Pairs Shortest Paths problem using Floyd's algorithm.
2. Solve Travelling Sales Person problem using Dynamic programming.
3. Solve 0/1 Knapsack problem using Dynamic Programming method.

| | |
|---|---|
| **Teaching-Learning Process** | 1. Chalk & board, Active Learning, MOOC, Problem based Learning.<br>2. Laboratory Demonstration. |

**Module-5**

**Backtracking**: General method, solution using back tracking to N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles Problems.

**Branch and Bound**: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem

**NP-Complete and NP-Hard problems**: Basic concepts, non- deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

**Textbook 1: Chapter 12 (Sections 12.1,12.2) Chapter 11(11.3)**

**Textbook 2: Chapter 7 (Sections 7.1,7.2,7.3,7.4,7.5) Chapter 11 (Section 11.1)**

***Laboratory Component:***

1. Design and implement C++/Java Program to find a subset of a given set S = {Sl, 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.

| | |
|---|---|
| 2. Design and implement C++/Java Program to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle. | |
| **Teaching-Learning Process** | 1. Chalk & board, Active Learning, MOOC, Problem based learning.<br>2. Laboratory Demonstration. |

**Course outcome (Course Skill Set)**

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

CO 1. Analyzethe performance of the algorithms, state the efficiency using asymptotic notations and analyze mathematically the complexity of the algorithm.
CO 2. Apply divide and conquer approaches and decrease and conquer approaches in solving the problemsanalyze the same
CO 3. Apply the appropriate algorithmic design technique like greedy method, transform and conquer approaches and compare the efficiency of algorithms to solve the given problem.
CO 4. Apply and analyze dynamic programming approaches to solve some problems. and improve an algorithm time efficiency by sacrificing space.
CO 5. Apply and analyze backtracking, branch and bound methods and to describe P, NP and NP-Complete 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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and 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:**

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to **20 marks**.

- Rubrics for each Experiment taken average for all Lab components – 15 Marks.
- Viva-Voce– 5 Marks (more emphasized on demonstration topics)

The sum of three tests, two assignments, and practical sessions will be out of 100 marks and will be **scaled down to 50 marks**
(to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the

methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper has to be 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 subject (**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.

The students have to answer 5 full questions, selecting one full question from each module. Marks scoredout of 100 shall be reduced proportionally to 50 marks

**Suggested Learning Resources:**

**Textbooks**

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.

**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)

**Weblinks and Video Lectures (e-Resources):**

1. http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html
2. https://nptel.ac.in/courses/106/101/106101060/
3. http://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html
4. http://cse01-iiith.vlabs.ac.in/
5. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms

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

1. Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Peasant, wolf, goat, cabbage puzzle, Konigsberg bridge puzzle etc.,
2. Demonstration of solution to a problem through programming.

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**IV Semester**

| MICROCONTROLLER AND EMBEDDED SYSTEMS | | | |
|---|---|---|---|
| Course Code | **21CS43** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 T + 20 P | Total Marks | 100 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:**

CLO 1: Understand the fundamentals of ARM-based systems, including programming modules with registers and the CPSR.

CLO 2: Use the various instructions to program the ARM controller.

CLO 3: Program various embedded components using the embedded C program.

CLO 4: Identify various components, their purpose, and their application to the embedded system's applicability.

CLO 5: Understand the embedded system's real-time operating system and its application in IoT.

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

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

1. The lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to develop the outcomes.
2. Show video/animation films to explain the 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 multiple 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 versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software.

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

**Textbook 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5**

***Laboratory Component:***

1. Using Keil software, observe the various registers, dump, CPSR, with a simple ALP programme.

| | |
|---|---|
| **Teaching-Learning Process** | 1. Demonstration of registers, memory access, and CPSR in a programme module.<br>2. For concepts, numerical, and discussion, use chalk and a whiteboard, as well as a PowerPoint presentation. |

**Module-2**

**Introduction to the ARM Instruction Set:** Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants

**C Compilers and Optimization :**Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing,

**Textbook 1: Chapter 3: Sections 3.1 to 3.6 (Excluding 3.5.2), Chapter 5**

***Laboratory Component:***

2. Write a program to find the sum of the first 10 integer numbers.
3. Write a program to find the factorial of a number.
4. Write a program to add an array of 16 bit numbers and store the 32 bit result in internal RAM.
5. Write a program to find the square of a number (1 to 10) using a look-up table.
6. Write a program to find the largest or smallest number in an array of 32 numbers.

| Teaching-Learning Process | 1. Demonstration of sample code using Keil software.<br>2. Laboratory Demonstration |
|---|---|

**Module-3**

**C Compilers and Optimization** :Structure Arrangement, Bit-fields, Unaligned Data and Endianness, Division, Floating Point, Inline Functions and Inline Assembly, Portability Issues.

**ARM programming using Assembly language:** Writing Assembly code, Profiling and cycle counting, instruction scheduling, Register Allocation, Conditional Execution, Looping Constructs

**Textbook 1: Chapter-5,6**

***Laboratory Component:***

1. Write a program to arrange a series of 32 bit numbers in ascending/descending order.
2. Write a program to count the number of ones and zeros in two consecutive memory locations.
3. Display "Hello World" message using Internal UART.

| Teaching-Learning Process | 1. Demonstration of sample code using Keil software.<br>2. Chalk and Board for numerical |
|---|---|

**Module-4**

**Embedded System Components:** Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems.

Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components.

**Textbook 2: Chapter 1 (Sections 1.2 to 1.6), Chapter 2 (Sections 2.1 to 2.6)**

***Laboratory Component:***

1. Interface and Control a DC Motor.
2. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
3. Determine Digital output for a given Analog input using Internal ADC of ARM controller.
4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Demonstrate the use of an external interrupt to toggle an LED On/Off.
7. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.

| Teaching-Learning Process | 1. Demonstration of sample code for various embedded components using keil.<br>2. Chalk and Board for numerical and discussion |
|---|---|

**Module-5**

**RTOS and IDE for Embedded System Design:** Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any

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**IV Semester**

| MICROCONTROLLER AND EMBEDDED SYSTEMS | | | |
|---|---|---|---|
| Course Code | 21CS43 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 T + 20 P | Total Marks | 100 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:**

CLO 1: Understand the fundamentals of ARM-based systems, including programming modules with registers and the CPSR.

CLO 2: Use the various instructions to program the ARM controller.

CLO 3: Program various embedded components using the embedded C program.

CLO 4: Identify various components, their purpose, and their application to the embedded system's applicability.

CLO 5: Understand the embedded system's real-time operating system and its application in IoT.

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

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

1. The lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to develop the outcomes.
2. Show video/animation films to explain the 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 multiple 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 versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software.

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

**Textbook 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5**

***Laboratory Component:***

1. Using Keil software, observe the various registers, dump, CPSR, with a simple ALP programme.

| | |
|---|---|
| **Teaching-Learning Process** | 1. Demonstration of registers, memory access, and CPSR in a programme module.<br>2. For concepts, numerical, and discussion, use chalk and a whiteboard, as well as a PowerPoint presentation. |

**Module-2**

**Introduction to the ARM Instruction Set:** Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants

**C Compilers and Optimization :**Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing,

program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques, target hardware debugging, boundary scan.

**Textbook 2: Chapter-10 (Sections 10.1, 10.2, 10.3, 10.4 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Chapter 12, Chapter-13 ( block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)**

***Laboratory Component:***

1. Demonstration of IoT applications by using Arduino and Raspberry Pi

| **Teaching-Learning Process** | 1. Chalk and Board for numerical and discussion<br>2. Significance of real time operating system[RTOS] using raspberry pi |
|---|---|

**Course outcome (Course Skill Set)**

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

CO 1. Explain C-Compilers and optimization
CO 2. Describe the ARM microcontroller's architectural features and program module.
CO 3. Apply the knowledge gained from programming on ARM to different applications.
CO 4. Program the basic hardware components and their application selection method.
CO 5. Demonstrate the need for a real-time operating system for embedded system applications.

**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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and 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:**

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to **20 marks**.

- Rubrics for each Experiment taken average for all Lab components – 15 Marks.
- Viva-Voce– 5 Marks (more emphasized on demonstration topics)

The sum of three tests, two assignments, and practical sessions will be out of 100 marks and will be **scaled down to 50 marks**

(to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper has to be 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 subject (**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.

The students have to answer 5 full questions, selecting one full question from each module. Marks scoredout of 100 shall be reduced proportionally to 50 marks

**Suggested Learning Resources:**

**Textbooks**


1. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.


**Reference Books**


1. Raghunandan. G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019
2. The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd.,1st edition, 2005.
3. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015.
4. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008.


**Weblinks and Video Lectures (e-Resources):**

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

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program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques, target hardware debugging, boundary scan.

**Textbook 2: Chapter-10 (Sections 10.1, 10.2, 10.3, 10.4 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Chapter 12, Chapter-13 ( block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)**

| | |
|---|---|
| *Laboratory Component:*<br>1. Demonstration of IoT applications by using Arduino and Raspberry Pi | |
| **Teaching-Learning Process** | 1. Chalk and Board for numerical and discussion<br>2. Significance of real time operating system[RTOS] using raspberry pi |

**Course outcome (Course Skill Set)**

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

CO 1. Explain C-Compilers and optimization
CO 2. Describe the ARM microcontroller's architectural features and program module.
CO 3. Apply the knowledge gained from programming on ARM to different applications.
CO 4. Program the basic hardware components and their application selection method.
CO 5. Demonstrate the need for a real-time operating system for embedded system applications.

**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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and 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:**

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to **20 marks**.

- Rubrics for each Experiment taken average for all Lab components – 15 Marks.
- Viva-Voce– 5 Marks (more emphasized on demonstration topics)

The sum of three tests, two assignments, and practical sessions will be out of 100 marks and will be **scaled down to 50 marks**

(to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper has to be 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

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**IV Semester**

| OPERATING SYSTEMS | | | |
|---|---|---|---|
| Course Code: | 21CS44 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 2:2:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course Objectives:**

CLO 1. Demonstrate the need for OS and different types of OS
CLO 2. Apply suitable techniques for management of different resources
CLO 3. Use processor, memory, storage and file system commands
CLO 4. 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. IntroduceTopics 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**

| | |
|---|---|
| **Teaching-Learning Process** | Active learning and problem solving<br>1. https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O<br>2. https://www.youtube.com/watch?v=a2B69vCtjOU&list=PL3-wYxbt4yCjpcfUDz-TgD_ainZ2K3MUZ&index=2 |

**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**

| **Teaching-Learning Process** | Active Learning and problem solving<br>1. https://www.youtube.com/watch?v=HW2Wcx-ktsc<br>2. https://www.youtube.com/watch?v=9YRxhlvt9Zo |
|---|---|

**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**

| **Teaching-Learning Process** | Active Learning, Problem solving based on deadlock with animation<br>1. https://www.youtube.com/watch?v=MYgmmJJfdBg<br>2. https://www.youtube.com/watch?v=Y14b7_T3AEw&list=PLEJxKK7AcSEGPOCFtQTJhOElU44J_JAun&index=30 |
|---|---|

**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**

| **Teaching-Learning Process** | Active learning about memory management and File system<br>1. https://www.youtube.com/watch?v=pJ6qrCB8pDw&list=PLIY8eNdw5tW-BxRY0yK3fYTYVqytw8qhp<br>2. https://www.youtube.com/watch?v=-orfFhvNBzY |
|---|---|

**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**

| **Teaching-Learning Process** | Active learning about case studies<br>1. https://www.youtube.com/watch?v=TTBkc5eiju4<br>2. https://www.youtube.com/watch?v=8hkvMRGTzCM&list=PLEAYkSg4uSQ2PAch478muxnoeTNz_QeUJ&index=36<br>3. https://www.youtube.com/watch?v=mX1FEur4VCw |
|---|---|

**Course Outcomes (Course Skill Set)**

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

CO 1. Identify the structure of an operating system and its scheduling mechanism.

CO 2. Demonstrate the allocation of resources for a process using scheduling algorithm.
CO 3. Identify root causes of deadlock and provide the solution for deadlock elimination
CO 4. Explore about the storage structures and learn about the Linux Operating system.
CO 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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and 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:**

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper has to be 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 subject (**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.

The students have to answer 5 full questions, selecting one full question from each module Marks scoredout of 100 shall be reduced proportionally to 50 marks

**Suggested Learning Resources:**

**Textbooks**

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.

**Weblinks and Video Lectures (e-Resources):**

1. https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp20
2. https://www.youtube.com/watch?v=783KAB-

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|---|
| tuE4&list=PLlemF3uozcAKTgsClj82voMK3TMR0YE_f<br>3. https://www.youtube.com/watch?v=3-ITLMMceXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeR-n6mk0 |
| **Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**<br>• Real world problem solving using group discussion.<br>• Role play for process scheduling.<br>• Present animation for Deadlock.<br>• Real world examples of memory management concepts |

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CO 2. Demonstrate the allocation of resources for a process using scheduling algorithm.
CO 3. Identify root causes of deadlock and provide the solution for deadlock elimination
CO 4. Explore about the storage structures and learn about the Linux Operating system.
CO 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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and 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:**

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper has to be 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 subject (**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.

The students have to answer 5 full questions, selecting one full question from each module Marks scoredout of 100 shall be reduced proportionally to 50 marks

**Suggested Learning Resources:**

**Textbooks**

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
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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.

**Weblinks and Video Lectures (e-Resources):**

1. https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O
2. https://www.youtube.com/watch?v=783KAB-

CO 2. Demonstrate the allocation of resources for a process using scheduling algorithm.
CO 3. Identify root causes of deadlock and provide the solution for deadlock elimination
CO 4. Explore about the storage structures and learn about the Linux Operating system.
CO 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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and 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:**

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

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2. https://www.youtube.com/watch?v=783KAB-

| |
|---|
| tuE4&list=PLlemF3uozcAKTgsCIj82voMK3TMR0YE_f<br>3. https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeR-n6mk0 |
| **Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**<br>• Real world problem solving using group discussion.<br>• Role play for process scheduling.<br>• Present animation for Deadlock.<br>• Real world examples of memory management concepts |

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CO 2. Demonstrate the allocation of resources for a process using scheduling algorithm.
CO 3. Identify root causes of deadlock and provide the solution for deadlock elimination
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Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

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The students have to answer 5 full questions, selecting one full question from each module Marks scoredout of 100 shall be reduced proportionally to 50 marks

**Suggested Learning Resources:**

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2. https://www.youtube.com/watch?v=783KAB-

| BIOLOGY FOR ENGINEERS | | | |
|---|---|---|---|
| Course Code | 21BE45 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 1:2:0:0 /2:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 25 | Total Marks | 100 |
| Credits | 02 | Exam Hours | 02 |

**Course objectives:**

- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of biodesign principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students develop the interdisciplinary vision of biological engineering.

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

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

- ✓ Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
- ✓ Instructions with interactions in classroom lectures (physical/hybrid).
- ✓ Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
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- ✓ Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
- ✓ Students' seminars (in solo or group) /oral presentations.

**Module-1 (5 Hours)**

**BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):** Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

**Module-2 (5 Hours)**

**HUMAN ORGAN SYSTEMS AND BIO DESIGNS - 1 (QUALITATIVE):** Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye).Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).

**Module-3 (5 Hours)**

**HUMAN ORGAN SYSTEMS AND BIO-DESIGNS - 2 (QUALITATIVE):** Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine).Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis).

**Module-4 (5 Hours)**

**NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):** Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

**Module-5 (5 Hours)**

**TRENDS IN BIOENGINEERING (QUALITATIVE):** Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self-healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

| BIOLOGY FOR ENGINEERS | | | |
|---|---|---|---|
| Course Code | 21BE45 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 1:2:0:0 /2:0:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 25 | Total Marks | 100 |
| Credits | 02 | Exam Hours | 02 |

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- To familiarize the students with the basic biological concepts and their engineering applications.
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**Module-1 (5 Hours)**

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Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

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**HUMAN ORGAN SYSTEMS AND BIO DESIGNS - 1 (QUALITATIVE):**

Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye).Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).

**Module-3 (5 Hours)**

**HUMAN ORGAN SYSTEMS AND BIO-DESIGNS - 2 (QUALITATIVE):**

Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine).Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis).

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**Course outcomes (Course Skill Set)**

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

- Elucidate the basic biological concepts via relevant industrial applications and case studies.
- Evaluate the principles of design and development, for exploring novel bioengineering projects.
- Corroborate the concepts of biomimetics for specific requirements.
- Think critically towards exploring innovative biobased solutions for socially relevant problems.

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

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Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for**20 Marks (duration 01 hours)**

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The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

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**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

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The students have to answer 5 full questions, selecting one full question from each module.

The SEE question paper will be set for 100 marks and marks scored will be proportionately reduced to 50 marks

**Suggested Learning Resources:**


- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

| BIOLOGY FOR ENGINEERS | | | |
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| Total Hours of Pedagogy | 25 | Total Marks | 100 |
| Credits | 02 | Exam Hours | 02 |

**Course objectives:**

- To familiarize the students with the basic biological concepts and their engineering applications.
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**Module-1 (5 Hours)**

**BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):**

Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

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**Module-3 (5 Hours)**

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**Module-5 (5 Hours)**

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- Blood Substitutes, Robert Winslow, Elsevier, 2005

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

- VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource
- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

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

- Group Discussion of Case studies
- Model Making and seminar/poster presentations
- Design of novel device/equipment like Cellulose-based water filters, Filtration system mimicking the kidney, Bioremediation unit for E-waste management, AI and ML based Bioimaging,

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**IV Semester**

| PYTHON PROGRAMMING LABORATORY | | | |
|---|---|---|---|
| Course Code | **21CSL46** | CIE Marks | 50 |
| Teaching Hours/Weeks (L: T: P: S) | 0: 0: 2: 0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 24 | Total Marks | 100 |
| Credits | 01 | Exam Hours | 03 |

**Course Objectives:**

CLO 1. Demonstrate the use of IDLE or PyCharm IDE to create Python Applications
CLO 2. Using Python programming language to develop programs for solving real-world problems
CLO 3. Implement the Object-Oriented Programming concepts in Python.
CLO 4. Appraise the need for working with various documents like Excel, PDF, Word and Others
CLO 5. Demonstrate regular expression using python programming

**Note: two hours tutorial is suggested for each laboratory sessions.**

**Prerequisite**

- Students should be familiarized about Python installation and setting Python environment
- Usage of IDLE or IDE like PyCharm should be introduced

  Python Installation: https://www.youtube.com/watch?v=Kn1HF3oD19c
  PyCharm Installation: https://www.youtube.com/watch?v=SZUNUB6nz3g

| *Sl. No.* | ***PART A – List of problems for which student should develop program and execute in the Laboratory*** |
|---|---|
| 1 | **Aim:** Introduce the Python fundamentals, data types, operators, flow control and exception handling in Python<br><br>a) Write a python program to find the best of two test average marks out of three test's marks accepted from the user.<br>b) Develop a Python program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number.<br><br>Datatypes: https://www.youtube.com/watch?v=gCCVsvgR2KU<br>Operators: https://www.youtube.com/watch?v=v5MR5JnKcZI<br>Flow Control: https://www.youtube.com/watch?v=PqFKRqpHrjw<br>For loop: https://www.youtube.com/watch?v=0ZvaDa8eT5s<br>While loop: https://www.youtube.com/watch?v=HZARImviDxg<br>Exceptions: https://www.youtube.com/watch?v=6SPDvPK38tw |
| 2 | **Aim:** Demonstrating creation of functions, passing parameters and return values<br><br>a) Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed.<br>b) Develop a python program to convert binary to decimal, octal to hexadecimal using functions.<br><br>Functions: https://www.youtube.com/watch?v=BVfCWuca9nw<br>Arguments: https://www.youtube.com/watch?v=ijXMGpoMkhQ<br>Return value: https://www.youtube.com/watch?v=nuNXiEDnM44 |
| 3 | **Aim:** Demonstration of manipulation of strings using string methods<br><br>a) Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters. |

| | |
|---|---|
| | b) Write a Python program to find the string similarity between two given strings<br>**Sample Output:**<br>Original string:<br>Python Exercises<br>Python Exercises<br>Similarity between two said strings:<br>1.0<br><br>**Sample Output:**<br>Original string:<br>Python Exercises<br>Python Exercise<br>Similarity between two said strings:<br>0.967741935483871<br><br>Strings: https://www.youtube.com/watch?v=lSItwlnF0eU<br>String functions: https://www.youtube.com/watch?v=9a3CxJyTq00 |
| 4 | **Aim:** Discuss different collections like list, tuple and dictionary<br><br>a) Write a python program to implement insertion sort and merge sort using lists<br>b) Writea program to convert roman numbers in to integer values using dictionaries.<br><br>Lists: https://www.youtube.com/watch?v=Eaz5e6M8tL4<br>List methods: https://www.youtube.com/watch?v=8-RDVWGktuI<br>Tuples: https://www.youtube.com/watch?v=bdS4dHIJGBc<br>Tuple operations: https://www.youtube.com/watch?v=TItKabcTTQ4<br>Dictionary: https://www.youtube.com/watch?v=4Q0pW8XBOkc<br>Dictionary methods: https://www.youtube.com/watch?v=oLeNHuORpNY |
| 5 | **Aim:** Demonstration of pattern recognition with and without using regular expressions<br><br>a) Write a function called isphonenumber () to recognize a pattern 415-555-4242 without using regular expression and also write the code to recognize the same pattern using regular expression.<br>b) Develop a python program that could search the text in a file for phone numbers (+919900889977) and email addresses (sample@gmail.com)<br><br>Regular expressions: https://www.youtube.com/watch?v=LnzFnZfHLS4 |
| 6 | **Aim:** Demonstration of reading, writing and organizing files.<br><br>a) Write a python program to accept a file name from the user and perform the following operations<br>1. Display the first N line of the file<br>2. Find the frequency of occurrence of the word accepted from the user in the file<br>b) Write a python program to create a ZIP file of a particular folder which contains several files inside it.<br><br>Files: https://www.youtube.com/watch?v=vuyb7CxZgbU<br>https://www.youtube.com/watch?v=FqcjKewJTQ0<br><br>File organization: https://www.youtube.com/watch?v=MRuq3SRXses |
| 7 | **Aim:** Demonstration of the concepts of classes, methods, objects and inheritance<br><br>a) By using the concept of inheritance write a python program to find the area of triangle, circle and rectangle. |

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**IV Semester**

| PYTHON PROGRAMMING LABORATORY | | | |
|---|---|---|---|
| Course Code | **21CSL46** | CIE Marks | 50 |
| Teaching Hours/Weeks (L: T: P: S) | 0: 0: 2: 0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 24 | Total Marks | 100 |
| Credits | 01 | Exam Hours | 03 |

**Course Objectives:**

CLO 1. Demonstrate the use of IDLE or PyCharm IDE to create Python Applications
CLO 2. Using Python programming language to develop programs for solving real-world problems
CLO 3. Implement the Object-Oriented Programming concepts in Python.
CLO 4. Appraise the need for working with various documents like Excel, PDF, Word and Others
CLO 5. Demonstrate regular expression using python programming

**Note: two hours tutorial is suggested for each laboratory sessions.**

**Prerequisite**

- Students should be familiarized about Python installation and setting Python environment
- Usage of IDLE or IDE like PyCharm should be introduced

Python Installation: https://www.youtube.com/watch?v=Kn1HF3oD19c
PyCharm Installation: https://www.youtube.com/watch?v=SZUNUB6nz3g

| *Sl. No.* | ***PART A – List of problems for which student should develop program and execute in the Laboratory*** |
|---|---|
| 1 | **Aim:** Introduce the Python fundamentals, data types, operators, flow control and exception handling in Python<br><br>a) Write a python program to find the best of two test average marks out of three test's marks accepted from the user.<br>b) Develop a Python program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number.<br><br>Datatypes: https://www.youtube.com/watch?v=gCCVsvgR2KU<br>Operators: https://www.youtube.com/watch?v=v5MR5JnKcZI<br>Flow Control: https://www.youtube.com/watch?v=PqFKRqpHrjw<br>For loop: https://www.youtube.com/watch?v=0ZvaDa8eT5s<br>While loop: https://www.youtube.com/watch?v=HZARImviDxg<br>Exceptions: https://www.youtube.com/watch?v=6SPDvPK38tw |
| 2 | **Aim:** Demonstrating creation of functions, passing parameters and return values<br><br>a) Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed.<br>b) Develop a python program to convert binary to decimal, octal to hexadecimal using functions.<br><br>Functions: https://www.youtube.com/watch?v=BVfCWuca9nw<br>Arguments: https://www.youtube.com/watch?v=ijXMGpoMkhQ<br>Return value: https://www.youtube.com/watch?v=nuNXiEDnM44 |
| 3 | **Aim:** Demonstration of manipulation of strings using string methods<br><br>a) Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters. |

| | |
|---|---|
| | b) Write a Python program to find the string similarity between two given strings<br>**Sample Output:**<br>Original string:<br>Python Exercises<br>Python Exercises<br>Similarity between two said strings:<br>1.0<br><br>**Sample Output:**<br>Original string:<br>Python Exercises<br>Python Exercise<br>Similarity between two said strings:<br>0.967741935483871<br><br>Strings: https://www.youtube.com/watch?v=lSItwlnF0eU<br>String functions: https://www.youtube.com/watch?v=9a3CxJyTq00 |
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| 7 | **Aim:** Demonstration of the concepts of classes, methods, objects and inheritance<br><br>a) By using the concept of inheritance write a python program to find the area of triangle, circle and rectangle. |

| | |
|---|---|
| | b) 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.<br><br>OOP's concepts: https://www.youtube.com/watch?v=qiSCMNBIP2g<br>Inheritance: https://www.youtube.com/watch?v=Cn7AkDb4pIU |
| 8 | **Aim:** Demonstration of classes and methods with polymorphism and overriding<br><br>a) 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.<br><br>Overriding: https://www.youtube.com/watch?v=CcTzTuIsoFk |
| 9 | **Aim:** Demonstration of working with excel spreadsheets and web scraping<br><br>a) Write a python program to download the all XKCD comics<br>b) Demonstrate python program to read the data from the spreadsheet and write the data in to the spreadsheet<br><br>Web scraping: https://www.youtube.com/watch?v=ng2o98k983k<br><br>Excel: https://www.youtube.com/watch?v=nsKNPHJ9iPc |
| 10 | **Aim:** Demonstration of working with PDF, word and JSON files<br><br>a) Write a python program to combine select pages from many PDFs<br>b) Write a python program to fetch current weather data from the JSON file<br><br>PDFs: https://www.youtube.com/watch?v=q70xzDG6nls<br>https://www.youtube.com/watch?v=JhQVD7Y1bsA<br>https://www.youtube.com/watch?v=FcrW-ESdY-A<br><br>Word files: https://www.youtube.com/watch?v=ZU3cSl51jWE<br><br>JSON files: https://www.youtube.com/watch?v=9N6a-VLBa2I |
| **Python (Full Course):** https://www.youtube.com/watch?v=_uQrJ0TkZlc | |
| **Pedagogy** | For the above experiments the following pedagogy can be considered. Problem based learning, Active learning, MOOC, Chalk &Talk |
| **PART B – Practical Based Learning** | |
| A problem statement for each batch is to be generated in consultation with the co-examiner and student should develop an algorithm, program and execute the program for the given problem with appropriate outputs. | |
| **Course Outcomes:**<br>CO 1. Demonstrate proficiency in handling of loops and creation of functions.<br>CO 2. Identify the methods to create and manipulate lists, tuples and dictionaries.<br>CO 3. Discover the commonly used operations involving regular expressions and file system.<br>CO 4. Interpret the concepts of Object-Oriented Programming as used in Python.<br>CO 5. Determine the need for scraping websites and working with PDF, JSON and other file formats. | |
| **Assessment Details (both CIE and SEE)**<br><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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. | |

The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

**Continuous Internal Evaluation (CIE):**

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

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

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is 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 downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each 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. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

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

**Semester End Evaluation (SEE):**

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by 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 internal /external 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)
- *Students can pick one experiment from the questions lot of PART A with equal choice to all the students in a batch. For PART B examiners should frame a question for each batch, student should develop an algorithm, program, execute and demonstrate the results with appropriate output for the given problem.*
- *Weightage of marks for PART A is 80% and for PART B is 20%. General rubrics suggested to be followed for part A and part B.*
- Change of experiment is allowed only once andMarks allotted to the procedure part to be made zero (Not allowed for Part B).
- The duration of SEE is 03 hours

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| Rubrics suggested in Annexure-II of Regulation book |
| --- |
| **Textbooks:**<br>1. Al Sweigart, **"Automate the Boring Stuff with Python"**,1stEdition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)<br>2. Reema Thareja **"Python Programming Using Problem Solving Approach"** Oxford University Press.<br>3. Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist"**, 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf) |

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III/IV Semester

# Constitution of India and Professional Ethics (CIP)

| | | | |
|---|---|---|---|
| Course Code | 21CIP37/47 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | L:0,T:2,P:0 = 02 Hours | SEE Marks | 50 |
| Total Hours of Pedagogy | 02 Hours/Week | Total Marks | 100 |
| Credits | 01 | Exam Hours | 01 Hours |

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

1. To know about the basic structure of Indian Constitution.
2. To know the Fundamental Rights (FR's), DPSP's and Fundamental Duties (FD's) of our constitution.
3. To know about our Union Government, political structure & codes, procedures.
4. To know the State Executive & Elections system of India.
5. To learn the Amendments and Emergency Provisions, other important provisions given by the constitution.

**Teaching-Learning Process**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective: Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological tools.

(i) Direct instructional method ( Low/Old Technology), (ii) Flipped classrooms (High/advanced Technological tools), (iii) Blended learning (Combination of both), (iv) Enquiry and evaluation based learning, (v) Personalized learning, (vi) Problems based learning through discussion.

Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adapted so that the delivered lesson can progress the students In theoretical applied and practical skills.

## Module - 1

**Introduction to Indian Constitution:** The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly. The Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of India Constitution.

## Module - 2

**FR's, FD's and DPSP's:** Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

## Module - 3

**Union Executive :** Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India. Judicial Reviews and Judicial Activism.

## Module - 4

**State Executive & Elections, Amendments and Emergency Provisions:** State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (How and Why) and Important Constitutional Amendments till today. Emergency Provisions.

## Module-5

**Professional Ethics**: Ethics & Values. Types of Ethics. Scope & Aims of Professional & Engineering Ethics. Positive and Negative Faces of Engineering Ethics. Clash of Ethics, Conflicts of Interest. The impediments to Responsibility. Trust & Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.

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

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

| | |
|---|---|
| CO1 | Analyse the basic structure of Indian Constitution. |
| CO2 | Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution. |
| CO3 | know about our Union Government, political structure & codes, procedures. |
| CO4 | Understand our State Executive & Elections system of India. |
| CO5 | Remember the Amendments and Emergency Provisions, other important provisions given by the constitution. |

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

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**Continuous Internal Evaluation:**

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks

**Total CIE : IA 20*3=60, Assignment 10+10=20, Quiz 20 = 100 /2 = 50**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester End Examination:**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 02 hours)**

1. The question paper will have 50 questions. Each question is set for 01 mark.
2. Semester End Exam (SEE) Pattern will be in MCQ Model (Multiple Choice Questions) for 50 marks (60 minutes duration).

## Suggested Learning Resources:

### Textbook:


1. **"Constitution of India" (for Competitive Exams)** - Published by Naidhruva Edutech Learning Solutions. Bengaluru. – 2022.
2. "**Engineering Ethics**", M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Prentice –Hall, 2004.


### Reference Books:


1. **"Samvidhana Odu" - for Students & Youths by Justice HN Nagamohan Dhas, Sahayana, kerekon.**
2. **"Constitution of India, Professional Ethics and Human Rights"** by Shubham Singles, Charles E. Haries, and et al: published by Cengage Learning India. Latest Edition – 2019.
3. "**Introduction to the Constitution of India**", (Students Edition.) by Durga Das Basu (**DD Basu**): Prentice –Hall, 2008.
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III/IV Semester

# Constitution of India and Professional Ethics (CIP)

| Course Code | 21CIP37/87 | CIE Marks | 50 |
|---|---|---|---|
| Teaching Hours/Week (L:T:P: S) | 1:0:T:2:P:0 = 02 Hours | SEE Marks | 50 |
| Total Hours of Pedagogy | 02 Hours/Week | Total Marks | 100 |
| Credits | 01 | Exam Hours | 01 Hours |

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

1. To know about the basic structure of Indian Constitution.
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4. To know the State Executive & Elections system of India.
5. To learn the Amendments and Emergency Provisions, other important provisions given by the constitution.

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III/IV Semester

## Constitution of India and Professional Ethics (CIP)

| | | | |
|---|---|---|---|
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Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adapted so that the delivered lesson can progress the students In theoretical applied and practical skills.

**Module - 1**

**Introduction to Indian Constitution:** The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly. The Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of India Constitution.

**Module - 2**

**FR's, FD's and DPSP's:** Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

**Module - 3**

**Union Executive :** Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.

**Module - 4**

**State Executive & Elections, Amendments and Emergency Provisions:** State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (How and Why) and Important Constitutional Amendments till today. Emergency Provisions.

**Module-5**

**Professional Ethics**: Ethics & Values. Types of Ethics. Scope & Aims of Professional & Engineering Ethics. Positive and Negative Faces of Engineering Ethics. Clash of Ethics, Conflicts of Interest. The impediments to Responsibility. Trust & Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.

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

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

| | |
|---|---|
| CO1 | Analyse the basic structure of Indian Constitution. |
| CO2 | Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution. |
| CO3 | know about our Union Government, political structure & codes, procedures. |
| CO4 | Understand our State Executive & Elections system of India. |
| CO5 | Remember the Amendments and Emergency Provisions, other important provisions given by the constitution. |

IV Semester

| R PROGRAMMING (Practical based) | | | |
|---|---|---|---|
| Course Code | 21CSL483 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 0:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 12T + 12P | Total Marks | 100 |
| Credits | 01 | Exam Hours | 02 |

**Course Objectives:**

CLO 1. Explore and understand how R and R Studio interactive environment.
CLO 2. To learn and practice programming techniques using R programming.
CLO 3. Read Structured Data into R from various sources.
CLO 4. Understand the different data Structures, data types in R.
CLO 5. To develop small applications using R Programming

**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 a 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 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.

| Module-1 | |
|---|---|
| **Numeric, Arithmetic, Assignment, and Vectors:** R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments Logical expressions.<br><br>**Textbook 1: Chapter 2(2.1 to 2.7)** | |
| **Teaching-Learning Process** | Chalk and board, Active Learning, practical based learning |
| **Module-2** | |
| **Matrices and Arrays:** Defining a Matrix, Sub-setting, Matrix Operations, **Conditions and Looping:** if statements, looping with for, looping with while, vector based programming.<br><br>**Textbook 1: Chapter 2- 2.8, chapter 3- 3.2 to 3.5** | |
| **Teaching-Learning Process** | Chalk and board, Active Learning, Demonstration, presentation, problem solving |
| **Module-3** | |
| **Lists and Data Frames:** Data Frames, **Lists,** Special values, The apply facmily.<br><br>**Textbook 1: Chapter 6- 6.2 to 6.4** | |
| **Teaching-Learning Process** | Chalk and board, Demonstration, problem solving |
| **Module-4** | |
| **Functions:** Calling functions, scoping, Arguments matching, writing functions: The function command, Arguments, specialized function.<br><br>**Textbook 1: Chapter 5- 5.1 to 5.6** | |

| Teaching-Learning Process | Chalk and board, Practical based learning, practical's |
|---|---|

**Module-5**

Pointers: packages, frames, de bugging, manipulation of code, compilation of the code.

**Textbook 1: Chapter 8- 8.1 to 8.8**

| Teaching-Learning Process | Chalk and board, MOOC |
|---|---|

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

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

CO 1. To understand the fundamental syntax of R through readings, practice exercises,
CO 2. To demonstrations, and writing R code.
CO 3. To apply critical programming language concepts such as data types, iteration,
CO 4. To understand control structures, functions, and Boolean operators by writing R programs and through examples
CO 5. To import a variety of data formats into R using R-Studio
CO 6. To prepare or tidy data for in preparation for analyze.

**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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

**Continuous Internal Evaluation (CIE):**

***NOTE: List of experiments to be prepared by the faculty based on the syllabus mentioned above***

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

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

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is 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 downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each 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. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

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

**Semester End Evaluation (SEE):**

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by 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 internal /external 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)
- The duration of SEE is 02 hours

Rubrics suggested in Annexure-II of Regulation book

**Textbooks**

1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.

**References:**

1. Michael J. Crawley, "Statistics: An Introduction using R", Second edition, Wiley,2015

**Weblinks and Video Lectures (e-Resources):**

1. Wickham, H. & Grolemund, G. (2018). for Data Science. O'Reilly: New York. Available for free at http://r4ds.had.co.nz

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

- Demonstration of simple projects

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SAMPLE TEMPLATE

**IV Semester**

**UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY and ETHICAL HUMAN CONDUCT**

| | | | |
|---|---|---|---|
| Course Code | 21UHV49 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 2:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 20 | Total Marks | 100 |
| Credits | 01 | Exam Hours | 01 |

**Course objectives:**

This introductory course input is intended:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

This course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

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

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

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. The course is in the form of 20 lectures (discussions)
3. It is free from any dogma or value prescriptions.
4. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation – the whole existence is the lab and every activity is a source of reflection.
5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
6. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

**Module-1**

**Introduction to Value Education (4 hours)**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

| | |
|---|---|
| **Teaching-Learning Process** | Introduction to Value Education- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos |

| Module-2 | |
|---|---|
| **Harmony in the Human Being (4 hours)**<br>Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health | |
| **Teaching-Learning Process** | Introduction to the concepts- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos |
| **Module-3** | |
| **Harmony in the Family and Society (4 hours)**<br>Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order | |
| **Teaching-Learning Process** | Introduction to the concepts- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos |
| **Module-4** | |
| **Harmony in the Nature/Existence (4 hours)**<br>Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence | |
| **Teaching-Learning Process** | Introduction to the concepts- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos |
| **Module-5** | |
| **Implications of the Holistic Understanding – a Look at Professional Ethics (4 hours)**<br>Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession | |
| **Teaching-Learning Process** | Introduction to the concepts- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos |
| **Course outcome (Course Skill Set)**<br>By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.<br>They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. | |

SAMPLE TEMPLATE

**IV Semester**

**UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY and ETHICAL HUMAN CONDUCT**

| | | | |
|---|---|---|---|
| Course Code | 21UHV49 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 2:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 20 | Total Marks | 100 |
| Credits | 01 | Exam Hours | 01 |

**Course objectives:**

This introductory course input is intended:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

This course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

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

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

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. The course is in the form of 20 lectures (discussions)
3. It is free from any dogma or value prescriptions.
4. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation – the whole existence is the lab and every activity is a source of reflection.
5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
6. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

**Module-1**

**Introduction to Value Education (4 hours)**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

| | |
|---|---|
| **Teaching-Learning Process** | Introduction to Value Education- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos |

Therefore, the course and further follow up is expected to positively impact common graduate attributes like:

1. Holistic vision of life
2. Socially responsible behaviour
3. Environmentally responsible work
4. Ethical human conduct
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

**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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% ( 18 Marks out of 50)in the semester-end examination(SEE), and 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:**

**Three Unit Tests each of 20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

**Two assignments each of 10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /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 subject (**duration 01 hours)**

1. The question paper will have 50 questions. Each question is set for 01 marks.
2. The students have to answer all the questions, selecting one full question from each module

**Suggested Learning Resources:**

**Books**

**-READINGS:**

Text Book and Teachers Manual

a. The Textbook
*A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher"s Manual

Teachers' Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G

**Reference Books**


1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.


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

1. Value Education websites, https://www.uhv.org.in/uhv-ii, http://uhv.ac.in, http://www.uptu.ac.in
2. **Story of Stuff, http://www.storyofstuff.com**
3. **Al Gore, An Inconvenient Truth, Paramount Classics, USA**
4. **Charlie Chaplin, Modern Times, United Artists, USA**
5. **IIT Delhi, Modern Technology – the Untold Story**
6. Gandhi A., Right Here Right Now, Cyclewala Productions
7. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
8. https://fdp-si.aicte-india.org/8dayUHV_download.php
9. https://www.youtube.com/watch?v=8ovkLRYXIjE
10. https://www.youtube.com/watch?v=OgdNx0X923I
11. https://www.youtube.com/watch?v=nGRcbRpvGoU
12. https://www.youtube.com/watch?v=sDxGXOgYEKM

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

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(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

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Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 01 hours)**

1. The question paper will have 50 questions. Each question is set for 01 marks.
2. The students have to answer all the questions, selecting one full question from each module

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**Books**

**-READINGS:**

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3. **Al Gore, An Inconvenient Truth, Paramount Classics, USA**
4. **Charlie Chaplin, Modern Times, United Artists, USA**
5. **IIT Delhi, Modern Technology – the Untold Story**
6. Gandhi A., Right Here Right Now, Cyclewala Productions
7. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
8. https://fdp-si.aicte-india.org/8dayUHV_download.php
9. https://www.youtube.com/watch?v=8ovkLRYXIjE
10. https://www.youtube.com/watch?v=OgdNx0X923I
11. https://www.youtube.com/watch?v=nGRcbRpvGoU
12. https://www.youtube.com/watch?v=sDxGXOgYEKM

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

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IV Semester

| ADDITIONAL MATHEMATICS-II<br>(Mandatory Learning Course: Common to all Programme)<br>A bridge course for Lateral Entry Students under Diploma quota to BE/B.Tech. programme | | | |
|---|---|---|---|
| Course Code: | 21MATDIP41 | CIE Marks | 100 |
| Teaching Hours/Week (L:T:P: S): | 3:0:0 | Total Marks | 100 |
| Total Hours of Pedagogy: | 40 hours | Credits: | 0 |

**Course objectives:**

The mandatory course **21MATDIP41** viz., **Additional Mathematics –II** aims to provide essential concepts of Linear algebra, Second and higher-order differential equations, insight into Elementary probability theory and Numerical methods.

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

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

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

**Module-1: Linear Algebra**

Introduction, Rank of a matrix by elementary row operations, Consistency of system of linear equations, Solution by Gauss Elimination method. Eigenvalues and eigenvectors of a square matrix. Problems.

**RBT Levels: L1, L2 and L3** **8 hours**

| **Teaching-Learning Process** | Chalk and talk method/ Powerpoint presentation |
|---|---|

**Module-2: Higher-Order Differential Equations**

Linear homogeneous/nonhomogeneous differential equations of second and higher-order with constant coefficients. Solution by using the inverse differential operator method. [Particular Integrals restricted to $R(x) = e^{ax}$, sinax/ cosax, $x^n$ ]

**RBT Levels: L1, L2 and L3** **8 hours**

| **Teaching-Learning Process** | Chalk and talk method/ Powerpoint presentation |
|---|---|

**Module-3: Probability Theory**

Introduction, Sample space and Events, Axioms of Probability. Addition and Multiplication theorem. Conditional Probability. Independent events. Baye's theorem, Problems.

**RBT Levels: L1, L2 and L3** **8 hours**

| **Teaching-Learning Process** | Chalk and talk method/ Powerpoint presentation |
|---|---|

**Module-4: Numerical Method -1**

Finite differences, Interpolation/extrapolation using Newton's forward and Backward difference formulae (No derivation), Problems. Solution of polynomial and transcendental equations by Newton–Raphson and Regula–Falsi methods (no derivation), Problems. Numerical Integration: Simson's 1/3 rd rule and 3/8 rule, problems.

**RBT Levels: L1, L2 and L3** **8 hours**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method/ Powerpoint presentation |

**Module-5: Numerical Method -II**

Numerical solution of first-order ordinary differential equations: Taylor's series method, Modified Euler's method, Runge-Kutta method of order 4, Milne's predictor-corrector method. Problems

**RBT Levels: L1, L2 and L3** **8 hours**

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk method/ Powerpoint presentation |

**Course outcome (Course Skill Set)**

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

CO1: Test for consistency and solve the system of linear equations

CO2: Solve higher order differential equations

CO3: Apply elementary probability theory and solve related problems

CO4: To interpolate/extrapolate from the given data

CO5: Apply the knowledge of numerical methods in modelling and solving engineering problems

**Assessment Details (CIE)**

**Continuous Internal Evaluation:**

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. The first test at the end of 5th week of the semester
2. The second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of the 4th week of the semester
5. Second assignment at the end of the 9th week of the semester

Course Seminar suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**.

The sum of three tests, two assignments, and a seminar will be out of 100 marks

The student shall secure a minimum of 40% of marks of the course to qualify and become eligible for the award of a degree.

**Suggested Learning Resources:**

Text Book

1. Higher Engineering Mathematics: B. S. Grewal, Khanna Publishers, New Delhi, 43rd Ed., 2015.

**Reference Books:**


1. Higher Engineering Mathematics: V. Ramana, McGraw-Hill Education, 11th Ed.
2. Engineering Mathematics: Srimanta Pal & Subodh C. Bhunia, Oxford University Press, 3rd Reprint, 2016.
3. A textbook of Engineering Mathematics: N.P Bali and Manish Goyal, Laxmi Publications, Latest edition.
4. Higher Engineering Mathematics: H.K. Dass and Er. Rajnish Verma, S. Chand Publication (2014).


**Weblinks and Video Lectures (e-Resources):**

1. http://www.class-central.com/subject/math(MOOCs)
2. http://academicearth.org/
3. http://www.bookstreet.in.
4. VTU e-Shikshana Program
5. VTU EDUSAT Program

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

- Quizzes
- Assignments
- Seminars