

III Semester

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES			
Course Code:	21MAT31	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
CLO 1. To have an insight into solving ordinary differential equations by using Laplace transform techniques			
CLO 2. Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis.			
CLO 3. To enable the students to study Fourier Transforms and concepts of infinite Fourier Sine and Cosine transforms and to learn the method of solving difference equations by the z-transform method.			
CLO 4. To develop the proficiency in solving ordinary and partial differential equations arising in engineering applications, using numerical methods			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.			
2. Use of Video/Animation to explain functioning of various concepts.			
3. Encourage collaborative (Group Learning) Learning in the class.			
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.			
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.			
6. Introduce Topics in manifold representations.			
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.			
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
Module-1			
Definition and Laplace transforms of elementary functions (statements only). Problems on Laplace transform of $e^{at}f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$. Laplace transforms of Periodic functions (statement only) and unit-step function – problems.			
Inverse Laplace transforms definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Laplace transforms of derivatives, solution of differential equations.			
Self-study: Solution of simultaneous first-order differential equations.			
Teaching-Learning Process	Chalk and talk method /		
Module-2			
Introduction to infinite series, convergence and divergence. Periodic functions, Dirichlet's condition. Fourier series of periodic functions with period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.			
Self-study: Convergence of series by D'Alembert's Ratio test and, Cauchy's root test			
Teaching-Learning Process	Chalk and talk method / Powerpoint Presentation		

Module-3	
Infinite Fourier transforms definition, Fourier sine and cosine transforms. Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. Problems.	
Difference equations, z-transform-definition, Standard z-transforms, Damping and shifting rules, Problems. Inverse z-transform and applications to solve difference equations.	
Self-Study: Initial value and final value theorems, problems.	
Teaching-Learning Process	Chalk and talk method / Powerpoint Presentation
Module-4	
Classifications of second-order partial differential equations, finite difference approximations to derivatives, Solution of Laplace's equation using standard five-point formula. Solution of heat equation by Schmidt explicit formula and Crank- Nicholson method, Solution of the Wave equation. Problems.	
Self-Study: Solution of Poisson equations using standard five-point formula.	
Teaching-Learning Process	Chalk and talk method / Powerpoint Presentation
Module-5	
Second-order differential equations - Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).	
Calculus of Variations: Functionals, Euler's equation, Problems on extremals of functional. Geodesics on a plane, Variational problems.	
Self- Study: Hanging chain problem	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Course Outcomes (Course Skill Set)	
At the end of the course the student will be able to:	
CO 1. To solve ordinary differential equations using Laplace transform. CO 2. Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory. CO 3. To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations CO 4. To solve mathematical models represented by initial or boundary value problems involving partial differential equations CO 5. Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.	
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 5 th week of the semester 2. Second test at the end of the 10 th week of the semester 3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester 5. Second assignment at the end of 9 th 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 13 th week of the semester	

<p>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</p> <p>(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).</p> <p>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.</p> <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p> <p>Textbooks</p> <ol style="list-style-type: none"> 1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018 2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016. <p>Reference Books:</p> <ol style="list-style-type: none"> 1. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed. 2. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016. 3. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, Latest edition. 4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw - Hill Book Co.Newyork, Latest ed. 5. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", McGraw Hill Education(India) Pvt. Ltd 2015. 6. H.K.Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S.Chand Publication (2014). 7. James Stewart: "Calculus" Cengage publications, 7th edition, 4th Reprint 2019
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 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
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <ul style="list-style-type: none"> • Quizzes • Assignments • Seminars

III Semester

DATA STRUCTURES AND APPLICATIONS			
Course Code:	21CS32	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 Objectives: CLO 1. Explain the fundamentals of data structures and their applications essential for implementing solutions to problems. CLO 2. Illustrate representation of data structures: Stack, Queues, Linked Lists, Trees and Graphs. CLO 3. Design and Develop Solutions to problems using Arrays, Structures, Stack, Queues, Linked Lists. CLO 4. Explore usage of Trees and Graph for application development. CLO 5. Apply the Hashing techniques in mapping key value pairs.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none"> 1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes. 2. Use of Video/Animation to explain functioning of various concepts. 3. Encourage collaborative (Group Learning) Learning in the class. 4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking. 5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it. 6. Introduce Topics in manifold representations. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding. 			
Module-1			
Introduction: Data Structures, Classifications (Primitive & Non-Primitive), Data structure operations (Traversing, inserting, deleting, searching, and sorting). Review of Arrays. Structures: Array of structures Self-Referential Structures. Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, dynamically allocated arrays and Multidimensional Arrays. Demonstration of representation of Polynomials and Sparse Matrices with arrays.			
Textbook 1: Chapter 1: 1.2, Chapter 2: 2.2 - 2.7, Text Textbook 2: Chapter 1: 1.1 - 1.4, Chapter 3: 3.1 - 3.3, 3.5, 3.7, Chapter 4: 4.1 - 4.9, 4.14 Textbook 3: Chapter 1: 1.3			
Laboratory Component: <ol style="list-style-type: none"> 1. Design, Develop and Implement a menu driven Program in C for the following Array Operations <ol style="list-style-type: none"> a. Creating an Array of N Integer Elements b. Display of Array Elements with Suitable Headings c. Exit. Support the program with functions for each of the above operations. 2. Design, Develop and Implement a menu driven Program in C for the following Array operations <ol style="list-style-type: none"> a. Inserting an Element (ELEM) at a given valid Position (POS) b. Deleting an Element at a given valid Position POS) c. Display of Array Elements d. Exit. 			

Support the program with functions for each of the above operations.	
Teaching-Learning Process	<p>Problem based learning (Implementation of different programs to illustrate application of arrays and structures.</p> <p>https://www.youtube.com/watch?v=3Xo6P V-qns&t=201s</p> <p>https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html</p> <p>https://ds1-iiith.vlabs.ac.in/data-structures-1/List%20of%20experiments.html</p>
Module-2	
<p>Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays. Different representation of expression. Stack Applications: Infix to postfix conversion, Infix to prefix conversion, evaluation of postfix expression, recursion.</p> <p>Queues: Definition, Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues using Dynamic arrays, Dequeues, Priority Queues.</p> <p>Textbook 1: Chapter 3: 3.1 -3.4, 3.6 Textbook 2: Chapter 6: 6.1 -6.4, 6.5, 6.7-6.13</p>	
<p>Laboratory Component:</p> <ol style="list-style-type: none"> Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) <ol style="list-style-type: none"> Push an Element on to Stack Pop an Element from Stack Demonstrate <i>Overflow</i> and <i>Underflow</i> situations on Stack Display the status of Stack Exit <p>Support the program with appropriate functions for each of the above operations</p> Design, Develop and Implement a Program in C for the following Stack Applications <ol style="list-style-type: none"> Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ Solving Tower of Hanoi problem with n disks 	
Teaching-Learning Process	<p>Active Learning, Problem based learning</p> <p>https://nptel.ac.in/courses/106/102/106102064/</p> <p>https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html</p>
Module-3	
<p>Linked Lists: Definition, classification of linked lists. Representation of different types of linked lists in Memory, Traversing, Insertion, Deletion, Searching, Sorting, and Concatenation Operations on Singly linked list, Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples.</p> <p>Textbook 1: Chapter 4: 4.1 – 4.4, 4.5.2, 4.7, 4.8, Textbook 2: Chapter 5: 5.1 – 5.9</p>	
<p>Laboratory Component:</p> <ol style="list-style-type: none"> Singly Linked List (SLL) of Integer Data <ol style="list-style-type: none"> Create a SLL stack of N integer. Display of SLL Linear search. Create a SLL queue of N Students Data Concatenation of two SLL of integers. Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Professor Data with the fields: ID, Name, Branch, Area of specialization <ol style="list-style-type: none"> Create a DLL stack of N Professor's Data. Create a DLL queue of N Professor's Data <p>Display the status of DLL and count the number of nodes in it.</p> 	

Teaching-Learning Process	MOOC, Active Learning, Problem solving based on linked lists. https://nptel.ac.in/courses/106/102/106102064/ https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
Module-4	
Trees 1: Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, and Searching operation on Binary search tree. Application of Trees-Evaluation of Expression.	
Textbook 1: Chapter 5: 5.1 –5.5, 5.7; Textbook 2: Chapter 7: 7.1 – 7.9	
Laboratory Component: <ol style="list-style-type: none"> Given an array of elements, construct a complete binary tree from this array in level order fashion. That is, elements from left in the array will be filled in the tree level wise starting from level 0. Ex: Input : arr[] = {1, 2, 3, 4, 5, 6} Output : Root of the following tree <pre> 1 / \ 2 3 / \ / \ 4 5 6 </pre> Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers <ol style="list-style-type: none"> Create a BST of N Integers Traverse the BST in Inorder, Preorder and Post Order 	
Teaching-Learning Process	Problem based learning http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html
Module-5	
Trees 2: AVL tree, Red-black tree, Splay tree, B-tree.	
Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth FirstSearch.	
Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.	
Textbook 1: Chapter 10:10.2, 10.3, 10.4, Textbook 2:7.10 – 7.12, 7.15 Chapter 11: 11.2, Textbook 1: Chapter 6 : 6.1–6.2, Chapter 8 : 8.1-8.3, Textbook 2: 8.1 – 8.3, 8.5, 8.7	
Textbook 3: Chapter 15:15.1, 15.2,15.3, 15.4,15.5 and 15.7	
Laboratory Component: <ol style="list-style-type: none"> Design, Develop and implement a program in C for the following operations on Graph (G) of cities 	

<ol style="list-style-type: none"> Create a Graph of N cities using Adjacency Matrix. Print all the nodes reachable from a given starting node in a diagraph using DFS/BFS method. <ol style="list-style-type: none"> Design and develop a program in C that uses Hash Function $H:K \rightarrow L$ as $H(K)=K \bmod m$ (remainder method) and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing. 	
Teaching-Learning Process	NPTEL, MOOC etc. courses on trees and graphs. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
Course Outcomes (Course Skill Set) At the end of the course the student will be able to: CO 1. Identify different data structures and their applications. CO 2. Apply stack and queues in solving problems. CO 3. Demonstrate applications of linked list. CO 4. Explore the applications of trees and graphs to model and solve the real-world problem. CO 5. Make use of Hashing techniques and resolve collisions during mapping of key value pairs	
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) <ol style="list-style-type: none"> First test at the end of 5th week of the semester Second test at the end of the 10th week of the semester Third test at the end of the 15th week of the semester Two assignments each of 10 Marks <ol style="list-style-type: none"> First assignment at the end of 4th week of the semester Second assignment at the end of 9th week of the semester <p>Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to 20 marks.</p> <ul style="list-style-type: none"> Rubrics for each Experiment taken average for all Lab components – 15 Marks. Viva-Voce– 5 Marks (more emphasized on demonstration topics) <p>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.</p> 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) <ol style="list-style-type: none"> The question paper will have ten questions. Each question is set for 20 marks. There will be 2 questions from each module. Each of the two questions under a module (with a 	

<p>maximum of 3 sub-questions), should have a mix of topics under that module.</p> <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p>
<p>Textbooks:</p> <ol style="list-style-type: none"> 1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014. 2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014. 3. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012. <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014. 2. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013 3. A M Tenenbaum, Data Structures using C, PHI, 1989 4. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html 2. https://nptel.ac.in/courses/106/105/106105171/ 3. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <ul style="list-style-type: none"> • Real world problem solving using group discussion. • Back/Forward stacks on browsers. • Undo/Redo stacks in Excel or Word. • Linked list representation of real-world queues -Music player, image viewer

III Semester

ANALOG AND DIGITAL ELECTRONICS			
Course Code	21CS33	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 use of photo electronics devices, 555 timer IC, Regulator ICs and uA741 CLO 2. Make use of simplifying techniques in the design of combinational circuits. CLO 3. Illustrate combinational and sequential digital circuits CLO 4. Demonstrate the use of flipflops and apply for registers CLO 5. Design and test counters, Analog-to-Digital and Digital-to-Analog conversion techniques.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">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			
BJT Biasing: Fixed bias, Collector to base Bias, voltage divider bias Operational Amplifier Application Circuits: Peak Detector, Schmitt trigger, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-to-Voltage and Voltage-to-Current Converter, Regulated Power Supply Parameters, adjustable voltage regulator, D to A and A to D converter.			
Textbook 1: Part A: Chapter 4 (Sections 4.2, 4.3, 4.4), Chapter 7 (Sections 7.4, 7.6 to 7.11), Chapter 8 (Sections 8.1 and 8.5), Chapter 9.			
Laboratory Component: <ol style="list-style-type: none">1. Simulate BJT CE voltage divider biased voltage amplifier using any suitable circuit simulator.2. Using ua 741 Opamp, design a 1 kHz Relaxation Oscillator with 50% duty cycle3. Design an astable multivibrator circuit for three cases of duty cycle (50%, <50% and >50%) using NE 555 timer IC.4. Using ua 741 opamp, design a window comparator for any given UTP and LTP.			
Teaching-Learning Process		<ol style="list-style-type: none">1. Demonstration of circuits using simulation.2. Project work: Design a integrated power supply and function generator operating at audio frequency. Sine, square and triangular functions are to be generated.3. Chalk and Board for numerical	
Module-2			
Karnaugh maps: minimum forms of switching functions, two and three variable Karnaugh maps, four			

variable Karnaugh maps, determination of minimum expressions using essential prime implicants, Quine-McClusky Method: determination of prime implicants, the prime implicant chart, Petricks method, simplification of incompletely specified functions, simplification using map-entered variables

Textbook 1: Part B: Chapter 5 (Sections 5.1 to 5.4) Chapter 6 (Sections 6.1 to 6.5)

Laboratory Component:

1. Given a 4-variable logic expression, simplify it using appropriate technique and implement the same using basic gates.

Teaching-Learning Process

1. Chalk and Board for numerical
2. Laboratory Demonstration

Module-3

Combinational circuit design and simulation using gates: Review of Combinational circuit design, design of circuits with limited Gate Fan-in, Gate delays and Timing diagrams, Hazards in combinational Logic, simulation and testing of logic circuits

Multiplexers, Decoders and Programmable Logic Devices: Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices.

Textbook 1: Part B: Chapter 8, Chapter 9 (Sections 9.1 to 9.6)

Laboratory Component:

1. Given a 4-variable logic expression, simplify it using appropriate technique and realize the simplified logic expression using 8:1 multiplexer IC.
2. Design and implement code converter I) Binary to Gray (II) Gray to Binary Code

Teaching-Learning Process

1. Demonstration using simulator
2. Case study: Applications of Programmable Logic device
3. Chalk and Board for numerical

Module-4

Introduction to VHDL: VHDL description of combinational circuits, VHDL Models for multiplexers, VHDL Modules.

Latches and Flip-Flops: Set Reset Latch, Gated Latches, Edge-Triggered D Flip Flop 3, SR Flip Flop, J K Flip Flop, T Flip Flop.

Textbook 1: Part B: Chapter 10(Sections 10.1 to 10.3), Chapter 11 (Sections 11.1 to 11.7)

Laboratory Component:

1. Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same in HDL simulator
2. Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table. And implement the same in HDL.

Teaching-Learning Process

1. Demonstration using simulator
2. Case study: Arithmetic and Logic unit in VHDL
3. Chalk and Board for numerical

Module-5

Registers and Counters: Registers and Register Transfers, Parallel Adder with accumulator, shift registers, design of Binary counters, counters for other sequences, counter design using SR and J K Flip Flops.

Textbook 1: Part B: Chapter 12 (Sections 12.1 to 12.5)

Laboratory Component:

<ol style="list-style-type: none"> 1. Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working. 2. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate on 7-segment display (using IC-7447) 	
Teaching-Learning Process	<ol style="list-style-type: none"> 1. Demonstration using simulator 2. Project Work: Designing any counter, use LED / Seven-segment display to display the output 3. Chalk and Board for numerical
Course outcome (Course Skill Set) At the end of the course the student will be able to: <ol style="list-style-type: none"> CO 1. Design and analyze application of analog circuits using photo devices, timer IC, power supply and regulator IC and op-amp. CO 2. Explain the basic principles of A/D and D/A conversion circuits and develop the same. CO 3. Simplify digital circuits using Karnaugh Map, and Quine-McClusky Methods CO 4. Explain Gates and flip flops and make us in designing different data processing circuits, registers and counters and compare the types. CO 5. Develop simple HDL programs 	
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). 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) <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 4. First assignment at the end of 4th week of the semester 5. Second assignment at the end of 9th week of the semester <p>Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to 20 marks.</p> <ul style="list-style-type: none"> • Rubrics for each Experiment taken average for all Lab components – 15 Marks. • Viva-Voce– 5 Marks (more emphasized on demonstration topics) <p>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.</p>	
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) <ol style="list-style-type: none"> 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 	

<p>maximum of 3 sub-questions), should have a mix of topics under that module.</p> <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p>
<p>Textbooks</p> <ol style="list-style-type: none"> 1. Charles H Roth and Larry L Kinney, Raghunandan g H, Analog and Digital Electronics, Cengage Learning, 2019
<p>Reference Books</p> <ol style="list-style-type: none"> 1. Anil K Maini, Varsha Agarwal, Electronic Devices and Circuits, Wiley, 2012. 2. Donald P Leach, Albert Paul Malvino & Goutam Saha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015. 3. M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008. 4. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. Analog Electronic Circuits: https://nptel.ac.in/courses/108/102/108102112/ 2. Digital Electronic Circuits: https://nptel.ac.in/courses/108/105/108105132/ 3. Analog Electronics Lab: http://vlabs.iitkgp.ac.in/be/ 4. Digital Electronics Lab: http://vlabs.iitkgp.ac.in/dec
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <ol style="list-style-type: none"> 1. Real world problem solving - applying the design concepts of oscillator, amplifier, switch, Digital circuits using Opamps, 555 timer, transistor, Digital ICs and design a application like tone generator, temperature sensor, digital clock, dancing lights etc.

III Semester

COMPUTER ORGANIZATION AND ARCHITECTURE			
Course Code	21CS34	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Understand the organization and architecture of computer systems, their structure and operation			
CLO 2. Illustrate the concept of machine instructions and programs			
CLO 3. Demonstrate different ways of communicating with I/O devices			
CLO 4. Describe different types memory devices and their functions			
CLO 5. Explain arithmetic and logical operations with different data types			
CLO 6. Demonstrate processing unit with parallel processing and pipeline architecture			
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			
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.			
Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes			
Textbook 1: Chapter1 – 1.3, 1.4, 1.6 (1.6.1-1.6.4, 1.6.7), Chapter2 – 2.2 to 2.5			
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning		
Module-2			
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits			
Textbook 1: Chapter4 – 4.1, 4.2, 4.4, 4.5, 4.6			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration		
Module-3			
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Virtual memories			
Textbook 1: Chapter 5 – 5.1 to 5.4, 5.5 (5.5.1, 5.5.2)			
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration		

Module-4	
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers	
Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Hardwired control, Microprogrammed control	
Textbook 1: Chapter 2-2.1, Chapter 6 – 6.1 to 6.3	
Textbook 1: Chapter 7 – 7.1, 7.2, 7.4, 7.5	
Teaching-Learning Process	Chalk & board, Problem based learning
Module-5	
Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing, Array Processors	
Textbook 2: Chapter 9 – 9.1, 9.2, 9.3, 9.4, 9.6, 9.7	
Teaching-Learning Process	Chalk and board, MOOC
Course Outcomes At the end of the course the student will be able to: <ul style="list-style-type: none"> CO 1. Explain the organization and architecture of computer systems with machine instructions and programs CO 2. Analyze the input/output devices communicating with computer system CO 3. Demonstrate the functions of different types of memory devices CO 4. Apply different data types on simple arithmetic and logical unit CO 5. Analyze the functions of basic processing unit, Parallel processing and pipelining 	
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) <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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) <ol style="list-style-type: none"> 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) <ol style="list-style-type: none"> 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 	

<p>maximum of 3 sub-questions), should have a mix of topics under that module.</p> <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Textbooks</p> <ol style="list-style-type: none"> 1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill 2. M. Morris Mano, Computer System Architecture, PHI, 3rd Edition <p>Reference:</p> <ol style="list-style-type: none"> 1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/106/103/106103068/ 2. https://nptel.ac.in/content/storage2/courses/106103068/pdf/coa.pdf 3. https://nptel.ac.in/courses/106/105/106105163/ 4. https://nptel.ac.in/courses/106/106/106106092/ 5. https://nptel.ac.in/courses/106/106/106106166/ 6. http://www.nptelvideos.in/2012/11/computer-organization.html
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <ul style="list-style-type: none"> • Discussion and literature survey on real world use cases • Quizzes

III Semester

OBJECT ORIENTED PROGRAMMING WITH JAVA LABORATORY			
Course Code	21CSL35	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	24	Total Marks	100
Credits	1	Exam Hours	03
Course Objectives: CLO 1. Demonstrate the use of Eclipse/Netbeans IDE to create Java Applications. CLO 2. Using java programming to develop programs for solving real-world problems. CLO 3. Reinforce the understanding of basic object-oriented programming concepts.			
Note: two hours tutorial is suggested for each laboratory sessions.			
Prerequisite			
	<ul style="list-style-type: none"> Students should be familiarized about java installation and setting the java environment. Usage of IDEs like Eclipse/Netbeans should be introduced. 		
Sl. No.	PART A – List of problems for which student should develop program and execute in the Laboratory		
1	Aim: Introduce the java fundamentals, data types, operators in java Program: Write a java program that prints all real solutions to the quadratic equation $ax^2+bx+c=0$. Read in a, b, c and use the quadratic formula.		
2	Aim: Demonstrating creation of java classes, objects, constructors, declaration and initialization of variables. Program: Create a Java class called Student with the following details as variables within it. USN Name Branch Phone Write a Java program to create n Student objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.		
3	Aim: Discuss the various Decision-making statements, loop constructs in java Program: A. Write a program to check prime number B. Write a program for Arithmetic calculator using switch case menu		
4	Aim: Demonstrate the core object-oriented concept of Inheritance, polymorphism Design a super class called Staff with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display at least 3 staff objects of all three categories.		
5	Aim: Introduce concepts of method overloading, constructor overloading, overriding. Program: Write a java program demonstrating Method overloading and Constructor overloading.		
6	Aim: Introduce the concept of Abstraction, packages. Program: Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.		
7	Aim: Introduction to abstract classes, abstract methods, and Interface in java		

	Program: Write a program to generate the resume. Create 2 Java classes Teacher (data: personal information, qualification, experience, achievements) and Student (data: personal information, result, discipline) which implements the java interface Resume with the method biodata().
8	<p>Aim: Demonstrate creation of threads using Thread class and Runnable interface, multi-threaded programming.</p> <p>Program: Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.</p>
9	<p>Aim: Introduce java Collections.</p> <p>Program: Write a program to perform string operations using ArrayList. Write functions for the following a. Append - add at end b. Insert - add at particular index c. Search d. List all string starts with given letter.</p>
10	<p>Aim: Exception handling in java, introduction to throwable class, throw, throws, finally.</p> <p>Program: Write a Java program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero.</p>
11	<p>Aim: Introduce File operations in java.</p> <p>Program: Write a java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes</p>
12	<p>Aim: Introduce java Applet, awt, swings.</p> <p>Programs: Develop an applet that displays a simple message in center of the screen. Develop a simple calculator using Swings.</p>
PART B – Practical Based Learning	
01	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.
<p>Course Outcome (Course Skill Set) At the end of the course the student will be able to:</p> <p>CO 1. Use Eclipse/NetBeans IDE to design, develop, debug Java Projects. CO 2. Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP. CO 3. Demonstrate the ability to design and develop java programs, analyze, and interpret object-oriented data and document results. CO 4. Apply the concepts of multiprogramming, exception/event handling, abstraction to develop robust programs. CO 5. Develop user friendly applications using File I/O and GUI concepts.</p>	
<p>Assessment Details (both CIE and SEE)</p> <p>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).</p> <p>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.</p> <ul style="list-style-type: none"> 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 down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 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 and Marks allotted to the procedure part to be made zero (Not allowed for Part B).
- The duration of SEE is 03 hours
- Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. E Balagurusamy, Programming with Java, Graw Hill, 6th Edition, 2019.
2. Herbert Schildt, C: Java the Complete Reference, McGraw Hill, 11th Edition, 2020

III Semester

MASTERING OFFICE (Practical based)			
Course Code	21CSL381	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	12T + 12P	Total Marks	100
Credits	01	Exam Hours	02
Course Objectives: CLO 1. Understand the basics of computers and prepare documents and small presentations. CLO 2. Attain the knowledge about spreadsheet/worksheet with various options. CLO 3. Create simple presentations using templates various options available. CLO 4. Demonstrate the ability to apply application software in an office environment. CLO 5. Use MS Office to create projects, applications.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.2. Use of Video/Animation to explain functioning of various concepts.3. Encourage collaborative (Group Learning) Learning in the class.4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.6. Introduce Topics in manifold representations.7. Show the different ways to solve the same problem 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			
MS-Word -Working with Files, Text – Formatting, Moving, copying and pasting text, Styles – Lists – Bulleted and numbered lists, Nested lists, Formatting lists. Table Manipulations. Graphics – Adding clip Art, add an image from a file, editing graphics, Page formatting - Header and footers, page numbers, Protect the Document, Mail Merge, Macros – Creating & Saving web pages, Hyperlinks.			
Textbook 1: Chapter 2			
Teaching-Learning Process	Chalk and board, Active Learning, practical based learning		
Module-2			
MS-Excel- Modifying a Worksheet – Moving through cells, adding worksheets, rows and columns, Resizing rows and columns, selecting cells, Moving and copying cells, freezing panes - Macros – recording and running. Linking worksheets - Sorting and Filling, Alternating text and numbers with Auto fill, Auto filling functions. Graphics – Adding clip art, add an image from a file, Charts – Using chart Wizard, Copy a chart to Microsoft Word.			
Textbook 1: Chapter 3			
Teaching-Learning Process	Active Learning, Demonstration, presentation,		
Module-3			
MS-Power Point -Create a Presentation from a template- Working with Slides – Insert a new slide, applying a design template, changing slide layouts – Resizing a text box, Text box properties, delete a text box - Video and Audio effects, Color Schemes & Backgrounds Adding clip art, adding an image from a file, Save as a web page.			

Textbook 1: Chapter 5	
Teaching-Learning Process	Demonstration, presentation preparation for case studies
Module-4	
MS-Access - Using Access database wizard, pages and projects. Creating Tables – Create a Table in design view. Datasheet Records – Adding, Editing, deleting records, Adding and deleting columns Resizing rows and columns, finding data in a table & replacing, Print a datasheet. Queries - MS-Access.	
Textbook 1: Chapter 4	
Teaching-Learning Process	Chalk& board, Practical based learning.
Module-5	
Microsoft Outlook- Introduction, Starting Microsoft Outlook, Outlook Today, Different Views In Outlook, Outlook Data Files	
Textbook 1: Chapter 7	
Teaching-Learning Process	Chalk and board, MOOC
Course Outcomes (Course Skill Set): At the end of the course the student will be able to: <ul style="list-style-type: none"> CO 1. Know the basics of computers and prepare documents, spreadsheets, make small presentations with audio, video and graphs and would be acquainted with internet. CO 2. Create, edit, save and print documents with list tables, header, footer, graphic, spellchecker, mail merge and grammar checker CO 3. Attain the knowledge about spreadsheet with formula, macros spell checker etc. CO 4. Demonstrate the ability to apply application software in an office environment. CO 5. Use Google Suite for office data management tasks 	
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 . <ul style="list-style-type: none"> • 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 down to 30 marks (60% of maximum marks). • Weightage to be given for neatness and submission of record/write-up on time. • Department shall conduct 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): <ul style="list-style-type: none"> • 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

Weblinks and Video Lectures (e-Resources):

1. <https://youtu.be/9VRmgC2GRFE>
2. <https://youtu.be/rjPW5x0g3I>
3. <https://youtu.be/tcj2BhhCMN4>
4. <https://youtu.be/ubmwp8kbfPc>
5. <https://youtu.be/i6eNvfQ8fTw>
6. <http://office.microsoft.com/en-us/training/CR010047968.aspx>
7. <https://gsuite.google.com/learning-center>
8. <http://spoken-tutorial.org>

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

- Real world problem solving using group discussion.
- Real world examples of Windows Framework.

III Semester

PROGRAMMING IN C++			
Course Code	21CS382	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	12	Total Marks	100
Credits	01	Exam Hours	01
Course Objectives: CLO 1. Understanding about object oriented programming and Gain knowledge about the capability to store information together in an object. CLO 2. Understand the capability of a class to rely upon another class and functions. CLO 3. Understand about constructors which are special type of functions. CLO 4. Create and process data in files using file I/O functions CLO 5. Use the generic programming features of C++ including Exception handling.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">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			
Introduction to Object Oriented Programming: Computer programming background- C++ overview- First C++ Program -Basic C++ syntax, Object Oriented Programming: What is an object, Classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism.			
Textbook 1: Chapter 1(1.1 to 1.8)			
Teaching-Learning Process	Chalk and board, Active Learning, practical based learning		
Module-2			
Functions in C++: Tokens – Keywords – Identifiers and constants – Operators in C++ – Scope resolution operator – Expressions and their types – Special assignment expressions – Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Function overloading.			
Textbook 2: Chapter 3(3.2,3.3,3.4,3.13,3.14,3.19, 3.20) , chapter 4(4.3,4.4,4.5,4.6,4.7,4.9)			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration, presentation, problem solving		
Module-3			
Inheritance & Polymorphism: Derived class Constructors, destructors-Types of Inheritance- Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance.			
Textbook 2: Chapter 6 (6.2,6.11) chapter 8 (8.1 to,8.8)			

Teaching-Learning Process	Chalk and board, Demonstration, problem solving
Module-4	
I/O Streams: C++ Class Hierarchy- File Stream-Text File Handling- Binary File Handling during file operations.	
Textbook 1: Chapter 12(12.5) , Chapter 13 (13.6,13.7)	
Teaching-Learning Process	Chalk and board, Practical based learning, practical's
Module-5	
Exception Handling: Introduction to Exception - Benefits of Exception handling- Try and catch block- Throw statement- Pre-defined exceptions in C++ .	
Textbook 2: Chapter 13 (13.2 to13.6)	
Teaching-Learning Process	Chalk and board, MOOC
Course Outcomes (Course Skill Set): At the end of the course the student will be able to: <ul style="list-style-type: none"> CO 1. Able to understand and design the solution to a problem using object-oriented programming concepts. CO 2. Able to reuse the code with extensible Class types, User-defined operators and function Overloading. CO 3. Achieve code reusability and extensibility by means of Inheritance and Polymorphism CO 4. Identify and explore the Performance analysis of I/O Streams. CO 5. Implement the features of C++ including templates, exceptions and file handling for providing programmed solutions to complex 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) <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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) <ol style="list-style-type: none"> 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 01 hours) SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 01 hours	

Textbooks

1. Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.
2. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd , Fourth Edition 2010.

Reference Books

1. Bhavne, " Object Oriented Programming With C++", Pearson Education , 2004.
2. Ray Lischner, "Exploring C++ : The programmer's introduction to C++", apress, 2010
3. Bhavne, " Object Oriented Programming With C++", Pearson Education , 2004

Weblinks and Video Lectures (e-Resources):

1. Basics of C++ - <https://www.youtube.com/watch?v=BCIS40yzssA>
2. Functions of C++ - <https://www.youtube.com/watch?v=p8ehAjZWjPw>

Tutorial Link:

1. https://www.w3schools.com/cpp/cpp_intro.asp
2. <https://www.edx.org/course/introduction-to-c-3>

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

- Demonstration of simple projects

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. <ol style="list-style-type: none"> 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. 2. Chalk & board, Active Learning. 3. Laboratory Demonstration.
Module-2	
<p>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.</p> <p>Decrease and Conquer Approach: Introduction, Insertion sort, Graph searching algorithms, Topological Sorting. It's efficiency analysis.</p> <p>Textbook 2: Chapter 3(Sections 3.1,3.3,3.4,3.5,3.6)</p> <p>Textbook 1: Chapter 4 (Sections 4.1,4.2,4.3), Chapter 5(Section 5.1,5.2,5.3)</p>	
<p>Laboratory Component:</p> <ol style="list-style-type: none"> 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. 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. 2. Laboratory Demonstration.
Module-3	
<p>Greedy Method: General method, Coin Change Problem, Knapsack Problem, solving Job sequencing with deadlines Problems.</p> <p>Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm with performance analysis.</p> <p>Single source shortest paths: Dijkstra's Algorithm.</p> <p>Optimal Tree problem: Huffman Trees and Codes.</p> <p>Transform and Conquer Approach: Introduction, Heaps and Heap Sort.</p> <p>Textbook 2: Chapter 4(Sections 4.1,4.3,4.5)</p> <p>Textbook 1: Chapter 9(Section 9.1,9.2,9.3,9.4), Chapter 6(section 6.4)</p>	
Laboratory Component:	

Write & Execute C++/Java Program	
<ol style="list-style-type: none"> 1. To solve Knapsack problem using Greedy method. 2. To find shortest paths to other vertices from a given vertex in a weighted connected graph, using Dijkstra's algorithm. 3. To find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program. 4. To find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm. 	
Teaching-Learning Process	<ol style="list-style-type: none"> 1. Chalk & board, Active Learning, MOOC, Problem based Learning. 2. Laboratory Demonstration.
Module-4	
<p>Dynamic Programming: General method with Examples, Multistage Graphs.</p> <p>Transitive Closure: Warshall's Algorithm. All Pairs Shortest Paths: Floyd's Algorithm, Knapsack problem, Bellman-Ford Algorithm, Travelling Sales Person problem.</p> <p>Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching-Harspool's algorithm.</p> <p>Textbook 2: Chapter 5 (Sections 5.1,5.2,5.4,5.9)</p> <p>Textbook 1: Chapter 8(Sections 8.2,8.4), Chapter 7 (Sections 7.1,7.2)</p>	
<p>Laboratory Component:</p> <p>Write C++/ Java programs to</p> <ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Chalk & board, Active Learning, MOOC, Problem based Learning. 2. Laboratory Demonstration.
Module-5	
<p>Backtracking: General method, solution using back tracking to N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles Problems.</p> <p>Branch and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem</p> <p>NP-Complete and NP-Hard problems: Basic concepts, non- deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.</p> <p>Textbook 1: Chapter 12 (Sections 12.1,12.2) Chapter 11(11.3)</p> <p>Textbook 2: Chapter 7 (Sections 7.1,7.2,7.3,7.4,7.5) Chapter 11 (Section 11.1)</p>	
<p>Laboratory Component:</p> <ol style="list-style-type: none"> 1. Design and implement C++/Java Program to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ 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	<ol style="list-style-type: none"> 1. Chalk & board, Active Learning, MOOC, Problem based learning. 2. Laboratory Demonstration.
Course outcome (Course Skill Set) At the end of the course the student will be able to: CO 1. Analyze the 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 problems analyze 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) <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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 . <ul style="list-style-type: none"> • 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 scored out 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.

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.			
<div><div>1.</div><div>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.</div></div> <div><div>2.</div><div>Show video/animation films to explain the functioning of various concepts.</div></div> <div><div>3.</div><div>Encourage collaborative (group learning) learning in the class.</div></div> <div><div>4.</div><div>Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div></div> <div><div>5.</div><div>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.</div></div> <div><div>6.</div><div>Topics will be introduced in multiple representations.</div></div> <div><div>7.</div><div>Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.</div></div> <div><div>8.</div><div>Discuss how every concept can be applied to the real world, and when that's possible, it helps improve the students' understanding.</div></div>			
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	<div><div>1.</div><div>Demonstration of registers, memory access, and CPSR in a programme module.</div></div> <div><div>2.</div><div>For concepts, numerical, and discussion, use chalk and a whiteboard, as well as a PowerPoint presentation.</div></div>		
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: <ol style="list-style-type: none"> Write a program to find the sum of the first 10 integer numbers. Write a program to find the factorial of a number. Write a program to add an array of 16 bit numbers and store the 32 bit result in internal RAM. Write a program to find the square of a number (1 to 10) using a look-up table. Write a program to find the largest or smallest number in an array of 32 numbers. 	
Teaching-Learning Process	<ol style="list-style-type: none"> Demonstration of sample code using Keil software. 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: <ol style="list-style-type: none"> Write a program to arrange a series of 32 bit numbers in ascending/descending order. Write a program to count the number of ones and zeros in two consecutive memory locations. Display "Hello World" message using Internal UART. 	
Teaching-Learning Process	<ol style="list-style-type: none"> Demonstration of sample code using Keil software. 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: <ol style="list-style-type: none"> Interface and Control a DC Motor. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction. Determine Digital output for a given Analog input using Internal ADC of ARM controller. Interface a DAC and generate Triangular and Square waveforms. Interface a 4x4 keyboard and display the key code on an LCD. Demonstrate the use of an external interrupt to toggle an LED On/Off. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between. 	
Teaching-Learning Process	<ol style="list-style-type: none"> Demonstration of sample code for various embedded components using keil. 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	

<p>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.</p> <p>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)</p>	
<p>Laboratory Component:</p> <p>1. Demonstration of IoT applications by using Arduino and Raspberry Pi</p>	
<p>Teaching-Learning Process</p>	<p>1. Chalk and Board for numerical and discussion</p> <p>2. Significance of real time operating system[RTOS] using raspberry pi</p>
<p>Course outcome (Course Skill Set)</p> <p>At the end of the course, the student will be able to:</p> <p>CO 1. Explain C-Compilers and optimization</p> <p>CO 2. Describe the ARM microcontroller's architectural features and program module.</p> <p>CO 3. Apply the knowledge gained from programming on ARM to different applications.</p> <p>CO 4. Program the basic hardware components and their application selection method.</p> <p>CO 5. Demonstrate the need for a real-time operating system for embedded system applications.</p>	
<p>Assessment Details (both CIE and SEE)</p> <p>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</p> <p>Continuous Internal Evaluation:</p> <p>Three Unit Tests each of 20 Marks (duration 01 hour)</p> <ol style="list-style-type: none"> 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 <p>Two assignments each of 10 Marks</p> <ol style="list-style-type: none"> 4. First assignment at the end of 4th week of the semester 5. Second assignment at the end of 9th week of the semester <p>Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to 20 marks.</p> <ul style="list-style-type: none"> • Rubrics for each Experiment taken average for all Lab components – 15 Marks. • Viva-Voce– 5 Marks (more emphasized on demonstration topics) <p>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).</p> <p>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.</p> <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question</p>	

papers for the subject (duration 03 hours)
<ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
Suggested Learning Resources:
Textbooks <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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

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. <ol style="list-style-type: none">1. Lecturer methods (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.2. Use of Video/Animation to explain functioning of various concepts.3. Encourage collaborative (Group Learning) Learning in the class.4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.6. Introduce Topics in manifold representations.7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
Module-1			
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.			
Operating System Services: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.			
Process Management: Process concept; Process scheduling; Operations on processes; Inter process communication			
Textbook 1: Chapter - 1,2,3			
Teaching-Learning Process	Active learning and problem solving <ol style="list-style-type: none">1. https://www.youtube.com/watch?v=vBURt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2Q2. 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 1. https://www.youtube.com/watch?v=HW2Wcx-ktsc 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 1. https://www.youtube.com/watch?v=MYgmmJlfdBg 2. https://www.youtube.com/watch?v=Y14b7_T3AEw&list=PLEJxKK7AcSEGPOCFtQTJhOEIU44J_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 1. https://www.youtube.com/watch?v=pJ6qrCB8pDw&list=PLIY8eNdw5tW-BxRY0yK3fYTYVqytw8qhp 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 1. https://www.youtube.com/watch?v=TTBkc5eiju4 2. https://www.youtube.com/watch?v=8hkvMRGTzCM&list=PLEAYkSg4uSQ2PAch478muxnoeTNz_QeUI&index=36 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.	

<p>CO 2. Demonstrate the allocation of resources for a process using scheduling algorithm.</p> <p>CO 3. Identify root causes of deadlock and provide the solution for deadlock elimination</p> <p>CO 4. Explore about the storage structures and learn about the Linux Operating system.</p> <p>CO 5. Analyze Storage Structures and Implement Customized Case study</p>
<p>Assessment Details (both CIE and SEE)</p> <p>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</p> <p>Continuous Internal Evaluation:</p> <p>Three Unit Tests each of 20 Marks (duration 01 hour)</p> <ol style="list-style-type: none"> 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 <p>Two assignments each of 10 Marks</p> <ol style="list-style-type: none"> 4. First assignment at the end of 4th week of the semester 5. Second assignment at the end of 9th week of the semester <p>Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)</p> <ol style="list-style-type: none"> 6. At the end of the 13th week of the semester <p>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</p> <p>(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).</p> <p>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.</p> <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p> <p>Textbooks</p> <ol style="list-style-type: none"> 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006 <p>Reference Books</p> <ol style="list-style-type: none"> 1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition 2. D.M Dhamdhare, 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.
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O 2. https://www.youtube.com/watch?v=783KAB-

- tuE4&list=PLIemF3uozcAKTgsClj82voMK3TMR0YE_f
3. <https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeR-n6mk0>

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

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

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			
<ul style="list-style-type: none"> 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 a) Write a python program to find the best of two test average marks out of three test's marks accepted from the user. 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. Datatypes: https://www.youtube.com/watch?v=gCCVsvgR2KU Operators: https://www.youtube.com/watch?v=v5MR5JnKcZI Flow Control: https://www.youtube.com/watch?v=PqFKRqpHrjw For loop: https://www.youtube.com/watch?v=0ZvaDa8eT5s While loop: https://www.youtube.com/watch?v=HZARImviDxg Exceptions: https://www.youtube.com/watch?v=6SPDvPK38tw		
2	Aim: Demonstrating creation of functions, passing parameters and return values a) Defined as a function F as $F_n = F_{n-1} + F_{n-2}$. 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. b) Develop a python program to convert binary to decimal, octal to hexadecimal using functions. Functions: https://www.youtube.com/watch?v=BVfCWuca9nw Arguments: https://www.youtube.com/watch?v=ijXMGpoMkhQ Return value: https://www.youtube.com/watch?v=nuNXiEDnM44		
3	Aim: Demonstration of manipulation of strings using string methods a) Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters.		

	<p>b) Write a Python program to find the string similarity between two given strings</p> <p>Sample Output:</p> <p>Original string: Python Exercises Python Exercises Similarity between two said strings: 1.0</p> <p>Sample Output:</p> <p>Original string: Python Exercises Python Exercise Similarity between two said strings: 0.967741935483871</p> <p>Strings: https://www.youtube.com/watch?v=ISItwlnF0eU String functions: https://www.youtube.com/watch?v=9a3CxJyTq00</p>
4	<p>Aim: Discuss different collections like list, tuple and dictionary</p> <p>a) Write a python program to implement insertion sort and merge sort using lists b) Write a program to convert roman numbers in to integer values using dictionaries.</p> <p>Lists: https://www.youtube.com/watch?v=Eaz5e6M8tL4 List methods: https://www.youtube.com/watch?v=8-RDVWGktuI Tuples: https://www.youtube.com/watch?v=bdS4dHIJGBc Tuple operations: https://www.youtube.com/watch?v=TIItKabcTTQ4 Dictionary: https://www.youtube.com/watch?v=4Q0pW8XB0kc Dictionary methods: https://www.youtube.com/watch?v=oLeNHuORpNY</p>
5	<p>Aim: Demonstration of pattern recognition with and without using regular expressions</p> <p>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. b) Develop a python program that could search the text in a file for phone numbers (+919900889977) and email addresses (sample@gmail.com)</p> <p>Regular expressions: https://www.youtube.com/watch?v=LnzFnZfHLS4</p>
6	<p>Aim: Demonstration of reading, writing and organizing files.</p> <p>a) Write a python program to accept a file name from the user and perform the following operations</p> <ol style="list-style-type: none"> 1. Display the first N line of the file 2. Find the frequency of occurrence of the word accepted from the user in the file <p>b) Write a python program to create a ZIP file of a particular folder which contains several files inside it.</p> <p>Files: https://www.youtube.com/watch?v=vuyb7CxZgbU https://www.youtube.com/watch?v=FqcjKewJTQ0</p> <p>File organization: https://www.youtube.com/watch?v=MRuq3SRXses</p>
7	<p>Aim: Demonstration of the concepts of classes, methods, objects and inheritance</p> <p>a) By using the concept of inheritance write a python program to find the area of triangle, circle and rectangle.</p>

	<p>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.</p> <p>OOP's concepts: https://www.youtube.com/watch?v=qiSCMNBIP2g Inheritance: https://www.youtube.com/watch?v=Cn7AkDb4pIU</p>
8	<p>Aim: Demonstration of classes and methods with polymorphism and overriding</p> <p>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.</p> <p>Overriding: https://www.youtube.com/watch?v=CcTzTuIsoFk</p>
9	<p>Aim: Demonstration of working with excel spreadsheets and web scraping</p> <p>a) Write a python program to download the all XKCD comics b) Demonstrate python program to read the data from the spreadsheet and write the data in to the spreadsheet</p> <p>Web scraping: https://www.youtube.com/watch?v=ng2o98k983k Excel: https://www.youtube.com/watch?v=nsKNPHJ9iPc</p>
10	<p>Aim: Demonstration of working with PDF, word and JSON files</p> <p>a) Write a python program to combine select pages from many PDFs b) Write a python program to fetch current weather data from the JSON file</p> <p>PDFs: https://www.youtube.com/watch?v=q70xzDG6nls https://www.youtube.com/watch?v=JhQVD7Y1bsA https://www.youtube.com/watch?v=FcrW-ESdY-A</p> <p>Word files: https://www.youtube.com/watch?v=ZU3cSI51jWE JSON files: https://www.youtube.com/watch?v=9N6a-VLBa2I</p>
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.	
<p>Course Outcomes:</p> <p>CO 1. Demonstrate proficiency in handling of loops and creation of functions. CO 2. Identify the methods to create and manipulate lists, tuples and dictionaries. CO 3. Discover the commonly used operations involving regular expressions and file system. CO 4. Interpret the concepts of Object-Oriented Programming as used in Python. CO 5. Determine the need for scraping websites and working with PDF, JSON and other file formats.</p>	
<p>Assessment Details (both CIE and SEE)</p> <p>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.</p>	

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 down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 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 and Marks allotted to the procedure part to be made zero (Not allowed for Part B).
- The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Textbooks:

1. Al Sweigart, **"Automate the Boring Stuff with Python"**, 1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at <https://automatetheboringstuff.com/>)
2. Reema Thareja **"Python Programming Using Problem Solving Approach"** Oxford University Press.
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>)

IV Semester

WEB PROGRAMMING (Practical based)			
Course Code	21CSL481	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	12T + 12P	Total Marks	100
Credits	01	Exam Hours	02
Course Objectives: CLO 1. Learn Web tool box and history of web browsers. CLO 2. Learn HTML, XHTML tags with utilizations. CLO 3. Know CSS with dynamic document utilizations. CLO 4. Learn JavaScript with Element access in JavaScript. CLO 5. Logically plan and develop web pages..			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">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			
Introduction to WEB Programming: Internet, WWW, Web Browsers, and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox.			
Textbook 1: Chapter 1(1.1 to 1.9)			
Teaching-Learning Process	Chalk and board, Active Learning, practical based learning		
Module-2			
HTML and XHTML: Origins of HTML and XHTML, Basic syntax, Standard XHTML document structure, Basic text markup, Images, Hypertext Links, Lists, Tables. Forms, Frames in HTML and XHTML, Syntactic differences between HTML and XHTML.			
Textbook 1: Chapter 2(2.1 to 2.10)			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration, presentation, problem solving		
Module-3			
CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, Background images, tags.			
Textbook 1: Chapter 3(3.1 to 3.12)			
Teaching-Learning Process	Chalk and board, Demonstration, problem solving		
Module-4			
Java Script – I: Object orientation and JavaScript; General syntactic characteristics; Primitives, Operations, and expressions; Screen output and keyboard input.			

Textbook 1: Chapter 4(4.1 to 4.5)	
Teaching-Learning Process	Chalk and board, Practical based learning, practical's
Module-5	
Java Script – II: Control statements, Object creation and Modification; Arrays; Functions; Constructor; Pattern matching using expressions; Errors, Element access in JavaScript.	
Textbook 1: Chapter 4(4.6 to 4.14)	
Teaching-Learning Process	Chalk and board, MOOC
Course Outcomes (Course Skill Set): At the end of the course the student will be able to: <ul style="list-style-type: none"> CO 1. Describe the fundamentals of web and concept of HTML. CO 2. Use the concepts of HTML, XHTML to construct the web pages. CO 3. Interpret CSS for dynamic documents. CO 4. Evaluate different concepts of JavaScript & Construct dynamic documents. CO 5. Design a small project with JavaScript and XHTML. 	
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 . <ul style="list-style-type: none"> • 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 down to 30 marks (60% of maximum marks). • Weightage to be given for neatness and submission of record/write-up on time. • Department shall conduct 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): <ul style="list-style-type: none"> • 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 	

<p>/external examiners jointly.</p> <ul style="list-style-type: none"> • 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 <p>Rubrics suggested in Annexure-II of Regulation book</p>
<p>Textbooks</p> <ol style="list-style-type: none"> 1. Robert W Sebesta, "Programming the World Wide Web", 6th Edition, Pearson Education, 2008. <p>Reference Books</p> <ol style="list-style-type: none"> 1. M.Deitel, P.J.Deitel, A.B.Goldberg, "Internet & World Wide Web How to program", 3rd Edition, Pearson Education / PHI, 2004. 2. Chris Bates, "Web Programming Building Internet Applications", 3rd Edition, Wiley India, 2006. 3. Xue Bai et al, "The Web Warrior Guide to Web Programming", Thomson, 2003. 4. Sklar, "The Web Warrior Guide to Web Design Technologies", 1st Edition, Cengage Learning India <p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. Fundamentals of WEB Programming: https://www.youtube.com/watch?v=DR9dr6gxhDM 2. HTML and XHTML: https://www.youtube.com/watch?v=A1XlIDDXgwg 3. CSS: https://www.youtube.com/watch?v=j35jug1uHzE 4. Java Script and HTML Documents: https://www.youtube.com/watch?v=Gd0RBdFRvF0 5. Dynamic Documents with JavaScript: https://www.youtube.com/watch?v=HTFSIJALNKc <p>Tutorial Link:</p> <ol style="list-style-type: none"> 1. http://www.tutorialspoint.com 2. http://www.w3schools.com <p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <ul style="list-style-type: none"> • Demonstration of simple projects

IV Semester

UNIX SHELL PROGRAMMING			
Course Code	21CS482	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	12	Total Marks	100
Credits	01	Exam Hours	01
Course Objectives: CLO 1. To help the students to understand effective use of Unix concepts, commands and terminology. CLO 2. Identify, access, and evaluate UNIX file system. CLO 3. Understand UNIX command syntax and semantics. CLO 4. Ability to read and understand specifications, scripts and programs. CLO 5. Analyze Facility with UNIX Process.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <div><div>1.</div><div>Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.</div></div> <div><div>2.</div><div>Use of Video/Animation to explain functioning of various concepts.</div></div> <div><div>3.</div><div>Encourage collaborative (Group Learning) Learning in the class.</div></div> <div><div>4.</div><div>Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div></div> <div><div>5.</div><div>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.</div></div> <div><div>6.</div><div>Introduce Topics in manifold representations.</div></div> <div><div>7.</div><div>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.</div></div> <div><div>8.</div><div>Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</div></div>			
Module-1			
Introduction of UNIX -Introduction, History, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput, and bc.			
Textbook 1: Chapter 1(1.1 to 1.4) , Chapter 2- 2.1			
Teaching-Learning Process	Chalk and board, Active Learning, practical based learning		
Module-2			
UNIX File System -The file, what's in a filename? The parent-child relationship, pwd, the Home directory, absolute pathnames, using absolute pathnames for a command, cd, mkdir, rmdir, Relative pathnames, The UNIX file system.			
Textbook 1: Chapter 4			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration, presentation, problem solving		
Module-3			
Basic File Attributes - ls - l, the -d option, File Permissions, chmod, Security and File Permission, users and groups, security level, changing permission, user masks, changing ownership and group, File Attributes, More file attributes: hard link, symbolic link, umask, find.			
Textbook 1: Chapter 6			
Teaching-Learning Process	Chalk and board, Demonstration, problem solving		
Module-4			
Introduction to the Shell Scripting -Introduction to Shell Scripting, Shell Scripts, read, Command Line			

Arguments, Exit Status of a Command, The Logical Operators && and ||, exit, if, and case conditions, expr, sleep and wait, while, until, for, \$, @, redirection. The here document, set, trap, Sample Validation and Data Entry Scripts.

Textbook 1: Chapter 11,12,14

Teaching-Learning Process	Chalk and board, Practical based learning, practical's
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Module-5

Introduction to UNIX System process: Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file.. Signals.

Textbook 1: Chapter 9,19

Teaching-Learning Process	Chalk and board, MOOC
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Course Outcomes (Course Skill Set):

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

- CO 1. Know the basics of Unix concepts and commands.
- CO 2. Evaluate the UNIX file system.
- CO 3. Apply Changes in file system.
- CO 4. Understand scripts and programs.
- CO 5. Analyze Facility with UNIX system process

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 01 hours**)

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 01 hours

Textbooks

1. Unix Concepts & Applications 4th Edition, Sumitabha Das, Tata McGraw Hill

References:

<ol style="list-style-type: none">2. Unix Shell Programming, Yashwant Kanetkar3. Introduction to UNIX by M G Venkatesh Murthy.
Weblinks and Video Lectures (e-Resources): <ol style="list-style-type: none">1. https://www.youtube.com/watch?v=ffYUfAqEamY2. https://www.youtube.com/watch?v=Q05NZiYFcD03. https://www.youtube.com/watch?v=8GdT53KDIyY4. https://www.youtube.com/watch?app=desktop&v=3Pga3y7rCgo
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning <ul style="list-style-type: none">• Real world problem solving using group discussion.• Real world examples of Linux operating system Utilizations.

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. <ol style="list-style-type: none">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.			
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.			
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 family.			
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.			
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: <ul style="list-style-type: none"> 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) <p>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).</p> <p>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.</p> <ul style="list-style-type: none"> • 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 down to 30 marks (60% of maximum marks). • Weightage to be given for neatness and submission of record/write-up on time. • Department shall conduct 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). <p>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.</p>	
Semester End Evaluation (SEE): <ul style="list-style-type: none"> • 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. 	

<ul style="list-style-type: none"> • 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 <p>Rubrics suggested in Annexure-II of Regulation book</p>
<p>Textbooks</p> <ol style="list-style-type: none"> 1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series. <p>References:</p> <ol style="list-style-type: none"> 1. Michael J. Crawley, "Statistics: An Introduction using R", Second edition, Wiley,2015
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. Wickham, H. & Golemund, G. (2018). for Data Science. O'Reilly: New York. Available for free at http://r4ds.had.co.nz
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <ul style="list-style-type: none"> • Demonstration of simple projects

V Semester

OBJECT ORIENTED MODELLING AND DESIGN			
Course Code	21CD51	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Describe the concepts involved in Object-Oriented modelling and their benefits.			
CLO 2. Demonstrate concept of use-case model, sequence model and state chart model for a given problem.			
CLO 3. Explain the facets of the unified process approach to design and build a Software system.			
CLO 4. Translate the requirements into implementation for Object Oriented design.			
CLO 5. Choose an appropriate design pattern to facilitate development procedure.			
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) needs 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 approaches 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			
Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modeling; Events, States, Transitions and Conditions, State Diagrams, State diagram behaviour.			
Text Book-1: 4, 5			
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning		
Module-2			
UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models.			
Text Book-2:Chapter- 6:Page 210 to 250			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration		
Module-3			
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing			

a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis.

Text Book-1:Chapter- 10,11,and 12

Teaching-Learning Process

Chalk and board, Problem based learning, Demonstration

Module-4

Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design.

Text Book-2: Chapter 8: page 292 to 346

Teaching-Learning Process

Chalk & board, Problem based learning

Module-5

Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only).

Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4.

Teaching-Learning Process

Chalk and board, MOOC

Course Outcomes

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

- CO 1. Describe the concepts of object-oriented and basic class modelling.
- CO 2. Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
- CO 3. Choose and apply a befitting design pattern for the given problem
- CO 4. Translate the requirements into implementation for Object Oriented design
- CO 5. Choose an appropriate design pattern to facilitate development procedure

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**

1. First assignment at the end of 4th week of the semester
2. 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)**

1. 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 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.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks

1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005
2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005.
3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides: Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education, 2007.

Reference:

1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern – Oriented Software Architecture. A system of patterns, Volume 1, John Wiley and Sons, 2007.
3. Booch, Jacobson, Rumbaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, Pearson, Reprint 2013

Weblinks and Video Lectures (e-Resources):

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

Group Activities, quizzes, Puzzles and presentations

V Semester

COMPUTER NETWORKS			
Course Code:	21CS52	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40T + 20P	Total Marks	100
Credits	04	Exam Hours	03
Course Objectives: CLO 1. Fundamentals of data communication networks. CLO 2. Software and hardware interfaces CLO 3. Application of various physical components and protocols CLO 4. Communication challenges and remedies in the networks.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.2. Use of Video/Animation to explain functioning of various concepts.3. Encourage collaborative (Group Learning) Learning in the class.4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.6. Introduce Topics in manifold representations.7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
Module-1			
Introduction to networks: Network hardware, Network software, Reference models,			
Physical Layer: Guided transmission media, Wireless transmission			
Textbook 1: Ch.1.2 to 1.4, Ch.2.2 to 2.3			
Laboratory Component: <ol style="list-style-type: none">1. Implement Three nodes point – to – point network with duplex links between them for different topologies. 1Set the queue size, vary the bandwidth, and find the number of packets dropped for various iterations.			
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration		
Module-2			
The Data link layer: Design issues of DLL, Error detection and correction, Elementary data link protocols, Sliding window protocols.			
The medium access control sublayer: The channel allocation problem, Multiple access protocols.			
Textbook 1: Ch.3.1 to 3.4, Ch.4.1 and 4.2			
Laboratory Component: <ol style="list-style-type: none">1. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the throughput with respect to transmission of packets2. Write a program for error detecting code using CRC-CCITT (16- bits).			

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-3	
The Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, QoS.	
Textbook 1: Ch 5.1 to 5.4	
Laboratory Component: <ol style="list-style-type: none"> 1. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion in the network. 2. Write a program to find the shortest path between vertices using bellman-ford algorithm. 	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
The Transport Layer: The Transport Service, Elements of transport protocols, Congestion control, The internet transport protocols.	
Textbook 1: Ch 6.1 to 6.4 and 6.5.1 to 6.5.7	
Laboratory Component: <ol style="list-style-type: none"> 1. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination. 2. Write a program for congestion control using leaky bucket algorithm. 	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-5	
Application Layer: Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service.	
Textbook 2: Ch 2.1 to 2.4	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Course Outcomes (Course Skill Set) At the end of the course the student will be able to: <ol style="list-style-type: none"> CO 1. Learn the basic needs of communication system. CO 2. Interpret the communication challenges and its solution. CO 3. Identify and organize the communication system network components CO 4. Design communication networks for user requirements. 	
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) <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks:

1. Computer-Networks- Andrew S. Tanenbaum and David J. Wetherall, Pearson Education, 5th-Edition. (www.pearsonhighered.com/tanenbaum)
2. Computer Networking A Top-Down Approach -James F. Kurose and Keith W. Ross Pearson Education 7th Edition.

Reference Books:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
2. Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER

Weblinks and Video Lectures (e-Resources):

1. <https://www.digimat.in/nptel/courses/video/106105183/L01.html>
2. <http://www.digimat.in/nptel/courses/video/106105081/L25.html>
3. <https://nptel.ac.in/courses/106105081>
4. VTU e-Shikshana Program

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

Simulation of Personal area network, Home area network, achieve QoS etc.

Note: For the Simulation experiments modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude using NS2. Installation procedure of the required software must be demonstrated, carried out in groups, and documented in the report. Non simulation programs can be implemented using Java

V Semester

DATABASE MANAGEMENT SYSTEMS			
Course Code	21CS53	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Provide a strong foundation in database concepts, technology, and practice.			
CLO 2. Practice SQL programming through a variety of database problems.			
CLO 3. Demonstrate the use of concurrency and transactions in database			

CLO 4. Design and build database applications for real world problems.	
Teaching-Learning Process (General Instructions)	
<p>These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> 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	
<p>Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.</p> <p>Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.</p> <p>Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples</p> <p>Textbook 1: Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.7</p>	
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning
Module-2	
<p>Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.</p> <p>Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.</p> <p>Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.</p> <p>Textbook 1: Ch 5.1 to 5.3, 8.1 to 8.5, 9.1;</p>	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-3	
<p>SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.</p> <p>Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.</p> <p>Database</p>	

Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop.	
Textbook 1: Ch 6.1 to 6.5, 7.1 to 7.4; Textbook 2: 6.1 to 6.6;	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
<p>Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.</p> <p>Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms</p> <p>Textbook 1: Ch 14.1 to -14.7, 15.1 to 15.6</p>	
Teaching-Learning Process	Chalk& board, Problem based learning
Module-5	
<p>Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.</p> <p>Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.</p> <p>Textbook 1: Ch 20.1 to 20.6, 21.1 to 21.7;</p>	
Teaching-Learning Process	Chalk and board, MOOC
<p>Course Outcomes</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> CO 1. Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS CO 2. Use Structured Query Language (SQL) for database manipulation and also demonstrate the basic of query evaluation. CO 3. Design and build simple database systems and <i>relate</i> the concept of transaction, concurrency control and recovery in database CO 4. Develop application to interact with databases, relational algebra expression. CO 5. Develop applications using tuple and domain relation expression from queries. 	
<p>Assessment Details (both CIE and SEE)</p> <p>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</p> <p>Continuous Internal Evaluation:</p> <p>Three Unit Tests each of 20 Marks (duration 01 hour)</p> <ul style="list-style-type: none"> 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Reference Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan's Database System Concepts 6th Edition Tata McGraw Hill Education Private Limited

Weblinks and Video Lectures (e-Resources):

1. <https://www.youtube.com/watch?v=3EJlovevfcA>
2. <https://www.youtube.com/watch?v=9TwMRs3qTcU>
3. <https://www.youtube.com/watch?v=ZWl0Xow304I>
4. <https://www.youtube.com/watch?v=4YilEjKNPrQ>
5. <https://www.youtube.com/watch?v=CZTkgMoqVss>
6. <https://www.youtube.com/watch?v=Hl4NZB1XR9c>
7. https://www.youtube.com/watch?v=EGEwkad_IIA
8. <https://www.youtube.com/watch?v=t5hsV9lC1rU>

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

Demonstration of real time Database projects - E-commerce Platform, Inventory Management, Railway System, College Data Management, Library Data Management, Solution for Saving Student Records, Hospital Data Management, Blood Donation Management.

V Semester

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING			
Course Code	21CS54	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives CLO 1. Gain a historical perspective of AI and its foundations CLO 2. Become familiar with basic principles of AI toward problem solving CLO 3. Familiarize with the basics of Machine Learning & Machine Learning process, basics of Decision Tree, and probability learning CLO 4. Understand the working of Artificial Neural Networks and basic concepts of clustering algorithms			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">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 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			
Introduction: What is AI? Foundations and History of AI Problem-solving: Problem-solving agents, Example problems, Searching for Solutions, Uninformed Search Strategies: Breadth First search, Depth First Search, Textbook 1: Chapter 1- 1.1, 1.2, 1.3 Textbook 1: Chapter 3- 3.1, 3.2, 3.3, 3.4.1, 3.4.3			
Teaching-Learning Process	Chalk and board, Active Learning. Problem based learning		
Module-2			
Informed Search Strategies: Greedy best-first search, A*search, Heuristic functions. Introduction to Machine Learning , Understanding Data Textbook 1: Chapter 3 - 3.5, 3.5.1, 3.5.2, 3.6 Textbook 2: Chapter 1 and 2			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration		
Module-3			
Basics of Learning theory Similarity Based Learning Regression Analysis			

Textbook 2: Chapter 3 - 3.1 to 3.4, Chapter 4, chapter 5.1 to 5.4	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
Decision Tree learning Bayesian Learning	
Textbook 2: Chapter 6 and 8	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-5	
Artificial neural Network Clustering Algorithms	
Textbook 2: Chapter 10 and 13	
Teaching-Learning Process	Chalk and board, Active Learning.
Course Outcomes Course Skill Set)	
At the end of the course the student will be able to:	
CO 1. Apply the knowledge of searching and reasoning techniques for different applications. CO 2. Have a good understanding of machine learning in relation to other fields and fundamental issues and challenges of machine learning. CO 3. Apply the knowledge of classification algorithms on various dataset and compare results CO 4. Model the neuron and Neural Network, and to analyze ANN learning and its applications. CO 5. Identifying the suitable clustering algorithm for different pattern	
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 5 th week of the semester 2. Second test at the end of the 10 th week of the semester 3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester 5. Second assignment at the end of 9 th 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) OR Suitable Programming experiments based on the syllabus contents can be given to the students to submit the same as laboratory work(for example; Implementation of concept learning, implementation of decision tree learning algorithm for suitable data set, etc...)	
6. At the end of the 13 th 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence, 3rd Edition, Pearson, 2015
2. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford, 2021

Reference:

1. Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2013
2. George F Luger, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011
3. Tom Michel, Machine Learning, McGrawHill Publication.

Weblinks and Video Lectures (e-Resources):

1. <https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html>
2. <https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409>
3. <https://nptel.ac.in/courses/106/105/106105077/>
4. <https://www.javatpoint.com/history-of-artificial-intelligence>
5. <https://www.tutorialandexample.com/problem-solving-in-artificial-intelligence>
6. <https://techvidvan.com/tutorials/ai-heuristic-search/>
7. <https://www.analyticsvidhya.com/machine-learning/>
8. <https://www.javatpoint.com/decision-tree-induction>
9. <https://www.hackerearth.com/practice/machine-learning/machine-learning-algorithms/ml-decision-tree/tutorial/>
10. <https://www.javatpoint.com/unsupervised-artificial-neural-networks>

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

Role play for strategies– DFS & BFS, Outlier detection in Banking and insurance transaction for identifying fraudulent behaviour etc. Uncertainty and reasoning Problem- reliability of sensor used to detect pedestrians using Bayes Rule

V Semester

DATABASE MANAGEMENT SYSTEM LABORATORY WITH MINI PROJECT			
CourseCode	21CSL55	CIEMarks	50
TeachingHours/Week(L:T:P:S)	0:0:2:0	SEEMarks	50
TotalHoursofPedagogy	24	TotalMarks	100
Credits	01	ExamHours	03
Course Learning Objectives: CLO 1. Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers. CLO 2. Strong practice in SQL programming through a variety of database problems. CLO 3. Develop database applications using front-end tools and back-end DBMS..			
Sl. No.	PART-A: SQL Programming (Max. Exam Marks. 50) Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment. Create Schema and insert at least 5 records for each table. Add appropriate database constraints.		
1	Aim: Demonstrating creation of tables, applying the view concepts on the tables. Program: Consider the following schema for a Library Database: BOOK(Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(Book_id, Author_Name) PUBLISHER(Name, Address, Phone) BOOK_COPIES(Book_id, Programme_id, No-of_Copies) BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date) LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address) Write SQL queries to 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library. Reference: https://www.youtube.com/watch?v=AaSU-AOguls https://www.youtube.com/watch?v=-EwEvjxS-Fw		
2	Aim: Discuss the various concepts on constraints and update operations. Program: Consider the following schema for Order Database: SALESMAN(Salesman_id, Name, City, Commission) CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id) Write SQL queries to Count the customers with grades above Bangalore's average. 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted. Reference: https://www.youtube.com/watch?v=AA-KL1jbMeY		

	https://www.youtube.com/watch?v=7S_tz1z_5bA
3	<p>Aim: Demonstrate the concepts of JOIN operations.</p> <p>Program: Consider the schema for Movie Database: ACTOR(Act_id, Act_Name, Act_Gender) DIRECTOR(Dir_id, Dir_Name, Dir_Phone) MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(Act_id, Mov_id, Role) RATING(Mov_id, Rev_Stars)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015(use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5. <p>Reference: https://www.youtube.com/watch?v=hSiCUNVKIAo https://www.youtube.com/watch?v=Eod3aQkFz84</p>
4	<p>Aim: Introduce concepts of PLSQL and usage on the table.</p> <p>Program: Consider the schema for College Database: STUDENT(USN, SName, Address, Phone, Gender) SEMSEC(SSID, Sem, Sec) CLASS(USN, SSID) COURSE(Subcode, Title, Sem, Credits) IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all Courses. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak' <p>Give these details only for 8th semester A, B, and C section students.</p> <p>Reference: https://www.youtube.com/watch?v=horURQewW9c https://www.youtube.com/watch?v=P7-wKbKrAhk</p>
5	<p>Aim: Demonstrate the core concepts on table like nested and correlated nesting queries and also EXISTS and NOT EXISTS keywords.</p> <p>Program: Consider the schema for Company Database: EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate) DLOCATION(DNo, DLoc) PROJECT(PNo, PName, PLocation, DNo) WORKS_ON(SSN, PNo, Hours)</p> <p>Write SQL queries to</p> <p>Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.</p> <p>Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent</p>

	<p>raise.</p> <p>Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department</p> <p>Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator).</p> <p>For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs.6,00,000.</p> <p>Reference: https://www.youtube.com/watch?v=Dk8f3ejqKts</p>
Pedagogy	For the above experiments the following pedagogy can be considered. Problembasedlearning,Activelearning,MOOC,Chalk&Talk
PART B	
	Mini project: For any problem selected,make sure that the application should have five or more tables. Indicative areas include: Organization, health care, Ecommerce etc.
<p>Course Outcomes:</p> <p>At the end of the course the student will be able to:</p> <p>CO 1. Create, Update and query on the database.</p> <p>CO 2. Demonstrate the working of different concepts of DBMS</p> <p>CO 3. Implement, analyze and evaluate the project developed for an application.</p>	
<p>Assessment Details (both CIE and SEE)</p> <p>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).</p> <p>Continuous Internal Evaluation (CIE):</p> <p>CIE marks for the practical course is 50 Marks.</p> <p>The split-up of CIE marks for record/ journal and test are in the ratio 60:40.</p> <p>Each experiment to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.</p> <p>Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.</p> <p>Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).</p> <p>Weightage to be given for neatness and submission of record/write-up on time.</p> <p>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.</p> <p>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.</p> <p>The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book</p> <p>The average of 02 tests is scaled down to 20 marks (40% of the maximum marks).</p> <p>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.</p>	
<p>Semester End Evaluation (SEE):</p> <ul style="list-style-type: none"> SEE marks for the practical course is 50 Marks. SEE shall be conducted jointly by the two examiners of the same institute, examiners are 	

<p>appointed by the University</p> <ul style="list-style-type: none"> • 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) • <i>Students can pick one experiment from the questions lot of PART A with an equal choice to all the students in a batch. For PART B, the project group (Maximum of 4 students per batch) should demonstrate the mini-project.</i> • <i>Weightage of marks for PART A is 60% and for PART B is 40%. General rubrics suggested to be followed for part A and part B.</i> • Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero (Not allowed for Part B). • The duration of SEE is 03 hours <p>Rubrics suggested in Annexure-II of Regulation book</p>
<p>Textbooks:</p> <ol style="list-style-type: none"> 1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson. 2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill
<p>SuggestedWeblinks/EResource</p> <p>https://www.tutorialspoint.com/sql/index.htm</p>

V Semester

ANGULAR JS AND NODE JS (Practical based)			
Course Code:	21CSL581	CIE Marks	50
Teaching Hours/Week	0:0:2:0	SEE Marks	50
Total No. of Hours	12T + 12P	Total Marks	100
Credits	01	Exam Hours	02
Course Objectives: The student should be made to: CLO 1. To learn the basics of Angular JS. CLO 2. To understand the Angular JS Modules. CLO 3. To implement Forms, inputs and Services CLO 4. To implement Directives and Databases CLO 5. To understand basics of Node JS.			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<ol style="list-style-type: none">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 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			
Introduction To Angular JS: Introduction – Features – Angular JSModel-View-Controller – Expression - Directives and Controllers.			
Teaching-Learning Process	Chalk and board, Active Learning, practical based learning		
Module-2			
Angular JS Modules: Arrays –Working with ng-model – Working with Forms – Form Validation – Error Handling with Forms – Nested Forms with ng-form – Other Form Controls.			
Teaching-Learning Process	Chalk and board, Active Learning, practical based learning		
Module-3			
Directives& Building Databases:			
Part I- Filters – Using Filters in Controllers and Services – Angular JS Services – Internal Angular JS Services – Custom Angular JS Services			
Teaching-Learning Process	Chalk and board, Active Learning, practical based learning		
Module-4			
Directives& Building Databases:			
Part-II- Directives – Alternatives to Custom Directives – Understanding the Basic options – Interacting with Server –HTTP Services – Building Database, Front End and BackEnd			
Teaching-Learning Process	Chalk and board, Active Learning, practical based learning		
Module-5			
Introduction to NODE .JS: Introduction –Using the Terminals – Editors –Building a Webserver with Node – The HTTPModule – Views and Layouts.			
Teaching-Learning Process	Chalk and board, Active Learning, practical based learning		

Course Outcomes (Course Skill Set)

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

- CO 1. Describe the features of Angular JS.
- CO 2. Recognize the form validations and controls.
- CO 3. Implement Directives and Controllers.
- CO 4. Evaluate and createdatabase for simple application.
- CO 5. Plan and build webservers with node usingNode .JS.

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 down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 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

<p>100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)</p> <ul style="list-style-type: none"> The duration of SEE is 02 hours <p>Rubrics suggested in Annexure-II of Regulation book</p>
<p>Suggested Learning Resources:</p> <p>Textbooks</p> <ol style="list-style-type: none"> Adam Freeman - ProAngular JS, Apress, First Edition, 2014. ShyamSeshadri, Brad Green –“AngularJS: Up and Running: Enhanced Productivity with Structured Web Apps”, Apress, O'Reilly Media, Inc. AgusKurniawan–“AngularJS Programming by Example”, First Edition, PE Press, 2014. <p>Reference Books</p> <ol style="list-style-type: none"> Brad Dayley, “Learning Angular JS”, Addison-Wesley Professional, First Edition, 2014. Steve Hoberman, “Data Modelling for MongoDB”, Technics Publication, First Edition, 2014..
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> Introduction to Angular JS: https://www.youtube.com/watch?v=HEbphzK-0xE Angular JS Modules : https://www.youtube.com/watch?v=gWmOKmgnQkU Directives& Building Databases: https://www.youtube.com/watch?v=R_0kHflzgm0 Introduction to NODE .JS:https://www.youtube.com/watch?v=8u1o-0mOeGQ https://www.youtube.com/watch?v=7F1nLajs4Eo https://www.youtube.com/watch?v=t7x7c-x90FU
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <ul style="list-style-type: none"> Demonstration of simple projects

V Semester

C# AND .NET FRAMEWORK			
Course Code:	21CS582	CIE Marks	50
Teaching Hours/Week	1:0:0:0	SEE Marks	50
Total No. of Hours	12	Total Marks	100
Credits	01	Exam Hours	01
Course Objectives:			
CLO 1. Understand the basics of C# and .NET			
CLO 2. Learn the variables and constants of C#			
CLO 3. Know the object-oriented aspects and applications.			
CLO 4. Learn the basic structure of .NET framework.			
CLO 5. Learn to create a simple project of .NET Core			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<div><div>1.</div><div>Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.</div></div> <div><div>2.</div><div>Use of Video/Animation to explain functioning of various concepts.</div></div> <div><div>3.</div><div>Encourage collaborative (Group Learning) Learning in the class.</div></div> <div><div>4.</div><div>Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div></div> <div><div>5.</div><div>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.</div></div> <div><div>6.</div><div>Introduce Topics in manifold representations.</div></div> <div><div>7.</div><div>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.</div></div> <div><div>8.</div><div>Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</div></div>			
Module-1			
Introduction to C#			
Part-I: Understanding C#, .NET, overview of C#,Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, implicit and explicit casting.			
Teaching-Learning Process	Active learning		
Module-2			
Part-II: Constants,Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.			
Teaching-Learning Process	Active learning		
Module-3			
Object Oriented Concepts-I:			
Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism.			
Teaching-Learning Process	Active learning		
Module-4			
Object Oriented Concepts-II:			
Sealed class and methods, interface, abstract class, abstract and interface, operator overloading,			

delegates, events, errors and exception, Threading.	
Teaching-Learning Process	Active learning
Module-5	
Introduction to .NET FRAMEWORK:	
Assemblies, Versioning, Attributes, reflection, viewing meta data, remoting, security in .NET, Environment Setup of .NET Core and create a small project.	
Teaching-Learning Process	Active learning
Course Outcomes (Course Skill Set)	
At the end of the course the student will be able to:	
CO 1. Able to explain how C# fits into the .NET platform.	
CO 2. Describe the utilization of variables and constants of C#	
CO 3. Use the implementation of object-oriented aspects in applications.	
CO 4. Analyze and Set up Environment of .NET Core.	
CO 5. Evaluate and create a simple project application.	
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 5 th week of the semester	
2. Second test at the end of the 10 th week of the semester	
3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester	
5. Second assignment at the end of 9 th 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 13 th 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 01 hours)	
SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 01 hours	
Suggested Learning Resources:	

Textbooks

1. Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012.
2. Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012.

Reference Books

1. Andrew Troelsen, "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
2. Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O'Reilly, 2010.

Weblinks and Video Lectures (e-Resources):

1. Introduction to C# : <https://www.youtube.com/watch?v=ItoIFCT9P90>
2. Object Oriented Concepts : <https://www.youtube.com/watch?v=LP3llcExPK0>
3. .NET FRAMEWORK : <https://www.youtube.com/watch?v=h7huHkvPoEE>

Tutorial Link:

1. <https://www.tutorialsteacher.com/csharp>
2. <https://www.w3schools.com/cs/index.php>
3. <https://www.javatpoint.com/net-framework>

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

Real world problem solving using group discussion.

VI Semester

SOFTWARE ENGINEERING & PROJECT MANAGEMENT			
Course Code	21CS61	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 Learning Objectives CLO 1. Outline software engineering principles and activities involved in building large software programs. Identify ethical and professional issues and explain why they are of concern to Software Engineers. CLO 2. Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation. CLO 3. Infer the fundamentals of object oriented concepts, differentiate system models, use UML diagrams and apply design patterns. CLO 4. Explain the role of DevOps in Agile Implementation. CLO 5. Discuss various types of software testing practices and software evolution processes. CLO 6. Recognize the importance Project Management with its methods and methodologies. CLO 7. Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none"> 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			
Introduction: The evolving role of software, Software, The changing nature of software, Software engineering, A Process Framework, Process Patterns, Process Assessment, Personal and Team Process Models, Process Technology, Product and Process.			
Textbook 1: Chapter 1: 1.1 to 1.3			
Process Models: Prescriptive models, Waterfall model, Incremental process models, Evolutionary process models, Specialized process models.			
Textbook 1: Chapter 2: 2.1, 2.2, 2.4 to 2.7			
Requirements Engineering: Requirements Engineering Task, Initiating the RequirementsEngineering process, Eliciting Requirements, Developing use cases, Building the analysis model, Negotiating Requirements, Validating Requirements, Software Requirement Document (Sec 4.2)			
Textbook 1: Chapter 3: 3.1 to 3.6, Textbook 5: Chapter 4: 4.2			

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning
Module-2	
Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling, abstraction, The Three models. Class Modelling: Object and Class Concept, Link and associations concepts, Generalization and Inheritance, A sample class model, Navigation of class models, Introduction to RUP(Textbook: 5 Sec 2.4)and UML diagrams	
Textbook 2: Chapter 1,2,3	
Building the AnalysisModels: Requirement Analysis, Analysis Model Approaches, Data modelling Concepts, Object Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, class Based Modeling, Creating a Behavioral Model.	
Textbook 1: Chapter 8: 8.1 to 8.8	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-3	
Software Testing: A Strategic Approach to Software Testing,Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging.	
Textbook 1: Chapter 13: 13.1 to 13.7	
Agile Methodology & DevOps: Before Agile – Waterfall, Agile Development,	
Self-Learning Section: What is DevOps?, DevOps Importance and Benefits, DevOps Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing, How to Choose Right DevOps Tools?, Challenges with DevOps Implementation.	
Textbook 4: Chapter 2: 2.1 to 2.9	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-4	
Introduction to Project Management: Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.	
Textbook 3: Chapter 1: 1.1 to 1.17	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-5	
Activity Planning: Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, Identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks.	
Textbook 3: Chapter 6: 6.1 to 6.16	
Software Quality: Introduction, The place of software quality in project planning, Importance of software quality, software quality models, ISO 9126, quality management systems, process capability models, techniques to enhance software quality, quality plans.	
Textbook 3: Chapter 13: (13.1 to 13.6 , 13.9, 13.11, 13.14),	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Course Outcomes	

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

- CO 1. Understand the activities involved in software engineering and analyze the role of various process models
- CO 2. Explain the basics of object-oriented concepts and build a suitable class model using modelling techniques
- CO 3. Describe various software testing methods and to understand the importance of agile methodology and DevOps
- CO 4. Illustrate the role of project planning and quality management in software development
- CO 5. Understand the importance of activity planning and different planning models

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 scored out of 100 shall be reduced proportionally to 50 marks.

Suggested Learning Resources:

Textbooks

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.
3. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.
4. Deepak Gaikwad, Viral Thakkar, DevOps Tools From Practitioner's Viewpoint, Wiley.
5. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.

27.09.2022

Reference:

1. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.

Weblinks and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://www.youtube.com/watch?v=WxkP5KR_Emk&list=PLrjkTql3jnm9b5nr-ggx7Pt1G4UAHeFI
3. <http://elearning.vtu.ac.in/econtent/CSE.php>
4. <http://elearning.vtu.ac.in/econtent/courses/video/CSE/15CS42.html>
5. <https://nptel.ac.in/courses/128/106/128106012/> (DevOps)

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

Case study, Field visit

VI Semester

FULLSTACK DEVELOPMENT			
Course Code	21CS62	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 use of learning fullstack web development. CLO 2.Make use of rapid application development in the design of responsive web pages. CLO 3.Illustrate Models, Views and Templates with their connectivity in Django for full stack web development. CLO 4.Demonstrate the use of state management and admin interfaces automation in Django. CLO 5.Design and implement Django apps containing dynamic pages with SQL databases.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">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: MVC based Web Designing Web framework, MVC Design Pattern, Django Evolution, Views, Mapping URL to Views, Working of Django URL Confs and Loose Coupling, Errors in Django, Wild Card patterns in URLS.			
Textbook 1: Chapter 1 and Chapter 3			
Laboratory Component: <ol style="list-style-type: none">1. Installation of Python, Django and Visual Studio code editors can be demonstrated.2. Creation of virtual environment, Django project and App should be demonstrated3. Develop a Django app that displays current date and time in server4. Develop a Django app that displays date and time four hours ahead and four hours before as an offset of current date and time in server.			
Teaching-Learning Process	<ol style="list-style-type: none">1. Demonstration using Visual Studio Code2. PPT/Prezi Presentation for Architecture and Design Patterns3. Live coding of all concepts with simple examples		
Module-2: Django Templates and Models Template System Basics, Using Django Template System, Basic Template Tags and Filters, MVT Development Pattern, Template Loading, Template Inheritance, MVT Development Pattern. Configuring Databases, Defining and Implementing Models, Basic Data Access, Adding Model String			

Representations, Inserting/Updating data, Selecting and deleting objects, Schema Evolution Textbook 1: Chapter 4 and Chapter 5	
Laboratory Component:	
<ol style="list-style-type: none"> 1. Develop a simple Django app that displays an unordered list of fruits and ordered list of selected students for an event 2. Develop a layout.html with a suitable header (containing navigation menu) and footer with copyright and developer information. Inherit this layout.html and create 3 additional pages: contact us, About Us and Home page of any website. 3. Develop a Django app that performs student registration to a course. It should also display list of students registered for any selected course. Create students and course as models with enrolment as ManyToMany field. 	
Teaching-Learning Process	<ol style="list-style-type: none"> 1. Demonstration using Visual Studio Code 2. PPT/Prezi Presentation for Architecture and Design Patterns 3. Live coding of all concepts with simple examples 4. Case Study: Apply concepts learnt for an Online Ticket Booking System
Module-3: Django Admin Interfaces and Model Forms	
Activating Admin Interfaces, Using Admin Interfaces, Customizing Admin Interfaces, Reasons to use Admin Interfaces.	
Form Processing, Creating Feedback forms, Form submissions, custom validation, creating Model Forms, URLConf Ticks, Including Other URLConfs.	
Textbook 1: Chapters 6, 7 and 8	
Laboratory Component:	
<ol style="list-style-type: none"> 1. For student and course models created in Lab experiment for Module2, register admin interfaces, perform migrations and illustrate data entry through admin forms. 2. Develop a Model form for student that contains his topic chosen for project, languages used and duration with a model called project. 	
Teaching-Learning Process	<ol style="list-style-type: none"> 1. Demonstration using Visual Studio Code 2. PPT/Prezi Presentation for Architecture and Design Patterns 3. Live coding of all concepts with simple examples
Module-4: Generic Views and Django State Persistence	
Using Generic Views, Generic Views of Objects, Extending Generic Views of objects, Extending Generic Views.	
MIME Types, Generating Non-HTML contents like CSV and PDF, Syndication Feed Framework, Sitemap framework, Cookies, Sessions, Users and Authentication.	
Textbook 1: Chapters 9, 11 and 12	
Laboratory Component:	
<ol style="list-style-type: none"> 1. For students enrolment developed in Module 2, create a generic class view which displays list of students and detailview that displays student details for any selected student in the list. 2. Develop example Django app that performs CSV and PDF generation for any models created in previous laboratory component. 	
Teaching-Learning Process	<ol style="list-style-type: none"> 1. Demonstration using Visual Studio Code 2. PPT/Prezi Presentation for Architecture and Design Patterns 3. Live coding of all concepts with simple examples 4. Project Work: Implement all concepts learnt for Student Admission Management.

Module-5: jQuery and AJAX Integration in Django	
Ajax Solution, Java Script, XMLHttpRequest and Response, HTML, CSS, JSON, iFrames, Settings of Java Script in Django, jQuery and Basic AJAX, jQuery AJAX Facilities, Using jQuery UI Autocomplete in Django	
Textbook 2: Chapters 1, 2 and 7.	
Laboratory Component:	
<ol style="list-style-type: none"> 1. Develop a registration page for student enrolment as done in Module 2 but without page refresh using AJAX. 2. Develop a search application in Django using AJAX that displays courses enrolled by a student being searched. 	
Teaching-Learning Process	<ol style="list-style-type: none"> 1. Demonstration using Visual Studio Code 2. PPT/Prezi Presentation for Architecture and Design Patterns 3. Live coding of all concepts with simple examples 4. Case Study: Apply the use of AJAX and jQuery for development of EMI calculator.
Course outcome (Course Skill Set)	
<p>At the end of the course the student will be able to:</p> <p>CO 1. Understand the working of MVT based full stack web development with Django.</p> <p>CO 2. Designing of Models and Forms for rapid development of web pages.</p> <p>CO 3. Analyze the role of Template Inheritance and Generic views for developing full stack web applications.</p> <p>CO 4. Apply the Django framework libraries to render nonHTML contents like CSV and PDF.</p> <p>CO 5. Perform jQuery based AJAX integration to Django Apps to build responsive full stack web applications,</p>	
Assessment Details (both CIE and SEE)	
<p>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</p>	
Continuous Internal Evaluation:	
Three Unit Tests each of 20 Marks (duration 01 hour)	
<ol style="list-style-type: none"> 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	
<ol style="list-style-type: none"> 4. First assignment at the end of 4th week of the semester 5. Second assignment at the end of 9th week of the semester 	
<p>Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to 20 marks.</p>	

- 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks

1. Adrian Holovaty, Jacob Kaplan Moss, The Definitive Guide to Django: Web Development Done Right, Second Edition, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG Publishers, 2009
2. Jonathan Hayward, Django Java Script Integration: AJAX and jQuery, First Edition, Pack Publishing, 2011

Reference Books

1. Aidas Bendroraitis, Jake Kronika, Django 3 Web Development Cookbook, Fourth Edition, Packt Publishing, 2020
2. William Vincent, Django for Beginners: Build websites with Python and Django, First Edition, Amazon Digital Services, 2018
3. Antonio Mele, Django3 by Example, 3rd Edition, Pack Publishers, 2020
4. Arun Ravindran, Django Design Patterns and Best Practices, 2nd Edition, Pack Publishers, 2020.
5. Julia Elman, Mark Lavin, Light weight Django, David A. Bell, 1st Edition, Oreilly Publications, 2014

Weblinks and Video Lectures (e-Resources):

1. MVT architecture with Django: <https://freevideolectures.com/course/3700/django-tutorials>
2. Using Python in Django: <https://www.youtube.com/watch?v=2BqoLiMT3Ao>
3. Model Forms with Django: <https://www.youtube.com/watch?v=gMM1rtTwKxE>
4. Real time Interactions in Django: <https://www.youtube.com/watch?v=3gHmfoeZ45k>
5. AJAX with Django for beginners: <https://www.youtube.com/watch?v=3VaKNyjlxAU>

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

1. Real world problem solving - applying the Django framework concepts and its integration with AJAX to develop any shopping website with admin and user dashboards.

VI Semester

COMPUTER GRAPHICS AND FUNDAMENTALS OF IMAGE PROCESSING			
Course Code	21CS63	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Objectives: CLO 1. Overview of Computer Graphics along with its applications. CLO 2. Exploring 2D and 3D graphics mathematics along with OpenGL API's. CLO 3. Use of Computer graphics principles for animation and design of GUI's . CLO 4. Introduction to Image processing and Open CV. CLO 5. Image segmentation using Open CV.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes. <div><div>1.</div><div>Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.</div></div> <div><div>2.</div><div>Use of Video/Animation to explain functioning of various concepts.</div></div> <div><div>3.</div><div>Encourage collaborative (Group Learning) Learning in the class.</div></div> <div><div>4.</div><div>Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div></div> <div><div>5.</div><div>Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.</div></div> <div><div>6.</div><div>Introduce Topics in manifold representations.</div></div> <div><div>7.</div><div>Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.</div></div> <div><div>8.</div><div>Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</div></div>			
Module-1			
Overview: Computer Graphics hardware and software and OpenGL: Computer Graphics: Video Display Devices, Raster-Scan Systems Basics of computer graphics, Application of Computer Graphics.OpenGL: Introduction to OpenGL,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's).			
Textbook 1: Chapter -1,2,3, 5(1 and 2 only) Self-study topics : Input devices, hard copy devices, coordinate representation, graphics functions, fill area primitives, polygon fill areas, pixel arrays, Parallel Line algorithms			
Teaching-Learning Process	Chalk&board,Active Learning Virtual Lab		
Module-2			
2D and 3D graphics with OpenGL: 2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function,			
3D Geometric Transformations: Translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions			

Textbook 1: Chapter -6, 8	
Self-study topics: Transformation between 2D coordinate system, OpenGL geometric-transformation, Transformation between 3D coordinate system.	
Teaching-Learning Process	Chalk & board, Active Learning, Problem based learning Virtual Lab:
Module-3	
Interactive Input Methods and Graphical User Interfaces: Graphical Input Data , Logical Classification of Input Devices, Input Functions for Graphical Data , Interactive Picture-Construction Techniques, Virtual-Reality Environments, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions , Designing a Graphical User Interface.	
Computer Animation : Design of Animation Sequences, Traditional Animation Techniques, General Computer-Animation Functions, Computer-Animation Languages, Character Animation, Periodic Motions, OpenGL Animation Procedures.	
Textbook 1: Chapter -11, 18	
Self-study topics: Raster methods for computer animation, Key frame systems, Motion specification.	
Teaching-Learning Process	Chalk & board, MOOC, Active Learning
Module-4	
Introduction to Image processing: overview, Nature of IP, IP and its related fields, Digital Image representation, types of images.	
Digital Image Processing Operations: Basic relationships and distance metrics, Classification of Image processing Operations.	
Text book 2: Chapter 3	
<i>(Below topics is for experiential learning only , No questions in SEE)</i>	
Computer vision and OpenCV: What is computer vision, Evolution of computer vision, Application of Computer vision, Feature of OpenCV, OpenCV library modules, OpenCV environment, Reading, writing and storing images using OpenCV. OpenCV drawing Functions. OpenCV Geometric Transformations.	
<u>(Note : Computer vision and OpenCV for experimental learning or Activity Based Learning using web sources, Preferred for assignments. No questions in SEE)</u>	
Web Source: https://www.tutorialspoint.com/opencv/	
Teaching-Learning Process	Chalk & board, Problem based learning Lab practice for OpenCV for basic geometric objects and basic image operation
Module-5	
Image Segmentation: Introduction, classification, detection of discontinuities, Edge detection (up to canny edge detection(included)).	
Text Book 2: Chapter 9: 9.1 to 9.4.4.4	
<i>(Below topics is for experiential learning only , No questions in SEE)</i>	
Image processing with Open CV: Resizing , Rotation/ Flipping, Blending, Creating region of Interest (ROI), Image Thresholding, Image Blurring and smoothing, Edge Detection, Image contours and Face Detection on images using OpenCV.	
<u>(Note :Image Processing with OpenCV for experimental learning or Activity Based Learning using web sources, Preferred for assignments. No questions in SEE)</u>	

Web source: <https://medium.com/analytics-vidhya/introduction-to-computer-vision-opencv-in-python-fb722e805e8b>

Teaching-Learning Process	Chalk & board, MOOC Lab practice on image processing. Virtual Lab:
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Course Outcomes:

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

- CO 1. Construct geometric objects using Computer Graphics principles and OpenGL APIs.
- CO 2. Use OpenGL APIs and related mathematics for 2D and 3D geometric Operations on the objects.
- CO 3. Design GUI with necessary techniques required to animate the created objects
- CO 4. Apply OpenCV for developing Image processing applications.
- CO 5. Apply Image segmentation techniques along with programming, using OpenCV, for developing simple 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

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 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books

1. Donald D Hearn, M Pauline Baker and Warren Carithers: Computer Graphics with OpenGL 4th Edition, Pearson, 2014

2. S. Sridhar, Digital Image Processing, second edition, Oxford University press 2016.

Reference Books

1. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson education

Web links and Video Lectures (e-Resources):

Web links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/106/106/106106090/>
2. <https://nptel.ac.in/courses/106/102/106102063/>
3. <https://nptel.ac.in/courses/106/103/106103224/>
4. <https://nptel.ac.in/courses/106/102/106102065/>
5. <https://www.tutorialspoint.com/opencv/> (Tutorial, Types of Images, Drawing Functions)

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

2. Mini project on computer graphics using Open GL/Python/Open CV.

VI Semester

DESIGN OF IOT SYSTEMS			
Course Code	21CD641	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Define and explain basic issues, policy and challenges in the IoT			
CLO 2. Illustrate Mechanism and Key Technologies in IoT			
CLO 3. Explain the Standard of the IoT			
CLO 4. Describe IoT design methodologies			
CLO 5. Demonstrate data analytics for IoT			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.			
1. Lecture method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.			
2. Use of Video/Animation to explain functioning of various concepts.			
3. Encourage collaborative (Group Learning) Learning in the class.			
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.			
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.			
6. Introduce Topics in manifold representations.			
7. 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 Internet of Things(IoT): What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation.			
Internet of Things Definitions and frameworks:- IoT Definitions, IoT Frameworks, Basic Nodal Capabilities.			
Internet of Things Application Examples:- Overview, Smart Metering/Advanced Metering Infrastructure e-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.			
Text book 1: Chapter 1, Chapter 2 and Chapter 3			
Teaching-Learning Process	Chalk and board, Active Learning, Collaborative Learning		
Module-2			
Fundamental IoT Mechanism and Key Technologies:- Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies.			
Evolving IoT Standards:- Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zigbee IP(ZIP),IPSO.			

Text book 1: Chapter 4 and Chapter 5	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-3	
<p>Layer 12 Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M.</p> <p>Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities,IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6,Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.</p>	
Text book 1: Chapter 6 and Chapter 7	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
<p>IoT Platforms Design Methodology: IoT Design Methodology,</p> <p>IoT System-logical design using python: Python data types and data structures, control flow, functions, modules, python packages of interest for IoT.</p> <p>IoT Physical servers and cloud offerings: Python web application framework, Amazon web services for IoT.</p>	
Text book 2: Chapter 5- 5.1, 5.2, Chapter 6- 6.1,6.3,6.4,6.5,6.6,6.11 and Chapter 8-8.4,8.6	
Teaching-Learning Process	Chalk& board, Project based learning and Collaborative Learning
Module-5	
<p>Data Analytics for IoT: Introduction, Apache Hadoop, Using Hadoop Map Reduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.</p>	
Text Book 2: Chapter 10	
Teaching-Learning Process	Chalk& board, Project based learning and Collaborative Learning
<p>Course Outcomes</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> CO 1. Develop schemes for the applications of IoT in real time scenarios CO 2. Accomplish the Internet resources required for IoT CO 3. Model & design the Internet of things to business CO 4. Demonstrate the practical knowledge through different case studies CO 5. Implement data sets received through IoT devices and tools used for analysis 	
<p>Assessment Details (both CIE and SEE)</p> <p>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</p> <p>Continuous Internal Evaluation:</p> <p>Three Unit Tests each of 20 Marks (duration 01 hour)</p> <ol style="list-style-type: none"> 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 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Wiley, 2013.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands on Approach" Universities Press., 2015

Reference:

1. Michael Miller, "The Internet of Things", First Edition, Pearson, 2015.
2. Claire Rowland, Elizabeth Goodman et.al., "Designing Connected Products", First Edition, O'Reilly, 2015.

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/106/105/106105166/>
- <https://nptel.ac.in/courses/106/105/106105195/>
- <https://www.youtube.com/watch?v=unlPb-dfW7s>
- <https://www.coursera.org/lecture/iot/lecture-1-2-iot-devices-BYmZZ>
- <https://ocw.cs.pub.ro/courses/iot/courses/01>
- <https://freevideolectures.com/course/4638/nptel-introduction-internet-things/1>
- <https://freevideolectures.com/course/4638/nptel-introduction-internet-things/2>
- <https://freevideolectures.com/course/4638/nptel-introduction-internet-things/3>
- <https://freevideolectures.com/course/4638/nptel-introduction-internet-things/4>

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

VI Semester

ADVANCED JAVA PROGRAMMING			
Course Code	21CS642	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Understanding the fundamental concepts of Enumerations and Annotations			
CLO 2. Apply the concepts of Generic classes in Java programs			
CLO 3. Demonstrate the fundamental concepts of String operations			
CLO 4. Design and develop web applications using Java servlets and JSP			
CLO 5. Apply database interaction through Java database Connectivity			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<div><div>1.</div><div>Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.</div></div> <div><div>2.</div><div>Use of Video/Animation to explain functioning of various concepts.</div></div> <div><div>3.</div><div>Encourage collaborative (Group Learning) Learning in the class.</div></div> <div><div>4.</div><div>Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div></div> <div><div>5.</div><div>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.</div></div> <div><div>6.</div><div>Introduce Topics in manifold representations.</div></div> <div><div>7.</div><div>Show the different ways to solve the same program</div></div> <div><div>8.</div><div>Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</div></div>			
Module-1			
Enumerations, Autoboxing and Annotations:			
Enumerations, Enumeration fundamentals, the values() and valueOf() methods, Java enumerations are class types, enumerations inherits Enum, example, type wrappers, Autoboxing, Autoboxing methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of warning			
Annotations, Annotation basics, specifying retention policy, obtaining annotations at run time by use of reflection, Annotated element interface, Using default values, Marker Annotations, Single member annotations, Built in annotations			
Textbook 1: Chapter12			
Teaching-Learning Process	Chalk and board, Online demonstration, Problem based learning		
Module-2			
Generics: What are Generics, A Simple Generics Example, A Generic Class with Two Type Parameters, The General Form of a Generic Class, Bounded Types, Using Wildcard Arguments, Bounded Wildcards, Creating a Generic Method, Generic Interfaces, Raw types and Legacy code, Generic Class Hierarchies, Erasure, Ambiguity errors, Some Generic Restrictions			
Textbook 1: Chapter 14			
Teaching-Learning Process	Chalk and board, Online Demonstration		
Module-3			
String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf(), Changing the			

case of characters within a String, String Buffer, String Builder

Textbook 1: Chapter 15

Teaching-Learning Process	Chalk and board, Online Demonstration
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Module-4

Background; The life cycle of a servlet; A simple servlet; the servlet API; The javax.servlet package
Reading servlet parameter; the javax.servlet.http package; Handling HTTP Requests and Responses; using
Cookies; Session Tracking, Java Server Pages (JSP); JSP tags, Variables and Objects, Methods, Control
statements, Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects

Textbook 1: Chapter 31

Textbook 2: Chapter 11

Teaching-Learning Process	Chalk and board, Online Demonstration
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Module-5

The concept of JDBC; JDBC Driver Types; JDBC packages; A brief overview of the JDBC Process; Database
Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet;
Transaction Processing; Metadata, Data Types; Exceptions.

Textbook 2: Chapter 6

Teaching-Learning Process	Chalk and board, Online Demonstration
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Course Outcomes

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

- CO 1. Understanding the fundamental concepts of Enumerations and Annotations
- CO 2. Apply the concepts of Generic classes in Java programs
- CO 3. Demonstrate the concepts of String operations in Java
- CO 4. Develop web based applications using Java servlets and JSP
- CO 5. Illustrate database interaction and transaction processing in Java

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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks

1. Herbert Schildt: JAVA the Complete Reference. 9th Edition, Tata McGraw-Hill
2. Jim Keogh, The Complete Reference J2EE, Tata McGraw-Hill

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.

Weblinks and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. <https://nptel.ac.in/courses/106/105/106105225/>

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

- Programming exercises

VI Semester

ADVANCED COMPUTER ARCHITECTURE			
Course Code	21CS643	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Describe computer architecture.			
CLO 2. Measure the performance of architectures in terms of right parameters.			
CLO 3. Summarize parallel architecture and the software used for them			
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 program			
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			
Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer, Multivector and SIMD Computers, PRAM and VLSI Models, Program and Network Properties, Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup			
Performance Laws. For all Algorithm or mechanism any one example is sufficient.			
Chapter 1 (1.1to 1.4), Chapter 2(2.1 to 2.4) Chapter 3 (3.1 to 3.3)			
Teaching-Learning Process	Chalk and board, Online demonstration, Problem based learning		
Module-2			
Hardware Technologies 1: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology. For all Algorithms or mechanisms any one example is sufficient.			
Chapter 4 (4.1 to 4.4)			
Teaching-Learning Process	Chalk and board, Online Demonstration		
Module-3			
Hardware Technologies 2: Bus Systems, Cache Memory Organizations, Shared Memory Organizations, Sequential and Weak Consistency Models, Pipelining and Superscalar Techniques, Linear Pipeline Processors, Nonlinear Pipeline Processors. For all Algorithms or mechanisms any one example is sufficient.			
Chapter 5 (5.1 to 5.4) Chapter 6 (6.1 to 6.2)			

Teaching-Learning Process	Chalk and board, Online Demonstration
Module-4	
Parallel and Scalable Architectures: Multiprocessors and Multicomputers, Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Message-Passing Mechanisms, Multivector and SIMD Computers, Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine- Grain Multicomputers. For all Algorithms or mechanisms any one example is sufficient.	
Chapter 7 (7.1,7.2 and 7.4) Chapter 8(8.1 to 8.3) Chapter 9(9.1 to 9.3)	
Teaching-Learning Process	Chalk and board, Online Demonstration
Module-5	
Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays. Instruction and System Level Parallelism, Instruction Level Parallelism, Computer Architecture, Contents, Basic Design Issues, Problem Definition, Model of a Typical Processor, Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder Buffer, Register Renaming ,Tomasulo's Algorithm. For all Algorithms or mechanisms any one example is sufficient.	
Chapter 10(10.1 to 10.3) Chapter 12(12.1 to 12.9)	
Teaching-Learning Process	Chalk and board, Online Demonstration
Course Outcomes	
At the end of the course the student will be able to:	
CO 1. Explain the concepts of parallel computing CO 2. Explain and identify the hardware technologies CO 3. Compare and contrast the parallel architectures CO 4. Illustrate parallel programming concepts	
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 5 th week of the semester 2. Second test at the end of the 10 th week of the semester 3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester 5. Second assignment at the end of 9 th 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 13 th 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.	

<p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p>
<p>Textbooks</p> <ol style="list-style-type: none"> 1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elsevier, 2013
<p>Weblinks and Video Lectures (e-Resources):</p>
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p>

VI Semester

DATA SCIENCE AND VISUALIZATION			
Course Code	21CS644	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. To introduce data collection and pre-processing techniques for data science			
CLO 2. Explore analytical methods for solving real life problems through data exploration techniques			
CLO 3. Illustrate different types of data and its visualization			
CLO 4. Find different data visualization techniques and tools			
CLO 5. Design and mapelement of visualization well to perceive information			
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			
Introduction to Data Science			
Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Whynow? – Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference:Populationsandsamples,Statisticalmodelling,probabilitydistributions,fittingamodel.			
Textbook 1: Chapter 1			
Teaching-Learning Process	1. PPT – Recognizing different types of data, Data science process		
	2. Demonstration of different steps, learning definition and relation with data science		
Module-2			
Exploratory Data Analysis and the Data Science Process			
Basic tools (plots, graphs and summarystatistics)ofEDA,PhilosophyofEDA, TheDataScienceProcess,CaseStudy:Real Direct(onlinerealestatefirm).ThreeBasicMachineLearningAlgorithms:LinearRegression,k-NearestNeighbours(k-NN),k-means.			
Textbook 1: Chapter 2, Chapter 3			
Teaching-Learning Process	1. PPT –Plots, Graphs, Summary Statistics		
	2. Demonstration of Machine Learning Algorithms		

Module-3	
Feature Generation and Feature Selection Extracting Meaning from Data: Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system.	
Textbook 1: Chapter 6	
Teaching-Learning Process	1. PPT – Feature generation, selection 2. Demonstration recommendation engine
Module-4	
Data Visualization and Data Exploration Introduction: Data Visualization, Importance of Data Visualization, Data Wrangling, Tools and Libraries for Visualization Comparison Plots: Line Chart, Bar Chart and Radar Chart; Relation Plots: Scatter Plot, Bubble Plot, Correlogram and Heatmap; Composition Plots: Pie Chart, Stacked Bar Chart, Stacked Area Chart, Venn Diagram; Distribution Plots: Histogram, Density Plot, Box Plot, Violin Plot; Geo Plots: Dot Map, Choropleth Map, Connection Map; What Makes a Good Visualization? Textbook 2: Chapter 1, Chapter 2	
Teaching-Learning Process	1. Demonstration of different data visualization tools.
Module-5	
A Deep Dive into Matplotlib Introduction, Overview of Plots in Matplotlib, Pyplot Basics: Creating Figures, Closing Figures, Format Strings, Plotting, Plotting Using pandas DataFrames, Displaying Figures, Saving Figures; Basic Text and Legend Functions: Labels, Titles, Text, Annotations, Legends; Basic Plots: Bar Chart, Pie Chart, Stacked Bar Chart, Stacked Area Chart, Histogram, Box Plot, Scatter Plot, Bubble Plot; Layouts: Subplots, Tight Layout, Radar Charts, GridSpec; Images: Basic Image Operations, Writing Mathematical Expressions Textbook 2: Chapter 3	
Teaching-Learning Process	1. PPT – Comparison of plots 2. Demonstration charts
Course Outcomes At the end of the course the student will be able to: CO 1. Understand the data in different forms CO 2. Apply different techniques to Explore Data Analysis and the Data Science Process CO 3. Analyze feature selection algorithms & design a recommender system. CO 4. Evaluate data visualization tools and libraries and plot graphs. CO 5. Develop different charts and include mathematical expressions.	
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)	

<ol style="list-style-type: none"> 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 <p>Two assignments each of 10 Marks</p> <ol style="list-style-type: none"> 4. First assignment at the end of 4th week of the semester 5. Second assignment at the end of 9th week of the semester <p>Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)</p> <ol style="list-style-type: none"> 6. At the end of the 13th week of the semester <p>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).</p> <p>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.</p> <p>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)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p> <p>Textbooks</p> <ol style="list-style-type: none"> 1. DoingDataScience, Cathy O'Neil and Rachel Schutt, O'Reilly Media, Inc O'Reilly Media, Inc, 2013 2. Data Visualization workshop, Tim Grobmann and Mario Dobler, Packt Publishing, ISBN 9781800568112 <p>Reference:</p> <ol style="list-style-type: none"> 1. MiningofMassiveDatasets, Anand Rajaraman andJeffrey D. Ullman, CambridgeUniversityPress, 2010 2. Data Science from Scratch, Joel Grus, Shroff Publisher /O'Reilly Publisher Media 3. A handbook for data driven design by Andy krik
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/106/105/106105077/ 2. https://www.oreilly.com/library/view/doing-data-science/9781449363871/toc01.html 3. http://book.visualisingdata.com/ 4. https://matplotlib.org/ 5. https://docs.python.org/3/tutorial/ 6. https://www.tableau.com/
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning Demonstration using projects</p>

VI Semester

INTRODUCTION TO DATA STRUCTURES			
Course Code	21CS651	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Introduce elementary data structures.			
CLO 2. Analyze Linear Data Structures: Stack, Queues, Lists			
CLO 3. Analyze Non Linear Data Structures: Trees			
CLO 4. Assess appropriate data structure during program development/Problem Solving.			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<ol style="list-style-type: none">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.			
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:			
Introduction to arrays: one-dimensional arrays, two dimensional arrays, initializing two dimensional arrays, Multidimensional arrays.			
Introduction to Pointers: Pointer concepts, accessing variables through pointers, Dynamic memory allocation, pointers applications.			
Introduction to structures and unions: Declaring structures, Giving values to members, structure initialization, arrays of structures, nested structure, unions, size of structures.			
Textbook 1: Ch 8.3 to 8.15,Ch 12.3 to 12.19			
Textbook 2:Ch 2.1 to 2.13,2.51 ,2.80 to 2.98			
Teaching-Learning Process	Chalk and board, Active Learning		
Module-2			
Linear Data Structures-Stacks and queues:			
Introduction, Stack representation in Memory, Stack Operations, Stack Implementation, Applications of Stack. Introduction, Queues-Basic concept, Logical representation of Queues, Queue Operations and its types, Queue Implementation, Applications of Queue.			
Textbook 2: Ch 6.1 to 6.14 ,Ch 8.1,8.2			
Teaching-Learning Process	Chalk and board, Active Learning, Problem Based Learning		
Module-3			
Linear Data Structures-Linked List:			
Introduction, Linked list Basic concept, Logical representation of Linked list, Self-Referential structure, Singly-linked List Operations and Implementation, Circular Linked List, applications of Linked list.			

Textbook 1: Ch 15.1,15.3,15.4,15.8	
Textbook 2: Ch 9.2.9.5	
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning
Module-4	
Non Linear Data Structures – Trees	
Introduction, Basic concept, Binary Tree and its types, Binary Tree Representation, Binary Tree Traversal, Binary Search tree, Expression Trees.	
Textbook1: Ch 16.1,16.2	
Textbook2:Ch 10.1,10.2,10.4,10.6.3	
Teaching-Learning Process	Chalk& board, Active Learning, Problem based learning
Module-5	
Sorting and Searching	
Sorting: Introduction, Bubble sort, Selection sort, Insertion sort	
Searching: Introduction, Linear search, Binary search.	
Textbook1: Ch 17.1,17.2.2, 17.2.4, 17.3.1,17.3.2	
Textbook2: Ch 11.1.,11.2,11.3,11.7,11.10.1,11.10.2	
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning
Course Outcomes	
At the end of the course the student will be able to:	
CO 1. Express the fundamentals of static and dynamic data structure.	
CO 2. Summarize the various types of data structure with their operations.	
CO 3. Interpret various searching and sorting techniques.	
CO 4. Choose appropriate data structure in problem solving.	
CO 5. Develop all data structures in a high level language for problem solving.	
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 5 th week of the semester	
2. Second test at the end of the 10 th week of the semester	
3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester	
5. Second assignment at the end of 9 th 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 13 th 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks

1. C Programming and data structures, E Balaguruswamy 4th Edition, 2007, McGraw Hill
2. Systematic approach to Data structures using C, A M Padma Reddy, 7th Edition 2007, Sri Nandi Publications.

References

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

Weblinks and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=DFpWCl_49i0
2. <https://www.youtube.com/watch?v=x7t-ULoAZM>
3. <https://www.youtube.com/watch?v=I37kGX-nZEI>
4. <https://www.youtube.com/watch?v=XuCbpw6Bj1U>
5. <https://www.youtube.com/watch?v=R9PTBwOzceo>
6. <https://www.youtube.com/watch?v=qH6yxkw0u78>

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

Demonstration of projects developed using Linear/Non-linear data structures

VI Semester

INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS			
Course Code	21CS652	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Understand the basic concepts and the applications of database systems.			
CLO 2. Understand the relational database design principles.			
CLO 3. Master the basics of SQL and construct queries using SQL.			
CLO 4. Familiar with the basic issues of transaction processing and concurrency control.			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<ol style="list-style-type: none">1. Lecturer method (L) need not 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 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, develops 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			
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.			
Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.			
Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams,Examples			
Textbook 1: Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.7			
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning		
Module-2			
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.			
Relational Algebra: Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Examples of Queries in relational algebra.			
Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.			
Textbook 1:,ch5.1 to 5.3, 8.1 to 8.5, 9.1;			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration		

Module-3	
SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.	
Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.Database	
Textbook 1: Ch 6.1 to 6.5, 7.1 to 7.4; Textbook 2: 6.1 to 6.6;	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.	
Textbook 1: Ch 14.1 to -14.7, 15.1 to 15.6	
Teaching-Learning Process	Chalk& board, Problem based learning
Module-5	
Transaction management and Concurrency –Control Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management.	
Textbook 1: Ch 20.1 to 20.6, 21.1 to 21.7;	
Teaching-Learning Process	Chalk and board, MOOC
Course Outcomes At the end of the course the student will be able to: <ul style="list-style-type: none"> CO 1. Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS CO 2. Use Structured Query Language (SQL) for database manipulation. CO 3. Design and build simple database systems CO 4. Develop application to interact with databases. 	
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). 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) <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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) <ol style="list-style-type: none"> 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks

1. Fundamentals of Database Systems, RamezElmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Weblinks and Video Lectures (e-Resources):

1. <https://www.youtube.com/watch?v=3EJlovevfcA>
2. <https://www.youtube.com/watch?v=9TwMRs3qTcU>
3. <https://www.youtube.com/watch?v=ZWl0Xow304I>
4. <https://www.youtube.com/watch?v=4YilEjkNPrQ>
5. <https://www.youtube.com/watch?v=CZTkgMoqVss>
6. <https://www.youtube.com/watch?v=Hl4NZB1XR9c>
7. https://www.youtube.com/watch?v=EGEWkad_IIA
8. <https://www.youtube.com/watch?v=t5hsV9JC1rU>

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

Real world problem solving: Developing and demonstration of models / projects based on DBMS application

VI Semester

INTRODUCTION TO CYBER SECURITY			
Course Code	21CS653	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. To familiarize cybercrime terminologies and ACTs			
CLO 2. Understanding cybercrime in mobiles and wireless devices along with the tools for Cybercrime and prevention			
CLO 3. Understand the motive and causes for cybercrime, cybercriminals, and investigators			
CLO 4. Understanding criminal case and evidence, detection standing criminal case and evidence.			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<ol style="list-style-type: none">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			
Introduction to Cybercrime:			
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes,			
Cybercrime: The Legal Perspectives,			
Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000.			
Textbook1:Ch1 (1.1 to 1.8).			
Teaching-Learning Process	Chalk and board, Active Learning		
Module-2			
Cyber offenses:			
How Criminals Plan Them: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cybercafe and Cybercrimes.			
Botnets: The Fuel for Cybercrime, Attack Vector			
Textbook1: Ch2 (2.1 to 2.7).			
Teaching-Learning Process	Chalk and board, Active Learning		
Module-3			
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, Attacks on Wireless Networks.			

Textbook1: Ch4 (4.1 to 4.9, 4.12).	
Teaching-Learning Process	Chalk and board, Case studies
Module-4	
<p>Understanding the people on the scene: Introduction, understanding cyber criminals, understanding cyber victims, understanding cyber investigators.</p> <p>The Computer Investigation process: investigating computer crime.</p> <p>Understanding Cybercrime Prevention: Understanding Network Security Concepts, Understanding Basic Cryptography Concepts, Making the Most of Hardware and Software Security</p>	
Textbook 2:Ch3,Ch 4, Ch 7.	
Teaching-Learning Process	Chalk& board, Case studies
Module-5	
<p>Cybercrime Detection Techniques: Security Auditing and Log Firewall Logs, Reports, Alarms, and Alerts, Commercial Intrusion Detection Systems, Understanding E-Mail Headers Tracing a Domain Name or IP Address.</p> <p>Collecting and preserving digital Evidence: Introduction, understanding the role of evidence in a criminal case, collecting digital evidence, preserving digital evidence, recovering digital evidence, documenting evidence.</p>	
TextBook 2:Ch 9, Ch 10.	
Teaching-Learning Process	Chalk and board, Case studies
<p>Course Outcomes</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> CO 1. Describe the cyber crime terminologies CO 2. Analyze cybercrime in mobiles and wireless devices along with the tools for Cybercrime and prevention CO 3. Analyze the motive and causes for cybercrime, cybercriminals, and investigators CO 4. Apply the methods for understanding criminal case and evidence, detection standing criminal case and evidence. 	
<p>Assessment Details (both CIE and SEE)</p> <p>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</p> <p>Continuous Internal Evaluation:</p> <p>Three Unit Tests each of 20 Marks (duration 01 hour)</p> <ol style="list-style-type: none"> 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 <p>Two assignments each of 10 Marks</p> <ol style="list-style-type: none"> 4. First assignment at the end of 4th week of the semester 5. Second assignment at the end of 9th week of the semester <p>Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)</p> <ol style="list-style-type: none"> 6. At the end of the 13th week of the semester <p>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</p> <p>(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).</p>	

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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2013
2. Debra Little John Shinder and Michael Cross, "Scene of the cybercrime", 2nd edition, Syngress publishing Inc, Elsevier Inc, 2008

Reference Books:

1. Robert M Slade, "Software Forensics", Tata McGraw Hill, New Delhi, 2005.
2. Bernadette H Schell, Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004.
3. Nelson Phillips and Enfinger Stuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.
4. Kevin Mandia, Chris Proise, Matt Pepe, "Incident Response and Computer Forensics", Tata McGraw -Hill, New Delhi, 2006.

Weblinks and Video Lectures (e-Resources):

1. <https://www.youtube.com/watch?v=czDzUP1HclQ>
2. <https://www.youtube.com/watch?v=qS4ViqnjK8>
3. https://www.trendmicro.com/en_nz/ciso/21/h/cybercrime-today-and-the-future.html

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

Real world problem solving: Demonstration of projects related to Cyber security.

VI Semester

PROGRAMMING IN JAVA			
Course Code	21CS654	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Learn fundamental features of object oriented language and JAVA.			
CLO 2. To create, debug and run simple Java programs.			
CLO 3. Learn object oriented concepts using programming examples.			
CLO 4. Study the concepts of importing of packages and exception handling mechanism.			
CLO 5. Discuss the String Handling examples with Object Oriented concepts.			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<div>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.</div> <div>2. Use of Video/Animation to explain functioning of various concepts.</div> <div>3. Encourage collaborative (Group Learning) Learning in the class.</div> <div>4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div> <div>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.</div> <div>6. Introduce Topics in manifold representations.</div> <div>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.</div> <div>8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</div>			
Module-1			
An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries.			
Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings			
Textbook 1:Ch 2,Ch 3.			
Teaching-Learning Process	Chalk and board, Problem based learning.		
Module-2			
Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses,			
Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements.			
Textbook 1:Ch 4,Ch 5.			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration		
Module-3			
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize() Method, A Stack Class.			
A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding			

static, Introducing final, Arrays Revisited. Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding.	
Textbook 1: Ch 6, Ch 7.1-7.9, Ch 8.1-8.5	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces.	
Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions	
Textbook 1: Ch 9, Ch 10.	
Teaching-Learning Process	Chalk& board, Problem based learning, Demonstration
Module-5	
Enumerations : Enumerations, Type Wrappers.	
String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf(), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer, StringBuilder.	
Textbook 1: Ch 12.1, 12.2, Ch 15.	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Course Outcomes At the end of the course the student will be able to: <ul style="list-style-type: none"> CO 1. Develop JAVA programs using OOP principles and proper program structuring. CO 2. Develop JAVA program using packages, inheritance and interface. CO 3. Develop JAVA programs to implement error handling techniques using exception handling CO 4. Demonstrate string handling concepts using JAVA. 	
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) <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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) <ol style="list-style-type: none"> 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:	

<p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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 <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
Suggested Learning Resources:
<p>Textbooks</p> <ol style="list-style-type: none"> 1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15) <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Mahesh Bhavde and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2008, ISBN: 9788131720806. 2. Rajkumar Buyya, S. Thamaraiselvi, Xingchen Chu, Object oriented Programming with Java, Tata McGraw Hill Education Private Limited. 3. E. Balagurusamy, Programming with Java A primer, Tata McGraw Hill Companies. 4. Anita Sethi and B. L. Juneja, JAVA One step Ahead, Oxford University Press, 2017.
Weblinks and Video Lectures (e-Resources):
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <p>Real world problem solving: Demonstration of projects developed using JAVA</p>

VI Semester

COMPUTER GRAPHICS AND IMAGE PROCESSING LABORATORY			
Course Code	21CSL66	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	24	Total Marks	100
Credits	1	Exam Hours	03
Course Objectives: CLO 1: Demonstrate the use of Open GL. CLO 2: Demonstrate the different geometric object drawing using OpenGL CLO 3: Demonstration of 2D/3D transformation on simple objects. CLO 4: Demonstration of lighting effects on the created objects. CLO 5: Demonstration of Image processing operations on image/s.			
Sl. No.	Practise Programs		
	<ul style="list-style-type: none"> • Installation of OpenGL /OpenCV/ Python and required headers • Simple programs using OpenGL (Drawing simple geometric object like line, circle, rectangle, square) • Simple programs using OpenCV (operation on an image/s) 		
	PART A <i>List of problems for which student should develop program and execute in the Laboratory using OpenGL/openCV/ Python</i>		
1.	Develop a program to draw a line using Bresenham's line drawing technique		
2.	Develop a program to demonstrate basic geometric operations on the 2D object		
3.	Develop a program to demonstrate basic geometric operations on the 3D object		
4.	Develop a program to demonstrate 2D transformation on basic objects		
5.	Develop a program to demonstrate 3D transformation on 3D objects		
6.	Develop a program to demonstrate Animation effects on simple objects.		
7.	Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left.		
8.	Write a program to show rotation, scaling, and translation on an image.		
9.	Read an image and extract and display low-level features such as edges, textures using filtering techniques.		
10.	Write a program to blur and smoothing an image.		
11.	Write a program to contour an image.		
12.	Write a program to detect a face/s in an image.		
	PART B Practical Based Learning		
	Student should develop a mini project and it should be demonstrate in the laboratory examination, Some of the projects are listed and it is not limited to: <ul style="list-style-type: none"> ➤ Recognition of License Plate through Image Processing ➤ Recognition of Face Emotion in Real-Time ➤ Detection of Drowsy Driver in Real-Time ➤ Recognition of Handwriting by Image Processing ➤ Detection of Kidney Stone ➤ Verification of Signature ➤ Compression of Color Image ➤ Classification of Image Category ➤ Detection of Skin Cancer ➤ Marking System of Attendance using Image Processing ➤ Detection of Liver Tumor ➤ IRIS Segmentation ➤ Detection of Skin Disease and / or Plant Disease ➤ Biometric Sensing System . ➤ Projects which helps to formers to understand the present developments in agriculture. ➤ Projects which helps high school/college students to understand the scientific problems. 		

	➤ Simulation projects which helps to understand innovations in science and technology
Course Outcome (Course Skill Set) At the end of the course the student will be able to: <ul style="list-style-type: none"> CO 1: Use openGL /OpenCV for the development of mini Projects. CO 2: Analyze the necessity mathematics and design required to demonstrate basic geometric transformation techniques. CO 3: Demonstrate the ability to design and develop input interactive techniques. CO 4: Apply the concepts to Develop user friendly applications using Graphics and IP concepts. 	
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): 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 . <ul style="list-style-type: none"> • 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 down to 30 marks (60% of maximum marks). • Weightage to be given for neatness and submission of record/write-up on time. • Department shall conduct 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): <ul style="list-style-type: none"> • 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.
- **PART B** : Student should develop a mini project and it should be demonstrated in the laboratory examination (with report and presentation).
- Weightage of marks for **PART A is 60%** and for **PART B is 40%**. General rubrics suggested to be followed for part A and part B.
- Change of experiment is allowed only once (in part A) and marks allotted to the procedure part to be made zero.
- The duration of SEE is 03 hours.

Suggested Learning Resources:

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd/4th Edition, Pearson Education,2011
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson education

Weblinks and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/106/106/106106090/>
2. <https://nptel.ac.in/courses/106/102/106102063/>
3. <https://nptel.ac.in/courses/106/103/106103224/>
4. <https://nptel.ac.in/courses/106/102/106102065/>
5. <https://www.tutorialspoint.com/opencv/>
6. <https://medium.com/analytics-vidhya/introduction-to-computer-vision-opencv-in-python-fb722e805e8b>

VII Semester

ROBOTIC PROCESS AUTOMATION DESIGN AND DEVELOPMENT			
Course Code	21CD71	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
Course Learning Objectives			
CLO 1. To understand basic concepts of RPA			
CLO 2. To Describe RPA, where it can be applied and how its implemented			
CLO 3. To Describe the different types of variables, Control Flow and data manipulation techniques			
CLO 4. To Understand Image, Text and Data Tables Automation			
CLO 5. To Describe various types of Exceptions and strategies to handle			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<div>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.</div> <div>2. Use of Video/Animation to explain functioning of various concepts.</div> <div>3. Encourage collaborative (Group Learning) Learning in the class.</div> <div>4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div> <div>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.</div> <div>6. Introduce Topics in manifold representations.</div> <div>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.</div> <div>8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</div>			
Module-1			
RPA Foundations- What is RPA – Flavors of RPA- History of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- OCR-Databases-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 DevOps-Flowcharts.			
Textbook 1: Ch 1, Ch 2			
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning		
Module-2			
RPA Platforms- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by-step examples using the recorder.			
Textbook 2: Ch 1, Ch 2			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration		
Module-3			
Sequence, Flowchart, and Control Flow- Sequencing the workflow-Activities-Control flow, various types of loops, and decision making-Step-by-step example using Sequence and Flowchart-Step-by-step			

<p>example using Sequence and Control flow-Data Manipulation-Variables and Scope-Collections-Arguments – Purpose and use-Data table usage with examples-Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).</p> <p>Textbook 2: Ch 3, Ch 4</p>	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
<p>Taking Control of the Controls- Finding and attaching windows- Finding the control- Techniques for waiting for a control- Act on controls – mouse and keyboard activities- Working with UiExplorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points.</p> <p>Textbook 2: Ch 5</p>	
Teaching-Learning Process	Chalk& board, Problem based learning
Module-5	
<p>Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screensHOT- Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA</p> <p>Textbook 2: Ch 8 Textbook 1: Ch 13</p>	
Teaching-Learning Process	Chalk and board, MOOC
<p>Course Outcomes</p> <p>CO 1. To Understand the basic concepts of RPA CO 2. To Describe various components and platforms of RPA CO 3. To Describe the different types of variables, control flow and data manipulation techniques CO 4. To Understand various control techniques and OCR in RPA CO 5. To Describe various types and strategies to handle exceptions</p>	
<p>Assessment Details (both CIE and SEE)</p> <p>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</p> <p>Continuous Internal Evaluation:</p> <p>Three Unit Tests each of 20 Marks (duration 01 hour)</p> <ol style="list-style-type: none"> 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 <p>Two assignments each of 10 Marks</p> <ol style="list-style-type: none"> 4. First assignment at the end of 4th week of the semester 5. Second assignment at the end of 9th week of the semester <p>Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)</p> <ol style="list-style-type: none"> 6. At the end of the 13th week of the semester <p>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</p>	

<p>methods of the CIE. Each method of CIE should have a different syllabus portion of the course).</p> <p>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.</p> <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p> <p>Textbooks</p> <ol style="list-style-type: none"> 1. Tom Taulli , The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems, 2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher : Apress 2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940 <p>Reference:</p> <ol style="list-style-type: none"> 1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation. 2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant 3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
<p>Weblinks and Video Lectures (e-Resources):</p> <ul style="list-style-type: none"> • https://www.uipath.com/rpa/robotic-process-automation
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p>

VII Semester

CLOUD COMPUTING			
Course Code	21CS72	CIEMarks	50
Teaching Hours/Week (L:T:P: S)	2:0:0:0	SEEMarks	50
Total Hours of Pedagogy	24	TotalMarks	100
Credits	02	Exam Hours	03
Course Learning Objectives:			
CLO 1. Introduce the rationale behind the cloud computing revolution and the business drivers			
CLO 2. Introduce various models of cloud computing			
CLO 3. Introduction on how to design cloud native applications, the necessary tools and the design tradeoffs.			
CLO 4. Realize the importance of Cloud Virtualization, Abstraction`s and Enabling Technologies and cloud security			
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:			
Introduction ,Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka			
Textbook 1: Chapter 1: 1.1,1.2 and 1.3			
Teaching-Learning Process	Chalk and board, Active Learning		
Module-2			
Virtualization: Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples			
Textbook 1 : Chapter 3: 3.1 to 3.6			
Teaching-Learning Process	Chalk and board, Active Learning		
Module-3			
Cloud Computing Architecture: Introduction, Cloud Reference Model, Types of Clouds, Economics of the Cloud, Open Challenges			
Textbook 1: Chapter 4: 4.1 to 4.5			

Teaching-Learning Process	Chalk and board, Demonstration
Module-4	
Cloud Security: Risks, Top concern for cloud users, privacy impact assessment, trust, OS security, VM Security, Security Risks posed by shared images and management OS.	
Textbook 2: Chapter 9: 9.1 to 9.6, 9.8, 9.9	
Teaching-Learning Process	Chalk and board
Module-5	
Cloud Platforms in Industry Amazon web services: - Compute services, Storage services, Communication services, Additional services. Google AppEngine: - Architecture and core concepts, Application life cycle, Cost model, Observations.	
Textbook 1: Chapter 9: 9.1 to 9.2	
Cloud Applications: Scientific applications: - HealthCare: ECG analysis in the cloud, Biology: gene expression data analysis for cancer diagnosis, Geoscience: satellite image processing. Business and consumer applications: CRM and ERP, Social networking, media applications.	
Textbook 1: Chapter 10: 10.1 to 10.2	
Teaching-Learning Process	Chalk and board
Course outcome (Course Skill Set) At the end of the course the student will be able to: <ul style="list-style-type: none"> CO 1. Understand and analyze various cloud computing platforms and service provider. CO 2. Illustrate various virtualization concepts. CO 3. Identify the architecture, infrastructure and delivery models of cloud computing. CO 4. Understand the Security aspects of CLOUD. CO 5. Define platforms for development of cloud 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) <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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)	

<p>6. At the end of the 13th week of the semester</p> <p>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</p> <p>(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).</p> <p>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.</p> <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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 2 sub-questions), should have a mix of topics under that module. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p> <p>Suggested Learning Resources:</p> <p>Textbooks</p> <ol style="list-style-type: none"> 1. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi Mastering Cloud Computing McGraw Hill Education. 2. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013 <p>Reference Books</p> <ol style="list-style-type: none"> 1. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media. 2. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication. 3. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press. <p>Weblinks and Video Lectures (e-Resources):</p> <ul style="list-style-type: none"> • https://www.youtube.com/watch?v=1N3oqYhzHv4 • https://www.youtube.com/watch?v=RWgW-CgdIk0 <p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p>

VII Semester

MULTIMEDIA DESIGN			
Course Code	21CD731	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Understand characteristics of Multimedia contents			
CLO 2. Understand and compare different text and image standards.			
CLO 3. Understand audio digitization, processing, and storage.			
CLO 4. Understand video digitization, processing, and storage.			
CLO 5. Ability to build simple multimedia solutions that utilizes knowledge of text, image, audio and video standards.			
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) needs 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 analyse information rather than simply recall it.			
6. Introduce Topics in manifold representations.			
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.			
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
Module-1			
Overview: Introduction, Multimedia Presentation and Production, Characteristics of a Multimedia Presentation, Hardware and Software Requirements, Analog and Digital Representations, Digitization.			
Textbook1: Chapter 1			
Teaching-Learning Process	Chalk and board, Demonstrations		
Module-2			
Text & Image: Text - Introduction, Types of Text, Unicode Standard, Font, Text Compression, Text File Formats. Image - Introduction, Image Data Representation, Image Processing, Image File Formats, Image-Processing Software			
Textbook1: Chapter 2 & 3			
Teaching-Learning Process	Chalk and board, Demonstration, Experimentation		
Module-3			

Audio: Introduction, Acoustics, Types and Properties of Sounds, Psycho-Acoustics, Digital Audio, Musical Instrument Digital Interface (MIDI), Digital Audio Processing, Speech, Audio File Formats.	
Textbook 1: chapter 5	
Teaching-Learning Process	Chalk and board, Demonstration, Experimentation
Module-4	
Video: Introduction, Motion Video, Digital Video, Digital Video Processing, Video Recording and Storage Formats, Video File Formats, Video Editing Concepts.	
Textbook 1: Chapter 6	
Teaching-Learning Process	Chalk and board, Demonstration, Experimentation
Module-5	
Architecture and Design: Introduction, User Interfaces, OS Multimedia Support, Multimedia Extensions, Distributed Multimedia Applications, Real-time Protocols, Synchronization.	
Textbook 1: Chapter 10	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Course Outcomes At the end of the course the student will be able to: <ul style="list-style-type: none"> CO 1. Use optimally Multimedia content CO 2. Understand different text and image standards. CO 3. Appreciate audio digitization, processing, and storage. CO 4. Appreciate video digitization, processing, and storage. CO 5. Build simple multimedia solutions that utilizes knowledge of text, image, audio and video standards. 	
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) <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 4. First assignment at the end of 4th week of the semester 5. Second assignment at the end of 9th week of the semester 6. At the end of the 13th 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) 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	

<p>outcome defined for the course.</p> <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p>
<p>Textbook:</p> <ol style="list-style-type: none"> 1. Principles of Multimedia – 2nd edition by Ranjan Parekh. McGraw Hill publication
<p>Web links and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/117/105/117105083/
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p>

VII Semester

ANIMATION AND GAME DESIGN			
Course Code	21CD732	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Understand the basics of animation and game theory			
CLO 2. Demonstrate the principles of animations and operations			
CLO 3. Explain 2D animation techniques			
CLO 4. Describing and Solving Game theory problems			
CLO 5. Demonstrate applications of the Game Designs			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.			
1. Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.			
2. Use of Video/Animation to explain functioning of various concepts.			
3. Encourage collaborative (Group Learning) Learning in the class.			
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.			
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.			
6. Introduce Topics in manifold representations.			
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
Module-1			
Basics of Animations- Development: Idea Creation, Evolving a Storyline.			
Character Design: The Evolution of 2D Character Design,The Evolution of 3D Character Design, Animation Style, Concept and Environment Design.			
Project Financing: Animation Markets, Scheduling and Budgeting, Investment, Marketing, and DistributionPossibilities.			
Text book 1: Chapter1, Chapter2 and Chapter 3			
Teaching-Learning Process	Chalk and board, Active Learning, Animation Videos		
Module-2			
Principles of Animation: Key Poses, Breakdowns, and Inbetweens, Timing, Extreme Positions, Arcs and Paths of Action, Holds, Emphasis, Anticipation, Weight and Weighted Movement, Flexibility and Fluid Joint Movement, Overlapping Action, Generic Walks, Walk Cycles, Runs and Run Cycles, Silhouetting, Dialogue and Lip Sync, Laughter, Takes, Eyes and Expressions.			
Text book 1: Chapter 8			
Teaching-Learning Process	Chalk and board, Active Learning, Animation Videos		
Module-3			
2D Animation Overview: It's All about Pencils and Paper Script, The Tools of the Trade.			

2D Animation Basics: Keys, In-betweens, and Timing, Dope (Exposure) Sheets and Production Folders, Flipping and Peg Bars, Using Peg Bars	
Text book 1: Chapter 10 and Chapter 11	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
<p>Introduction to Game theory: What is game theory? An outline of the history of game theory, John von Neumann, The theory of rational choice, Coming attractions.</p> <p>Games with Perfect Information: Nash Equilibrium: Theory, Strategic games, Nash equilibrium, Examples of Nash equilibrium, Experimental evidence on the Prisoner's Dilemma, Focal points, Best response functions, Dominated actions, Equilibrium in a single population: symmetric games and symmetric equilibria</p>	
Text book 2: Chapter 1 and Chapter 2	
Teaching-Learning Process	Chalk & board, Problem based learning and Collaborative Learning
Module-5	
<p>Nash Equilibrium: Illustrations, Cournot's model of oligopoly, Bertrand's model of oligopoly, Cournot, Bertrand, and Nash: some historical notes, Electoral competition, The War of Attrition, Auctions, Auctions from Babylonia to eBay, Accident law</p>	
Text Book 2: Chapter 3	
Teaching-Learning Process	Chalk & board, Problem based learning and Collaborative Learning
<p>Course Outcomes</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> CO 1. Understand the Basics of Animation techniques. CO 2. Describe principles animation techniques. CO 3. Demonstrate the functions of 2D Animation techniques. CO 4. Apply game theory in real-time animated projects. CO 5. Apply the models of the Game theory problems 	
<p>Assessment Details (both CIE and SEE)</p> <p>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</p> <p>Continuous Internal Evaluation:</p> <p>Three Unit Tests each of 20 Marks (duration 01 hour)</p> <ol style="list-style-type: none"> 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 <p>Two assignments each of 10 Marks</p> <ol style="list-style-type: none"> 4. First assignment at the end of 4th week of the semester 5. Second assignment at the end of 9th week of the semester <p>Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)</p> <ol style="list-style-type: none"> 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 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books

1. Animation From Pencil to Pixels, Tony White, Classical Techniques for Digital Animators, Focal Press is an imprint of Elsevier.
2. Martin Osborne: An introduction to game theory, Oxford University Press, Indian Edition, 2004.

Reference:

1. 1. Sketching for Beginners: Step-by-step Guide to Getting Started With Your Drawing
2. Perspective Made Easy (Dover Art Instruction)
3. Roger B Myerson: Game theory: Analysis of Conflict, Harvard University Press, 1997
4. An Introduction to Game Theory: Strategy, Joel Watson, W W Norton and Company.
5. Algorithmic Game Theory, Noam Nisan, Tim Roughgarden, Eva Tardos, Vijay V Vazirani, Cambridge University Press

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=zlonHY5BcTQ> – Animation & Game Art Design
- <https://www.youtube.com/watch?v=vyKctxdo9KI> -Gaming , VFX and Animation course at IIT Bombay
- <https://www.youtube.com/watch?v=-woaDyBXkyU> - Animation Tutorial
- <https://www.linkedin.com/learning/topics/3d-animation> - 3D Animation
- <https://www.youtube.com/watch?v=n7u1puLdP90> – Game Design Fundamentals
- <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-189-multicore-programming-primer-january-iap-2007/lecture-notes-and-video/116-introduction-to-game-development/> - Game Development
- <https://ocw.mit.edu/courses/comparative-media-studies-writing/cms-608-game-design-spring-2008/lecture-notes/>
- <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-838-algorithms-for-computer-animation-fall-2002/download-course-materials/>
- <https://ocw.mit.edu/courses/comparative-media-studies-writing/cms-608-game-design-fall-2010/audio-lectures/lecture-25-fiction-and-stories-in-games/>

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

VII Semester

USER INTERFACE DESIGN			
Course Code	21IS733	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives: CLO 1. To study the concept of menus, windows, interfaces. CLO 2. To study about business functions. CLO 3. To study the characteristics and components of windows and the various controls for the windows. CLO 4. To study about various problems in windows design with color, text, graphics and CLO 5. To study the testing methods.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">1. Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.2. Use of Video/Animation to explain functioning of various concepts.3. Encourage collaborative (Group Learning) Learning in the class.4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.6. Introduce Topics in manifold representations.7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
Module-1			
The User Interface-Introduction, Overview, The importance of user interface Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design.			
Textbook 1: Ch. 1,2			
Teaching-Learning Process	Chalk and board, Demonstration, MOOC		
Module-2			
The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards.			
Textbook 1: Part-2			
Teaching-Learning Process	Chalk and board, Active Learning		
Module-3			
System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, Selecting menu choices, Navigating menus, Kinds of graphical menus.			

Textbook 1: Part-2	
Teaching-Learning Process	Chalk and board, Demonstration
Module-4	
Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls.	
Textbook 1: Part-2	
Teaching-Learning Process	Chalk& board, Problem based learning, Demonstration
Module-5	
Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests.	
Textbook 1: Part-2	
Teaching-Learning Process	Chalk and board, Demonstration, MOOC
Course Outcomes:	
At the end of the course the student will be able to:	
CO 1. Understand importance and characteristics of user interface design CO 2. Apply user interface design process on business functions CO 3. Demonstrate system menus, navigation schemes and windows characteristics CO 4. Analyze screen based controls and device based controls CO 5. Design the prototypes and test plans of user interface	
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 5 th week of the semester 2. Second test at the end of the 10 th week of the semester 3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester 5. Second assignment at the end of 9 th 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 13 th 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks:

1. Wilbert O, Galitz, "The Essential Guide to User Interface Design", John Wiley & Sons, Second Edition 2002

Reference Books:

1. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998
2. Alan Cooper, "The Essential of User Interface Design", Wiley-Dream Tech Ltd., 2002

Web links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ar10/>
2. <https://www.vtupulse.com/cbcs-cse-notes/17cs832-user-interface-design-uid-notes/>
3. https://www.brainkart.com/subject/User-Interface-Design_145/
4. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-831-user-interface-design-and-implementation-spring-2011/lecture-notes/>
5. <https://lecturenotes.in/download/material/21405-user-interface-design>

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

VII Semester

BLOCKCHAIN TECHNOLOGY			
Course Code	21CS734	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Explain the fundamentals of distributed computing and blockchain			
CLO 2. Discuss the concepts in bitcoin			
CLO 3. Demonstrate Ethereum platform			
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			
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.			
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.			
Textbook 1: Chapter 1, 2			
Teaching-Learning Process	Chalk and board, Active Learning – Oral presentations.		
Module-2			
Introduction to Cryptography & Cryptocurrencies: Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency,			
How Bitcoin Achieves Decentralization: Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work, Putting it all together,			
Textbook 2: Chapter 1, 2			
Teaching-Learning Process	Chalk and board, Demonstration		
Module-3			
Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements			
How to Store and Use Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys,			

Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets	
Textbook2: Chapter 3,4	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration, MOOC
Module-4	
Bitcoin Mining: The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies,	
Bitcoin and Anonymity: Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash,	
Textbook2: Chapter 5,6	
Teaching-Learning Process	Chalk& board, Problem based learning, MOOC
Module-5	
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts.	
Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.	
Textbook 1: Chapter 10	
Teaching-Learning Process	Chalk and board, MOOC, Practical Demonstration
Course Outcomes At the end of the course the student will be able to:	
CO 1. Describe the concepts of Distributed computing and its role in Blockchain CO 2. Describe the concepts of Cryptography and its role in Blockchain CO 3. List the benefits, drawbacks and applications of Blockchain CO 4. Appreciate the technologies involved in Bitcoin CO 5. Appreciate and demonstrate the Ethereum platform to develop blockchain application.	
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 5 th week of the semester 2. Second test at the end of the 10 th week of the semester 3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester 5. Second assignment at the end of 9 th 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 13 th 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	

<p>as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p> <p>Textbooks</p> <ol style="list-style-type: none"> 1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017. 2. Arvind Narayanan, Joseph Bonneau, Edward W. Felten, Andrew Miller, Steven Goldfeder and Jeremy Clark., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press, 2016. <p>Reference:</p> <ol style="list-style-type: none"> 1. Mastering Bitcoins: Unlocking Digital Cryptocurrencies by Andreas Antonopoulos. O'Reilly Media, Inc, 2013.
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. http://bitcoinbook.cs.princeton.edu/?_ga=2.8302578.1344744326.1642688462-86383721.1642688462 2. https://nptel.ac.in/courses/106/105/106105184/ 3. https://ethereum.org/en/developers/ 4. https://developer.ibm.com/components/hyperledger-fabric/tutorials/
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p>

VII Semester

OPERATING SYSTEMS CONCEPTS AND DESIGN			
Course Code	21CD735	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Define the fundamentals of Operating Systems.			
CLO 2. Understand process and threads, microkernel and illustration of these in Windows and Linux operating Systems			
CLO 3. Explain distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols			
CLO 4. Illustrate concepts of embedded systems and different types of Embedded Operating Systems and security issues			
CLO 5. Study Kernel organization			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
1. Lecture method (L) needs 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 analyse information rather than simply recall it.			
6. Introduce Topics in manifold representations.			
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
Module-1			
Operating System Overview: Process description & Control: Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems,			
Process Description and Control: What is a Process?, Process States, Process Description, Process Control, Operations on Processes, Inter Process Communication(IPC),Execution of the Operating System, Security Issues.			
Text 1: Chapter 2, Chapter 3			
Teaching-Learning Process	Chalk and board, Active Learning, Collaborative Learning		
Module-2			
Threads, SMP, and Microkernel: Processes and Threads, Symmetric Multiprocessing (SMP), Micro Kernels, Windows Vista Thread and SMP Hours Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX Memory Management, Windows Vista Memory Management.			

Text 1: Chapter 4	
Teaching-Learning Process	Chalk and board, Active Learning, Collaborative Learning
Module-3	
Multiprocessor and Real-Time Scheduling: Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX Preemptive Scheduling, Windows Vista Hours Scheduling, Process Migration: Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock	
Text 1: Chapter 10 and Chapter 16	
Teaching-Learning Process	Chalk and board, Active Learning, Collaborative Learning
Module-4	
Embedded Operating Systems: Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.	
Text 1: Chapter 13	
Teaching-Learning Process	Chalk& board, Project based learning and Collaborative Learning
Module-5	
Kernel Organization: Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine , Modules and Device Management, MODULE Organization, MODULE Installation and Removal, Process and Resource Management, Running Process Manager, Creating a new Task , IPC and Synchronization, The Scheduler , Memory Manager , The Virtual Address Space, The Page Fault Handler , File Management.	
Text 2: Chapter 20	
Teaching-Learning Process	Chalk& board, Project based learning and Collaborative Learning
Course Outcomes At the end of the course the student will be able to: CO 1. Describe basics Operating system, Process creation and management for Inter process Communication. CO 2. Explain Concepts process and threads, microkernel and illustration of these in Windows and Linux operating Systems CO 3. Describe multiprocessor and real time scheduling in Windows and Linux operating Systems and demonstrate distributed Mutual exclusion and Deadlock CO 4. Explain the concepts of embedded systems and different types of Embedded Operating Systems like TinyOS and security concepts related to OS CO 5. Illustrate the concepts of Kernel organization	
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
6. At the end of the 13th 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)**

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 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books

1. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.

Reference:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/106/106/106106144/>
- <https://nptel.ac.in/courses/106/105/106105214/>
- <https://nptel.ac.in/courses/106/105/106105172/>
- <https://nptel.ac.in/courses/106/102/106102132/>
- <https://nptel.ac.in/courses/106/108/106108101/>
- <http://web.stanford.edu/class/cs240/>
- <https://www.youtube.com/watch?v=EgC997B2JVY>
- <https://www.cse.iitb.ac.in/~mythili/os/> - Lectures on OS IIT Bombay
- https://csd.cmu.edu/course-profiles/15-410_605-Operating-System-Design-and-Implementation

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

VII Semester

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS			
Course Code	21CS741	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Learn How to add functionality to designs while minimizing complexity.			
CLO 2. What code qualities are required to maintain to keep code flexible?			
CLO 3. To Understand the common design patterns.			
CLO 4. To explore the appropriate patterns for design problems			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<ol style="list-style-type: none">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			
Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. A Notation for Describing Object-Oriented Systems			
Textbook 1: Chapter 1 and 2.7			
Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.			
Textbook 1: Chapter 6			
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning		
Module-2			
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.			
Textbook 2: chapter 4			

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-3	
Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Template Method	
Textbook 2: chapter 5	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
Interactive systems and the MVC architecture: Introduction, The MVC architectural pattern, analyzing a simple drawing program, designing the system, designing of the subsystems, getting into implementation, implementing undo operation, drawing incomplete items, adding a new feature, pattern-based solutions.	
Textbook 1: Chapter 11	
Teaching-Learning Process	Chalk & board, Problem based learning
Module-5	
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object-oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.	
Textbook 1: Chapter 12	
Teaching-Learning Process	Chalk and board
Course Outcomes	
At the end of the course the student will be able to:	
CO 1. Design and implement codes with higher performance and lower complexity CO 2. Experience core design principles and be able to assess the quality of a design. CO 3. Apply design pattern principles in the design of object oriented systems. CO 4. Demonstrate the range of design patterns that can be used to solve the given problem. CO 5. Select and apply suitable patterns in specific contexts.	
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 5 th week of the semester 2. Second test at the end of the 10 th week of the semester 3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester 5. Second assignment at the end of 9 th week of the semester 6. At the end of the 13 th 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)	
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).	

<p>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.</p> <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p>
<p>Textbooks</p> <ol style="list-style-type: none"> 1. Brahma Dathan, Sarnath Rammath, Object-oriented analysis, design and implementation, Universities Press, 2013 2. Erich Gamma, Richard Helan, Ralph Johman, John Vlissides, Design Patterns, Pearson Publication, 2013. <p>Reference:</p> <ol style="list-style-type: none"> 1. Frank Bachmann, Regine Meunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996. 2. William J Brown et al, "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.
<p>Weblinks and Video Lectures (e-Resources):</p>
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p>

VII Semester

COMPILER DESIGN			
Course Code	21CD742	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Ability to describe the functionality of a compiler and its major functional partitions			
CLO 2. Ability to implement simple parsing with error handling			
CLO 3. Ability to build simple intermediate code generator			
CLO 4. Ability to illustrate with examples concepts storage management at run time			
CLO 5. Ability to demonstrate strategies of code optimization			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<div><div></div><div>1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.</div><div></div><div>2. Use of Video/Animation to explain functioning of various concepts.</div><div></div><div>3. Encourage collaborative (Group Learning) Learning in the class.</div><div></div><div>4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div><div></div><div>5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.</div><div></div><div>6. Introduce Topics in manifold representations.</div><div></div><div>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.</div><div></div><div>8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</div></div>			
Module-1			
Introduction to Compilers: Overview of a compiler – Lexical Analysis – Tokens - Specification of Tokens – Recognition of Tokens – Finite Automata – Regular Expressions to Automata.			
Textbook1: Chapter 1 (1.1, 1.2), Chapter 3 (3.1 to 3.7)			
Teaching-Learning Process	Chalk and board, Problem based learning		
Module-2			
Syntax Analysis: Overview of Parsing – Grammars – Error Handling – Context-free grammars – Top-Down Parsing - General Strategies - Recursive Descent Parser - Predictive Parser - Error Handling and Recovery in Syntax Analyzer-YACC			
Textbook1:Chapter 4 (4.1 to 4.9)			
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration		
Module-3			
Intermediate Code Generation: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Types and Declarations, Translation of Expressions.			

Textbook 1: Chapter 6 (6.1 to 6.4)	
Teaching-Learning Process	Chalk and board, Problem based learning, Team project
Module-4	
Run-Time Environment and Code Generation: Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management Concepts.	
Textbook 1: Chapter 7 (7.1 to 7.4)	
Teaching-Learning Process	Chalk and board, Problem based learning, Team project
Module-5	
Code Optimization: Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks - Efficient Data Flow Algorithm	
Textbook 1: Chapter 8 (8.1 to 8.7), Chapter 9 (9.1 to 9.3)	
Pedagogy:	Chalk and board, Problem based learning, Demonstration
Course Outcomes	
CO 1. Apply the concepts of Finite Automata in the design lexical analyser CO 2. Analyse the role of grammar in Parsers CO 3. Demonstrate intermediate code generation CO 4. Explore and study the storage management at runtime CO 5. Apply various strategies for code optimization and code generation	
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 5 th week of the semester 2. Second test at the end of the 10 th week of the semester 3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester 5. Second assignment at the end of 9 th 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 13 th 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:	

<p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
Suggested Learning Resources:
<p>Textbook:</p> <ol style="list-style-type: none"> 1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools , Second Edition, Pearson Education, 2009. Principles of Multimedia – 2nd edition by Ranjan Parekh. McGraw Hill publication
<p>Web links and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/106/105/106105190/
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VII Semester

VIRTUAL REALITY			
Course Code	21CD743	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Understand the basic concepts and framework of virtual reality.			
CLO 2. To introduce the relevance of this course to the existing technology.			
CLO 3. Provides students with an opportunity to explore the research issues in Augmented Reality and Virtual Reality (VR & AR).			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<div><div>1.</div><div>Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.</div></div> <div><div>2.</div><div>Use of Video/Animation to explain functioning of various concepts.</div></div> <div><div>3.</div><div>Encourage collaborative (Group Learning) Learning in the class.</div></div> <div><div>4.</div><div>Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div></div> <div><div>5.</div><div>Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.</div></div> <div><div>6.</div><div>Introduce Topics in manifold representations.</div></div> <div><div>7.</div><div>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.</div></div> <div><div>8.</div><div>Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</div></div>			
Module-1			
Introduction to Virtual Reality: Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality.			
Text Book 1: Chapter 1			
Teaching-Learning Process	Chalk and board, Problem based learning		
Module-2			
Multiple Models of Input and Output Interface in Virtual Reality: Input - Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices.			
Text Book 1: Chapter 2, Chapter 3			
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration		
Module-3			
Visual Computation in Virtual Reality: Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of			

Large Scale Environments & Real Time Rendering.	
Text Book 1: Chapter 4	
Teaching-Learning Process	Chalk and board, Problem based learning, Team project
Module-4	
Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR.X3D Standard; Vega, MultiGen, Virtools etc.	
Text Book 1: Chapter5, Chapter 6	
Teaching-Learning Process	Chalk and board, Problem based learning, Team project
Module-5	
Augmented and Mixed Reality: Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	
Text Book 2: Chapters 2	
Pedagogy:	Chalk and board, Problem based learning, Demonstration
Course Outcomes	
CO 1. Understand the basic concepts and terminologies of Virtual Reality CO 2. Apply the concepts of Computer Graphics and allied concepts for design of Virtual Reality CO 3. Choose, develop, explain, and defend the use of particular designs for VR experiences. CO 4. Evaluate the benefits and drawbacks of specific VR techniques on the human body. CO 5. Identify and examine state-of-the-art VR design problems and solutions from the industry and academia	
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 5 th week of the semester 2. Second test at the end of the 10 th week of the semester 3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester 5. Second assignment at the end of 9 th 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 13 th week of the semester	
The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and	

<p>will be scaled down to 50 marks</p> <p>(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).</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p>
<p>Textbook:</p> <ol style="list-style-type: none"> 1. Virtual Reality Technology Burdea, G. C. P. Coffet Wiley-IEEE Press 2nd Edition 2003/2006 2. Understanding Augmented Reality, Concepts and Application Alan B. Craig Morgan Kaufmann 2013 <p>Reference Books</p> <ol style="list-style-type: none"> 1. Developing Virtual Reality Applications, Foundations of Effective Design Alan Craig William Sherman Jeffrey Will Morgan Kaufmann 2009
<p>Web links and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/121/106/121106013/ 2. https://nptel.ac.in/courses/106/106/106106138/ 3. https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ge08/
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <ul style="list-style-type: none"> ● Group Projects ● Promote Learning in slow learners ● Reflective Learning ● Learning through analysis Case studies ● Collaborative Learning ● Variety of Assignments and test – Knowledge level

VII Semester

BIG DATA ANALYTICS			
Course Code	21CD744	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives:			
CLO 1. Understand fundamentals and applications of Big Data analytics			
CLO 2. Explore the Hadoop framework and Hadoop Distributed File system and essential Hadoop Tools			
CLO 3. Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data			
CLO 4. Employ MapReduce programming model to process the big data			
CLO 5. Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.			
<ol style="list-style-type: none">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 HOTS (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 to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.			
Text book 1: Chapter 1: 1.2 -1.7			
Teaching-Learning Process	Chalk and board https://www.youtube.com/watch?v=n_Krer6YWW4 https://onlinecourses.nptel.ac.in/noc20_cs92/preview		
Module-2			
Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools.			
Hadoop Distributed File System Basics (T2): HDFS Design Features, Components, HDFS User Commands.			
Essential Hadoop Tools (T2): Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.			
Text book 1: Chapter 2 :2.1-2.6			
Text Book 2: Chapter 3			

Text Book 2: Chapter 7 (except walk throughs)	
Teaching-Learning Process	<ol style="list-style-type: none"> 1. Chalk and Board 2. Laboratory Demonstration
Module-3	
NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.	
Text book 1: Chapter 3: 3.1-3.7	
Teaching-Learning Process	<ol style="list-style-type: none"> 1. Chalk and Board 2. Laboratory Demonstration https://www.youtube.com/watch?v=pWbMrx5rVBE
Module-4	
Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.	
Text book 1: Chapter 4: 4.1-4.6	
Teaching-Learning Process	<ol style="list-style-type: none"> 1. Chalk and Board 2. Laboratory Demonstration
Module-5	
Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining.	
Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics:	
Text book 1: Chapter 6: 6.1 to 6.5	
Text book 1: Chapter 9: 9.1 to 9.5	
Teaching-Learning Process	<ol style="list-style-type: none"> 1. Chalk and Board 2. Laboratory Demonstration
Course outcome (Course Skill Set) At the end of the course the student will be able to: <ol style="list-style-type: none"> CO 1. Understand fundamentals and applications of Big Data analytics. CO 2. Investigate Hadoop framework, Hadoop Distributed File system and essential Hadoop tools. CO 3. Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data. CO 4. Demonstrate the MapReduce programming model to process the big data along with Hadoop tools. CO 5. Apply Machine Learning algorithms for real world big data, web contents and Social Networks to provide analytics with relevant visualization tools. 	
Assessment Details (both CIE and SEE)	
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). 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 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 scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books

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

Reference Books

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media, 2015. ISBN-13: 978-9352130672
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1st Edition, Wrox Press, 2014 ISBN-13: 978-8126551071
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators", 1st Edition, O'Reilly Media, 2012. ISBN-13: 978-9350239261
4. Arshdeep Bahga, Vijay Madiseti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=n_Krer6YWY4
2. https://onlinecourses.nptel.ac.in/noc20_cs92/preview
3. <https://www.digimat.in/nptel/courses/video/106104189/L01.html>
4. https://web2.qatar.cmu.edu/~mhhammou/15440-f19/recitations/Project4_Handout.pdf

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

Mini Project Topics for Practical Based Learning :Search Engine Optimization, Social Media Reputation Monitoring, Equity Research, Detection of Global Suicide rate, Find the Percentage of Pollution in India, Analyse crime rate in India, Health Status Prediction, Anomaly Detection in cloud server, Tourist Behaviour Analysis, BusBest Not limited to above topics

VII Semester

DESIGN THINKING			
Course Code	21CD745	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Basic concepts and techniques of engineering and reverse engineering			
CLO 2. Process of design, analytical thinking and ideas			
CLO 3. Basics and development of engineering drawing			
CLO 4. Application of engineering drawing with computer aide.			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.			
1. Lecture method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.			
2. Use of Video/Animation to explain functioning of various concepts.			
3. Encourage collaborative (Group Learning) Learning in the class.			
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.			
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.			
6. Introduce Topics in manifold representations.			
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
Module-1			
PROCESS OF DESIGN: Introduction – Product Life Cycle - Design Ethics - Design Process - Four Step - Five Step - Twelve Step - Creativity and Innovation in Design Process - Design limitation.			
Text 1: Chapter 2			
Teaching-Learning Process	Chalk and board, Active Learning, Collaborative Learning		
Module-2			
GENERATING AND DEVELOPING IDEAS : Introduction - Create Thinking - Generating Design Ideas - Lateral Thinking – Analogies – Brainstorming - Mind mapping - National Group Technique – Synaptic - Development of work - Analytical Thinking - Group Activities Recommended.			
Text 1: Chapter 4			
Teaching-Learning Process	Chalk and board, Active Learning, Collaborative Learning		
Module-3			
REVERSE ENGINEERING: Introduction - Reverse Engineering Leads to New Understanding about Products - Reasons for Reverse Engineering - Reverse Engineering Process - Step by Step - Case Study.			
Text 1: Chapter 6			
Teaching-Learning Process	Chalk and board, Active Learning, Collaborative Learning		

Learning Process	
Module-4	
BASICS OF DRAWING TO DEVELOP DESIGN IDEAS : Introduction - Many Uses of Drawing - Communication through Drawing - Drawing Basis – Line - Shape/ Form – Value – Color – Texture - Practice using Auto CAD recommended.	
Text 1: Chapter 5	
Teaching-Learning Process	Chalk& board, Project based learning and Collaborative Learning
Module-5	
TECHNICAL DRAWING TO DEVELOP DESIGN: Introduction - Perspective Drawing - One Point Perspective - Two Point Perspective - Isometric Drawing - Orthographic Drawing - Sectional Views - Practice using Auto CAD recommended.	
Text 1: Chapter 8	
Teaching-Learning Process	Chalk& board, Project based learning and Collaborative Learning
Course Outcomes At the end of the course the student will be able to: <ul style="list-style-type: none"> CO 1. Understand the concept of “ design Process” and “ Design Ethics” CO 2. Develop the ideas for the contemporary problems through different techniques CO 3. Identify the significance of reverse Engineering to understand products CO 4. Understand the basics of drawing to develop design ideas CO 5. Apply the knowledge of design ideas for developing technical drawing design 	
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) <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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) <ol style="list-style-type: none"> 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:	

<p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Suggested Learning Resources:</p>
<p>Text Books</p> <ol style="list-style-type: none"> 1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013. <p>Reference:</p> <ol style="list-style-type: none"> 1. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.
<p>Web links and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. www.tutor2u.net/business/presentations/.../productlifecycle/default.html 2. https://docs.oracle.com/cd/E11108_02/otn/pdf/.../E11087_01.pdf www.bizfilings.com › Home › Marketing › Product Developmen https://www.mindtools.com/brainstm.html 3. https://www.quicksprout.com/.../how-to-reverse-engineer-your-competit www.vertabelo.com/blog/documentation/reverse-engineering 4. https://support.microsoft.com/en-us/kb/273814 5. https://support.google.com/docs/answer/179740?hl=en 6. https://www.youtube.com/watch?v=2mjSDIBaUIM 7. thevirtualinstructor.com/foreshortening.html
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p>

VII Semester

PROGRAMMING IN PYTHON			
Course Code	21CS751	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. To understand why Python is a useful scripting language for developers			
CLO 2. To read and write simple Python programs			
CLO 3. To learn how to identify Python object types.			
CLO 4. To learn how to write functions and pass arguments in Python.			
CLO 5. To use Python data structures -- lists, tuples, dictionaries.			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<ol style="list-style-type: none">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			
INTRODUCTION DATA, EXPRESSIONS, STATEMENTS:08 Hours			
Introduction: Creativity and motivation, understanding programming, Terminology: Interpreter and compiler, Running Python, The First Program; Data types: Int, float, Boolean, string, and list, variables, expressions, statements, Operators and operands.			
Textbook 1: Chapter 1.1,1.2,1.3,1.6, Chapter 2.1-2.6			
Textbook 2: Chapter 1			
Teaching-Learning Process	Chalk and board, Active Learning		
Module-2			
CONTROL FLOW, LOOPS:			
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: while, for, break, continue, pass statement.			
Textbook 1: Chapter 3.1-3.6, chapter 5			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration		
Module-3			
FUNCTIONS AND STRINGS:			
Functions: Function calls, adding new functions, definition and uses, local and global scope, return values. Strings: strings, length of string, string slices, immutability, multiline comments, string functions and methods;			

Textbook 1: Chapter 6	
Textbook 2: Chapter 3	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-4	
LISTS, TUPLES, DICTIONARIES:08 Hours	
Lists: List operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters, list comprehension;	
Tuples: tuple assignment, tuple as return value, tuple comprehension;	
Dictionaries: operations and methods, comprehension;	
Textbook 2: Chapter 10,11,12	
Teaching-Learning Process	Chalk& board, Active Learning
Module-5	
REGULAR EXPRESSIONS,FILES AND EXCEPTION:	
Regular expressions: Character matching in regular expressions, extracting data using regular expressions, Escape character	
Files and exception: Text files, reading and writing files, command line arguments, errors andexceptions, handling exceptions, modules.	
Textbook 1: Chapter 11.1,11.2,11.4	
Textbook 2: Chapter 14	
Teaching-Learning Process	Chalk and board, MOOC
Suggested Course Outcomes	
At the end of the course the student will be able to:	
CO 1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.	
CO 2. Demonstrate proficiency in handling Strings and File Systems.	
CO 3. Represent compound data using Python lists, tuples, Strings, dictionaries.	
CO 4. Read and write data from/to files in Python Programs	
Assessment Details (both CIE and SEE)	
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). 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 5 th week of the semester	
2. Second test at the end of the 10 th week of the semester	
3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester	
5. Second assignment at the end of 9 th 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 13 th 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	

<p>methods of the CIE. Each method of CIE should have a different syllabus portion of the course).</p> <p>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.</p> <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ol style="list-style-type: none"> 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. <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Textbooks</p> <ol style="list-style-type: none"> 1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, CreateSpace Independent Publishing Platform, 2016. http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf 2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2ndEdition, Green Tea Press, 2015. (Chapters 15, 16, 17) http://greenteapress.com/thinkpython2/thinkpython2.pdf <p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. R. Nageswara Rao, "Core Python Programming", dreamtech 2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson 3. Python Programming , Reema theraja, OXFORD publication
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. https://www.w3resource.com/python/python-tutorial.php 2. https://data-flair.training/blogs/python-tutorials-home/ 3. https://www.youtube.com/watch?v=c235EsGFcZs 4. https://www.youtube.com/watch?v=v4e6oMRS2QA 5. https://www.youtube.com/watch?v=Uh2ebFW8OYM 6. https://www.youtube.com/watch?v=oSPMmeaiQ68 7. https://www.youtube.com/watch?v=uQrj0TkZlc 8. https://www.youtube.com/watch?v=K8L6KVGg-7o
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <p>Real world problem solving: Demonstration of projects developed using python language</p>

VII Semester

INTRODUCTION TO AI AND ML			
Course Code	21CS752	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives CLO1. Understands the basics of AI, history of AI and its foundations, basic principles of AI for problem solving CLO2. Explore the basics of Machine Learning & Machine Learning process, understanding data CLO3. Understand the Working of Artificial Neural Networks			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. <div><div>1.</div><div>Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.</div></div> <div><div>2.</div><div>Use of Video/Animation to explain functioning of various concepts.</div></div> <div><div>3.</div><div>Encourage collaborative (Group Learning) Learning in the class.</div></div> <div><div>4.</div><div>Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div></div> <div><div>5.</div><div>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.</div></div> <div><div>6.</div><div>Introduce Topics in manifold representations.</div></div> <div><div>7.</div><div>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.</div></div> <div><div>8.</div><div>Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</div></div>			
Module-1			
Introduction: What is AI, The foundation of Artificial Intelligence, The history of Artificial Intelligence, Intelligent Agents: Agents and Environments, Good Behaviour: The concept of rationality, the nature of Environments, the structure of Agents.			
Textbook 1: Chapter: 1 and 2			
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning		
Module-2			
Problem solving by searching: Problem solving agents, Example problems, Searching for solutions, Uniformed search strategies, Informed search strategies, Heuristic functions			
Textbook 1: Chapter: 3			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration		
Module-3			
Introduction to machine learning: Need for Machine Learning, Machine Learning Explained, and Machine Learning in relation to other fields, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications.			
Understanding Data: What is data, types of data, Big data analytics and types of analytics, Big data analytics framework, Descriptive statistics, univariate data analysis and visualization			
Textbook 2: Chapter: 1 and 2.1 to 2.5			
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration		
Module-4			

Understanding Data

Bivariate and Multivariate data, Multivariate statistics, Essential mathematics for Multivariate data, Overview hypothesis, Feature engineering and dimensionality reduction techniques,

Basics of Learning Theory: Introduction to learning and its types, Introduction computation learning theory, Design of learning system, Introduction concept learning.

Similarity-based learning: Introduction to Similarity or instance based learning, Nearest-neighbour learning, weighted k- Nearest - Neighbour algorithm.

Textbook 2: Chapter: 2.6 to 2.10, 3.1 to 3.4, 4.1 to 4.3

Teaching-Learning Process

Chalk & board, Problem based learning

Module-5

Artificial Neural Network: Introduction, Biological neurons, Artificial neurons, Perceptron and learning theory, types of Artificial neural Network, learning in multilayer Perceptron, Radial basis function neural network, self-organizing feature map,

Textbook 2: Chapter: 10

Teaching-Learning Process

Chalk and board, MOOC

Course Outcomes

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

- CO 1. Design intelligent agents for solving simple gaming problems.
- CO 2. Have a good understanding of machine learning in relation to other fields and fundamental issues and Challenges of machine learning
- CO 3. Understand data and applying machine learning algorithms to predict the outputs.
- CO 4. Model the neuron and Neural Network, and to analyze ANN learning and its 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

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 scored out of 100 shall be reduced proportionally to 50 marks

Textbooks

1. Stuart Russel, Peter Norvig: "Artificial Intelligence A Modern Approach", 3rd Edition, Pearson Education, 2015.
2. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford ,2021

REFERENCE BOOKS:

1. Elaine Rich, Kevin Knight: "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009, ISBN-10: 0070087709
2. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, 1980, ISBN: 978-3-540-11340-9.

Weblinks and Video Lectures (e-Resources):

<http://stpk.cs.rtu.lv/sites/all/files/stpk/materiali/MI/Artificial%20Intelligence%20A%20Modern%20Approach.pdf>.

1. http://www.getfreebooks.com/16-sites-with-free-artificial-intelligence-e-books/https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_overview.htm
2. [Problem solving agent:https://www.youtube.com/watch?v=KTPmo-KsOis](https://www.youtube.com/watch?v=KTPmo-KsOis).
3. https://www.youtube.com/watch?v=X_Qt0U66aH0&list=PLwdnzlV3ogoXaceHrrFVZCjKbm_laSHcH
4. <https://www.javatpoint.com/history-of-artificial-intelligence>
5. <https://www.tutorialandexample.com/problem-solving-in-artificial-intelligence>
6. <https://techvidvan.com/tutorials/ai-heuristic-search/>
7. <https://www.analyticsvidhya.com/machine-learning/>
8. <https://www.hackerearth.com/practice/machine-learning/machine-learning-algorithms/ml-decision-tree/tutorial/>
9. <https://www.javatpoint.com/unsupervised-artificial-neural-networks>

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

Real world problem solving: Demonstration of projects related to AI and ML.

VII Semester

INTRODUCTION TO BIG DATA			
Course Code	21CS753	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. Understand Hadoop Distributed File system and examine MapReduce Programming CLO 2. Explore Hadoop tools and manage Hadoop with Sqoop CLO 3. Appraise the role of data mining and its applications across industries CLO 4. Identify various Text Mining techniques			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<div><div>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.</div><div>2. Use of Video/Animation to explain functioning of various concepts.</div><div>3. Encourage collaborative (Group Learning) Learning in the class.</div><div>4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</div><div>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.</div><div>6. Introduce Topics in manifold representations.</div><div>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.</div><div>8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</div></div>			
Module-1			
Hadoop Distributed file system: HDFS Design, Features, HDFS Components, HDFS user commands Hadoop MapReduce Framework: The MapReduce Model, Map-reduce Parallel Data Flow,Map Reduce Programming			
Textbook 1: Chapter 3,5,68hr			
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning		
Module-2			
Essential Hadoop Tools: Using apache Pig, Using Apache Hive, Using Apache Sqoop, Using Apache Flume, Apache H Base			
Textbook 1: Chapter 78hr			
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration		
Module-3			
Data Warehousing: Introduction, Design Consideration, DW Development Approaches, DW Architectures			
Data Mining: Introduction, Gathering, and Selection, data cleaning and preparation, outputs ofData Mining, Data Mining Techniques			
Textbook 2: Chapter 4,5			
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration		
Module-4			

Decision Trees: Introduction, Decision Tree Problem, Decision Tree Constructions, Lessons from Construction Trees. Decision Tree Algorithm	
Regressions: Introduction, Correlations and Relationships, Non-Linear Regression, Logistic Regression, Advantages and disadvantages.	
Textbook 2: Chapter 6,7	
Teaching-Learning Process	Chalk& board, Problem based learning
Module-5	
Text Mining: Introduction, Text Mining Applications, Text Mining Process, Term Document Matrix, Mining the TDM, Comparison, Best Practices	
Web Mining: Introduction, Web Content Mining, Web Structured Mining, Web Usage Mining, Web Mining Algorithms.	
Textbook 2: Chapter 11,14	
Teaching-Learning Process	Chalk and board, MOOC
Suggested Course Outcomes	
At the end of the course the students will be able to:	
CO 1. Master the concepts of HDFS and MapReduce framework.	
CO 2. Investigate Hadoop related tools for Big Data Analytics and perform basic	
CO 3. Infer the importance of core data mining techniques for data analytics	
CO 4. Use Machine Learning algorithms for real world big data.	
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 5 th week of the semester	
2. Second test at the end of the 10 th week of the semester	
3. Third test at the end of the 15 th week of the semester	
Two assignments each of 10 Marks	
4. First assignment at the end of 4 th week of the semester	
5. Second assignment at the end of 9 th 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 13 th 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	

<p>maximum of 3 sub-questions), should have a mix of topics under that module.</p> <p>The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks</p>
<p>Textbooks</p> <ol style="list-style-type: none"> 1. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1st Edition, Pearson Education, 2016. 2. Anil Maheshwari, "Data Analytics", 1st Edition, McGraw Hill Education, 2017
<p>Weblinks and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/106/104/106104189/ 2. https://www.youtube.com/watch?v=mNP44rZYiAU 3. https://www.youtube.com/watch?v=qr_awo5vz0g 4. https://www.youtube.com/watch?v=rr17cbPGWGA 5. https://www.youtube.com/watch?v=G4NYQox4n2g 6. https://www.youtube.com/watch?v=owl7zxCqNY0 7. https://www.youtube.com/watch?v=FujVLsZYkuE
<p>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</p> <p>Real world problem solving: Demonstration of Big Data related projects</p> <p>Exploring the applications which involves big data.</p>

VII Semester

INTRODUCTION TO DATA SCIENCE			
Course Code	21CS754	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives			
CLO 1. To provide a foundation in data Science terminologies			
CLO 2. To familiarize data science process and steps			
CLO 3. To Demonstrate the data visualization tools			
CLO 4. To analyze the data science applicability in real time applications.			
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			
PREPARING AND GATHERING DATA AND KNOWLEDGE			
Philosophies of data science - Data science in a big data world - Benefits and uses of data science and big data - facts of data: Structured data, Unstructured data, Natural Language, Machine generated data, Audio, Image and video streaming data - The Big data Eco system: Distributed file system, Distributed Programming framework, Data Integration frame work, Machine learning Framework, NoSQL Databases, Scheduling tools, Benchmarking Tools, System Deployment, Service programming and Security.			
Textbook 1: Ch 1.1 to 1.4			
Teaching-Learning Process	Chalk and board, Active Learning, PPT Based presentation		
Module-2			
THE DATA SCIENCE PROCESS -Overview of the data science process- defining research goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory data analysis, Build the models, presenting findings and building application on top of them.			
Textbook 1:,Ch 2			
Teaching-Learning Process	Chalk and board, Active Learning, PPT Based presentation		
Module-3			
MACHINE LEARNING: Application for machine learning in data science- Tools used in machine learning-Modelling Process – Training model – Validating model – Predicting new observations –Types of machine Learning Algorithm : Supervised learning algorithms, Unsupervised learning algorithms.			
Textbook 1: Ch 3.1 to 3.3			

Teaching-Learning Process	Chalk and board, Active Learning, PPT Based presentation, Video
Module-4	
VISUALIZATION –Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools.	
Textbook 1: Ch 9	
Teaching-Learning Process	Chalk and board, Active Learning, PPT Based presentation, MOOC
Module-5	
CASE STUDIES Distributing data storage and processing with frameworks - Case study: e.g, Assessing risk when lending money.	
Textbook 1: Ch 5.1, 5.2	
Teaching-Learning Process	Chalk and board, Active Learning, PPT Based presentation, Video
Course Outcomes At the end of the course the student will be able to: CO 1. Describe the data science terminologies CO 2. Apply the Data Science process on real time scenario. CO 3. Analyze data visualization tools CO 4. Apply Data storage and processing with frameworks	
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) <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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) <ol style="list-style-type: none"> 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) <ol style="list-style-type: none"> 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 scored out of 100 shall be reduced proportionally to 50 marks	

Textbooks

1. Introducing Data Science, Davy Cielen, Arno D. B. Meysman and Mohamed Ali, Manning Publications, 2016.

Reference Books

1. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013.
2. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014
3. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013
4. Think Like a Data Scientist, Brian Godsey, Manning Publications, 2017.

Weblinks and Video Lectures (e-Resources):

1. <https://www.simplilearn.com/tutorials/data-science-tutorial/what-is-data-science>
2. <https://www.youtube.com/watch?v=N6BghzuFLIg>
3. <https://www.coursera.org/lecture/what-is-datascience/fundamentals-of-data-science-tPgFU>
4. <https://www.youtube.com/watch?v=ua-CiDNNj30>

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

Real world problem solving using Data science techniques and demonstration of data visualization methods with the help of suitable project.