BNM Institute of Technology

An Autonomous Institution under VTU

For Internal Communication

Department of Computer Science & Engineering

III SEMESTER

Scheme of Teaching for 2022-26 Batch

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week				Hours Per week	Credits	Examination		
					Theory Lecture	Tutorial	Practical	Project					
					L	T	P	J			CIA	SEA	Total
1	BSC	22MAT131	Fourier Transforms,Fundamentals of Logic and Linear Algebra	Mathematics	2	2	-	-	4	3	50	50	100
2	PCC	22CSE132	Computer Organization	CSE	3	-	-	-	3	3	50	50	100
3	PCC	22CSE133	Operating System	CSE	2	1	1	-	4	3	50	50	100
4	PCI	22CSE134	Data Structures and Applications	CSE	3	-	2	-	5	4	50	50	100
5	PCI	22CSE135	Logic Design and applications	CSE	3	-	2	-	5	4	50	50	100
6	PBL	22CSE136	Object Oriented Programming using Java	CSE	-	-	2	2	4	2	50	50	100
7	IPL	22CSE137	Innovative Project Lab [IPL] (Social Concern)	CSE	-	-	2	-	2	1	100		100
8	AEC	22SFT138	Soft Skill -1	HSS	-	-	2	-	2	1	100		100
TOTAL					13	3	11	2	29	21	500	300	800

CIE: Continuous Internal Evaluation, SEE: Semester End Examination, NCMC: Non Credit Mandatory Course

AICTE Activity Points to be earned by students admitted to BE day college programme (For more details refer to Chapter 6, AICTE Activity Point Programme, Model Internship Guidelines): Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other institutions and Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to BNMIT. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

BSC-->Basic Science	MAT-->Mathematics	PCC--> Professonal Core course	PCCI--> Professional Core Integrated
PBL--> Project based learning	HUM--> Humanity and Social Science	UHV--> Universal Human Values	AEC--> Ability Enhancement course
PW--> Project Work	PEC--> Professional Elective	INT--> Internship	PEC--> Professional Elective
OEC-->Open Elective			

BNM Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Department of Mathematics

Syllabus

Semester: III			
Course: Fourier Transform, Fundamentals of logic and Linear Algebra **Course Code: 22MAI131 (Common to CSE, ISE, AIML)**			
L:T:P:J	**2:1:1:0**	**CIA**	**: 50**
Credits:	**03**	**SEA**	**: 50**
Hours:	**40**	**SEA Duration**	**: 03 Hours**

Course Learning Objectives: The students will be able to

1 Have an insight into Fourier series, Fourier transforms.

2 Develop knowledge of Fundamentals of logic and Relations, Vector Spaces & Linear Transformation arising in engineering

Module-1: Fourier Series & Fourier Transforms	**No. of hours**	**Blooms cognitive Levels**
Examples from Engineering field that require Fourier series and Fourier Transforms. **Fourier series**: Periodic functions, Introduction to Fourier Series, Dirichlet's condition. Problems on Fourier series over $(-l, l)$. **Fourier Transforms:** Introduction to infinite Fourier transform, Fourier sine and cosine transform and properties, problems on infinite Fourier transform, Discrete & Fast Fourier Transform. ***Lab Component:*** *Finding the Fourier series and Fourier Transform of a function*	**L : 04** **T : 04**	**CO1** **Apply**
Module-2: Fundamentals of logic and Relations		
Examples from Engineering field that require Fundamentals of logic and Relations. **Fundamentals of logic:** Basic connectives and truth tables, logic equivalence - the laws of logic, logical implication- rules of inference **Relations:** First order linear recurrence relation, second order linear homogenous recurrence relation with constant coefficients. ***Lab Component:*** *Finding the solution of recurrence relation*	**L : 04** **T : 04**	**CO2** **Apply**
Module-3: Vector Spaces		
Examples from Engineering field that require vector spaces Recap of system of linear homogenous and non-homogeneous equation and solution sets. Vector spaces, subspaces, linearly independent and dependent, Linear span of a set, basis and dimension, coordinate vectors. ***Lab Component:*** *problems on linearly independent and dependent, basis and dimension of a vector space.*	**L : 04** **T : 04**	**CO3** **Apply**
Module-4: Linear Transformation		
Examples from Engineering field that require linear transformation. Linear transformations, algebra of linear transformations, representation of transformations by matrices, Non-singular linear transformation, Inverse of a linear transformation, Range space, Null space and problems on Rank-nullity theorem. ***Lab Component:*** *problems on Inverse of a linear transformation and Rank-nullity theorem*	**L : 04** **T : 04**	**CO4** **Apply**
Module-5: Inner Product Spaces		
Examples from Engineering field that require Inner product spaces. Inner products Inner product spaces, Orthogonal set, orthogonal projections, orthonormal bases, Gram-Schmidt process, QR-factorization, Recap of Eigen values and Eigen vectors, problems on singular value decomposition. ***Lab Component:*** *Problems on QR-factorization and singular value decomposition*	**L : 04** **T : 04**	**CO5** **Apply**

Course Outcomes: After completing the course, the students will be able to

CO 1: Apply Fourier series & Transform concepts in Data visualization and Cryptography.

CO 2: Communicate the basic concepts of logic and their relevance for computer science engineering.

CO 3: Apply the knowledge of vector spaces for solving problems in arising in engineering field

CO 4: Apply the knowledge of Linear transform for solving problems in arising in image processing

CO 5: Compute orthogonal and orthonormal bases vectors and decomposition of a symmetric matrix using standard technique.

Reference Books:

1. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons,10th Edition(Reprint), 2016.
2. B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2017.
3. H. K. Dass, " Advanced Engineering Mathematics" S. Chand publication.
4. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6" Edition, 2. McGraw-Hill Book Co., New York, 1995.
5. James Stewart : "Calculus —Early Transcendentals", Cengage Learning India Private Ltd., 2017.
6. B.V.Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
7. Srimanta Pal & Subobh C Bhunia: "Engineering Mathematics", Oxford University Press, 3"Reprint, 2016.
8. David C. Lay, Steven R. Lay and J. J. McDonald "Linear Algebra and its applications", 3rd Edition, Pearson Education Ltd., 2017.
9. Ralph P. Grimaldi, " Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education 2004.

Web links and Video Lectures:

1. https://nptel.ac.in/courses/111106111
2. https://youtu.be/OynpZwylau8
3. https://archive.nptel.ac.in/courses/111/106/111106051/
4. https://www.youtube.com/watch?v=zvRdbPMEMUI
5. https://www.youtube.com/watch?v=cHNmT1-qurk
6. https://www.youtube.com/watch?v=ATqV_I8DCh0

Assessment Process:

<table>
<tr><th rowspan="2">PCC</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th></tr>
<tr><td rowspan="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="2">Written Test</td><td>50</td><td>50</td><td rowspan="4">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module</td></tr>
<tr><td colspan="2">Average of two tests – scaled down to 25 Marks</td></tr>
<tr><td>Assignment</td><td colspan="2">Two assignments – one for 10 marks and another for 5 marks = 15</td></tr>
<tr><td>AAT</td><td colspan="2">10</td></tr>
<tr><td colspan="4">Total – 50 marks</td><td>Total – 50 marks</td></tr>
</table>

Note: Minimum 40% passing marks in all divisions

BNM Institute Of Technology

Dept. of Computer Science & Engineering

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

Semester:III

Course Name: Computer Organization		**Course Code: 22CSE132**
L: T: P: J	3:0:0:0	**CIA Marks:** 50
Credits:	3	**SEA Marks:** 50
Hours/Week (Total)	3 (40)	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	To understand the basic sub systems of a computer, their organization, structure, and operation.
2	Illustrate the concept of programs as sequences of machine instructions.
3	Teach the concepts of Memory system and cache memory.
4	Cultivate clear thinking in performing Arithmetic, Multiplication, division, and Floating-point number operations in computer.
5	Describe the working of pipelining and multiprocessor computer architecture.

Module1:Introduction	**No. of Hours**	**Blooms Cognitive Levels**
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, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions.	**8**	**Understand CO1**
Module 2: Input / Output Organization		
Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, USB.	**8**	**Understand CO2**
Module 3: Memory System		
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations.	**8**	**Analyze CO3**
Module 4: MIPS Arithmetic operations		
MIPS Addressing for 32-Bit Immediates and Addresses, Parallelism, and Instructions: Synchronization, Translating and Starting a Program, Addition and Subtraction (MIPS), Multiplication and Division (MIPS).	**8**	**Apply CO4**
Module 5:Pipelining and Multiprocessors		
Pipelining: Basic concepts, Data Hazards, Instruction hazards, Basic processing unit: some fundamental concepts, execution of complete instruction, multi-bus organization, The structure of general-purposes multiprocessors, **Parallel Computer Architecture:** Processor Architecture and Technology Trends, Flynn's Taxonomy of Parallel Architectures.	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE132.1	Ability to understand the abstraction of various components of a computer.
22CSE132.2	Ability to understand the functions of different sub systems, such as processor, Input/output, and memory
22CSE132.3	Analyze the concepts of Memory system and cache memory.
22CSE132.4	Apply Arithmetic, Multiplication, and division operations in computer.
22CSE132.5	Apply the working of pipelining and multiprocessor computer architecture.

Text Books

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002.
2. Parallel Programming for Multicore and Cluster Systems, Thomas Rauber, Gudula Runger, 2nd Edition, Springer, 2013.
3. David A. Patterson and John L. Hennessey, "Computer organization and design, The Hardware/Software interface", Morgan Kauffman / Elsevier, Fourth/Fifth edition, 2014.

Reference Books

1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015.

Marks Distribution for Assessment:

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Note: Minimum 40% passing marks in all divisions

BNM Institute Of Technology

Dept. of Computer Science & Engineering

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

Semester: III

Course Name: Operating Systems		**Course Code: 22CSE133**
L:T:P:J	**2: 1:1:0**	**CIAMarks:**50
Credits:	**3**	**SEAMarks:**50
Hours/Week (Total)	**4 (40)**	**SEADuration:**03Hours

Course Learning Objectives: The students will be able to

1	Introduce concepts and terminology used in OS
2	Explain threading and multithreaded systems
3	Illustrate process synchronization and concept of Deadlock
4	Introduce to Unix File Systems

Module-1: Introduction to Operating System& Process Management	**No. of Hours**	**Blooms Cognitive Levels**
Fundamental Concepts of Operating System: Introduction to Operating systems, Operating system functions and services, historical evolution of operating systems, System boot. **Process Management:** Process abstraction, process address space, process management, system calls, threads. **CPU Scheduling:** Levels of scheduling, comparative study of scheduling algorithms, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling, Multi-processor scheduling.	**8**	**Apply CO1**
Module-2: Process Synchronization and Deadlocks		
Concurrent Processes: Critical section problem, semaphores, Classical problems of synchronization, monitors, inter-process communication, message passing mechanisms. **Deadlocks:** Characterization, prevention and avoidance, deadlock detection and recovery.	**8**	**Apply CO2**
Module-3: Memory Management		
Memory Management: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation, virtual memory concept, demand paging, page replacement algorithms, thrashing, Disk Scheduling. **Solid State Drives**-SSD Architecture, Flash Controller, Garbage Collection, Bad Block Management.	**8**	**Apply CO3**
Module-4: UNIX file system		
Unix files: UNIX Architecture, Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative pathnames. File related commands – cat, mv, rm, cp, wc and od commands. **Practical component**: Execution of UNIX Shell Commands	**8**	**Apply CO4**
Module-5: File attributes and Shell programming		
File attributes and permissions: The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions. The shells interpretive cycle: Wild cards. Removing the special meanings of wild cards. Three standard files and redirection. **Connecting commands**: Pipe, grep,	**8**	**Analyze CO5**

egrep. **Shell programming**: Ordinary and environment variables. Read and read-only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document. Simple shell program examples. **Practical component:** Execution of Wildcards &UNIX Shell Programs		

Course Outcomes: After completing the course, the students will be able to	
22CSE133.1	Apply the concepts of process scheduling to improve CPU utilization and identify various multi- threading models
22CSE133.2	Identify the need of policies, protection required in managing deadlock, main and virtual memory & various techniques in managing concurrent processes
22CSE133.3	Apply the concept of paging & segmentation for effective memory management
22CSE133.4	Apply the concepts of Unix system and file commands to perform various tasks in files and system.
22CSE133.5	Analyze the concepts of Wildcards and Shell Programming to write basic shell scripts and formulating regular expressions for Pattern matching

Text Books

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006
2. Sumitabha Das., Unix Concepts and Applications., 4thEdition., Tata McGraw Hill .

Reference Books

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 9th Edition, 2018.
2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005
3. Unix System Programming Using C++ - Terrence Chan, PHI, 1999.

Marks Distribution for Assessment:

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Note: Minimum 40% passing marks in all divisions

BNM Institute of Technology

Dept. of Computer Science and Engineering

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

Semester: III

Course Name: Data Structure & Applications **Course Code: 22CSE134**

L: T: P: J	3:0:2:0	**CIA Marks:** 50
Credits:	4	**SEA Marks:** 50
Hours/Week (Total)	5 (50)	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Learn the fundamental data structures and identify data structuring strategies that are appropriate for a given contextual problem.
2	Design, develop, test and debug in C language considering appropriate data structure.
3	Illustrate and implement basic data structures such as stack, queue and linked list and apply them for the given problem.
4	Understand and distinguish the conceptual and applicative differences in trees, binary trees and binary search trees. Apply the concepts of trees for the given application.
5	Create and use appropriate data structures in C programs for solving real life problems.

Module-1: Introduction to DS, Stacks and Queues	**No. of Hours**	**Blooms Cognitive Levels with CO mapping**
Introduction to DS: Classification (Primitive & Non-primitive), Operations, Pattern Matching Algorithms (Brute force, KMP) **Stacks:** Definition, Operations, Implementation using arrays, Applications of Stacks – Infix to Postfix Conversion and Postfix Expression Evaluation. **Queues:** Definition, Operations, Implementation, Applications, Circular Queue (Message queue using Circular queue), Doubly Ended Queue, Priority Queue. **Sample Programs:** 1. Write a C program to implement data structure. 2. Write C Program to convert the given infix expression to postfix expression. 3. Write a C Program to Evaluate the given postfix Expression. 4. Write a C Program to implement Queue data structure. 5. Write a C Program to implement circular Queue data structure.	**10**	**Apply CO1, CO2, CO3**
Module-2: Linked List – I		
Linked Lists: Definition, Create, Insert, Delete, Update, Traverse, and Position-based Operations, Concatenate, Merge, and Reverse Lists, Doubly Linked List Implementation and Operations. **Sample Programs:** 1. Write a C Program to perform following operations on Singly Linked List 1. a. Create b. Insert (At the Mid Position) c. Delete (At End) d. Display 2. Write a C Program to store and display the specified student information using SLL. 3. Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with	**10**	**Apply CO1, CO2, CO3**

the fields: SSN, Name, Dept, Designation, Sal, PhNo a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue. f. Exit		
Module-3: Linked List – II & Trees		
Circular Linked List Implementation and Operations, Applications of Lists (Polynomial addition). Implementation of stacks and queues using Linked List **Introduction to Trees:** General Tree Representation, Traversals, Applications. **Sample Programs:** 1. Write a program to implement stack using SLL. 2. Write a program to implement Queue using SLL. 3. Develop a C code to perform polynomial addition using circular Singly Linked List with header node. 4. Develop a code to traverse a tree.	**10**	**Apply CO1, CO2, CO3**
Module-4: Advanced Trees and Heap		
Binary Trees: Definition, Properties, Traversals, Applications. **Binary Search Tree**: Definition, Implementation, Search, Insert, Delete operations. Building and Evaluating Binary Expression Tree. **Heap:** Definition, Implementation, Insert, Delete, Peek operations. **Sample Programs:** 1. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers. a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 5, 2. b. Traverse the BST in Inorder, Preorder and Postorder. c. Search the BST for a given element (KEY) and report the appropriate message. d. Exit. 2. Design, Develop and Implement a code to generate a max and min heap tree.	**10**	**Apply CO1, CO2, CO3, CO4**
Module-5: Hashing & Graphs		
Hashing: Hash Table, Hash Functions, Collision Handling by Open Addressing, Chaining. **Graphs:** Disjoint sets, Representation of Graphs - Adjacency/ Cost Matrix, Adjacency Lists, and Traversal of Graphs (BFS and DFS). **Sample Programs:** 1. Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K →L as H(K)=K mod m (remainder method) and implement hashing technique to map a given key K to the address space L.	**10**	**Apply CO1, CO2, CO3, CO4, CO5**

Resolve the collision (if any) using linear probing. 2. Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a digraph using BFS method. 3. Print all the nodes reachable from a given starting node in a digraph using DFS method.		

Course Outcomes: After completing the course, the students will be able to	
22CSE134.1	Apply fundamental data structures viz., Lists, Stacks, Queues, Linked Lists, Binary Trees from first principles.
22CSE134.2	Identify the use of appropriate data structures for a given problem.
22CSE134.3	Design and implement solutions to basic practical problems using customized data structures.
22CSE134.4	Apply the Advanced concepts like Heap & Hashing to solve problems.
22CSE134.5	Apply the concepts to solve graphical problems.

Text Books

1. "Data Structures and Program Design in C", Robert Kruse, C L Tondo, Bruce Leung and Shashi Mogalla, PHI, 2nd Edition, 2015.
2. Y. Langasm, M. J. Augenstein, A. M. Tenenbaum (2001) Data Structures Using C and C++, Prentice Hall India, New Delhi, India.

Reference Books

1. T. H. Cormen, C. E. Leiserson and R. L. Rivest (1990) Introduction to Algorithms, Third Edition, MIT Press, MA.
2. Fundamentals of Data Structures in C -- by Horowitz, Sahni and Anderson-Freed (Silicon Press 2007).
3. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4th Revised edition; 2013, Addison-Wesley, ISBN-13: 978-8131714744
4. Data Structures Using C, Reema Thareja, 1st Edition, 2011, Oxford Higher Education, ISBN-13: 978-0198099307.

Marks Distribution for Assessment:

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th colspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th><th>PART A</th><th>PART B</th></tr>
<tr><td rowspan="3">Conduction</td><td rowspan="3">50</td><td rowspan="3">50</td><td rowspan="2">IA Test</td><td>30</td><td>30</td><td rowspan="2">30 Marks</td><td rowspan="2">70 Marks</td></tr>
<tr><td colspan="2">Average of two tests – 30 M</td></tr>
<tr><td>Continuous Assessment</td><td colspan="2">weekly Assessment -20 marks</td></tr>
<tr><td colspan="5">Total – 50 Marks</td><td colspan="2">Total – 50 Marks</td></tr>
</table>

i) CIA: 50%

IA Test: 2 IA tests - each of 30 Marks	Average of 2 tests – 30 M
Practical Lab record – 10 Marks Performance – 05 Marks Viva – 05 Marks	20 Marks
	Total 50 Marks

ii) SEA : 50%

Question Paper:

Theory part	5 questions to answer each of 6 Marks 2 questions from each module with internal choice Student should answer one full question from each module	6 M x 5 = 30 Marks
Execution part	Write up - 20 Marks Conduction - 40 Marks Viva-Voce - 10 Marks	70 Marks
	Total	**100 Marks reduced to 50 M**

Note:

- **No Assignment and AAT**
- **Minimum 40% passing marks in all divisions**

B.N.M. Institute of Technology

Dept. of Computer Science & Engineering

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

Logic Design and Applications

SEMESTER–III

Course Name: Logic Design and Applications **Course Code: 22CSE135**

L: T: P: J	3:0:2:0	CIE Marks: 50
Credits:	4	SEE Marks: 50
Hours/Week (Total)	5 (50)	SEE Duration: 3 Hours

Course Objectives:

- Explain the use of Operational Amplifier, 555 timer IC, Regulator ICs and uA741, Analog-to-Digital and Digital-to-Analog conversion techniques.
- Make use of simplifying techniques in the design of combinational circuits.
- Illustrate combinational and sequential digital circuits
- Demonstrate the use of flip flops and apply for registers

Module-1: Analog Electronics	**Teaching Hours**	**Blooms cognitive Levels with CO mapping**
Analog Electronics: Introduction to Operational Amplifier, Operational Amplifier Application Circuits: Multivibrators using IC-555, Peak Detector, Schmitt trigger, 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. ***Laboratory Component:*** 1. Design and simulate a 1 kHz Relaxation Oscillator with 50% duty cycle using ua 741 Opamp 2. Design and simulate an astable multivibrator circuit for three cases of duty cycle (50%, <50% and >50%) using NE 555 timer IC. 3. Design and simulate a Schmitt trigger for given UTP and LTP using ua 741 opamap.	**10**	**CO1 Understand**
Module-2: Digital Electronics		
Digital Electronics: Review of Basic Logic gates, Positive and Negative Logic, Introduction to HDL. **Combinational Logic Circuits:** Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard covers, HDL Implementation Models. ***Laboratory Component:*** Given a 4-variable logic expression, simplify it using appropriate technique and implement the same using basic gates	**10**	**CO2 Apply**
Module-3: Data-Processing Circuits		
Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic Unit. ***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: i) Parity Generator (ii) Parity Checker	**10**	**CO3 Analyze**

Module-4: Flip- Flops		
Flip- Flops: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs. FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, HDL Implementation of FLIP-FLOP. **Registers:** Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL. ***Laboratory Component:*** Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table. And implement the same in HDL.	**10**	**CO4 Analyze**
Module-5: Counters		
Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus. Decade Counters, Presettable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL. ***Laboratory Component:*** 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<=9) and demonstrate on 7-segment display (using IC-7447)	**10**	**CO5 Analyze**

Course Outcomes: After completing the course, the students will be able to	
22CSE135.1	Interpret with the applications of analog circuits using Operational Amplifier
22CSE135.2	Apply Karnaugh Map, and Quine-McClusky Methods to simplify digital circuits.
22CSE135.3	Analyze the combinational logic circuits and simulate using HDL
22CSE135.4	Analyze the sequential logic circuits with different types of flip-flops and simulate using HDL.
22CSE135.5	Design and Analyze the functionalities of registers and counters

Text Books

1. Donald P Leach, Albert Paul Malvino & Goutam Saha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015.
2. Charles H Roth Jr, Larry L Kinney and Raghunandan G. H. Analog and Digital Electronics, Cengage Learning, 2020.

Reference Books

1. M. Morris Mano, Digital Design, 4th Edition, Pearson Prentice Hall, 2008.
2. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008

Marks distribution for assessment

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th></tr>
<tr><td rowspan="5">Conduction</td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="2">Written Test</td><td>50</td><td>50</td><td rowspan="5">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module</td></tr>
<tr><td colspan="2">Average of two tests – 50 marks scaled down to 15 marks</td></tr>
<tr><td>Assignment</td><td colspan="2">Average of 2 Assignments – 10M</td></tr>
<tr><td>Practical</td><td colspan="2">Weekly Assessment – 10 Marks
IA test – 15 Marks
(IA test to be conducted for 50 M and scaled down to 15M)</td></tr>
<tr><td colspan="5">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

i) CIA: 50%

Theory	**IA Test** (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1)** - 15 marks	25 Marks
	Total	**50 arks**

ii) SEA : 50%

Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M** **Reduced to 50 M**
	Total	**50 Marks**

Note: Minimum 40% passing marks in all divisions

B N M Institute of Technology

Dept. of Computer Science &Engineering

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

Semester: III

Course Name: Object Oriented Programming Using JAVA **Course Code: 22CSE136**

L:T:P:J	0:0:2:2	CIA Marks: 50
Credits:	2	SEA Marks: 50
Hours/Week (Total)	4 (30)	SEA Duration: 3 Hours

Pre-Requisites:

Course Learning Objectives : The students will be able to

1	Learn fundamental features of object oriented language and JAVA
2	Set up Java JDK environment to create, debug and run simple Java programs.
3	Create multi-threaded programs.
4	Solve real world problems using JAVA.

Module-1	No. of Hours	Blooms cognitive Levels
Introduction to Java: Features of OOP, Characteristics/Buzz words of Java, Java Environment: JDK, JVM, JRE, Fundamental Programming Structure in Java, Variables, Data Types, Operators & Expressions, Control Statements, Iteration Statements, Command Line Arguments, Arrays.	**6**	**Understand CO1**
Module-2		
Classes & Objects: Defining Classes & Objects, Access Specifies, Constructors, Overloading Constructor, Method Overloading, Passing and Returning object form Method, new operator, finalize() method, this keyword, Static Keyword, Encapsulation, Polymorphism. **Inheritance:** Defining a Inheritance, Types of Inheritance, Constructor in subclass, Method Overriding, super keyword, abstract keyword, final keyword.	**6**	**Understand CO2**
Module - 3		
Interfaces & Packages: Defining a Interface, Implementing a Interface, Difference between Interface & Classes, Extending a Interface, Usage of Package, Classpath, Importing a Package. **Exceptions:** Definition of Exception, Classification of Exception, Structure of Try & catch block, Error Vs Exception, Throw Keyword, Throws Keyword, Finally Keyword, Custom Exception	**6**	**Apply CO3**
Module-4		
Multi Threaded Programming: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, producer consumer problems.	**6**	**Apply CO4**
Module-5		
Database Connectivity: Basic SQL, Introduction to JDBC, JDBC Architecture & Drivers, Create a Database, Table, CRUD Operations, Java Application Using JDBC Connectivity, Driver Manager, ResultSet, Connection, Statement, Prepared Statement, DB Connectivity Steps, Store & Retrieving Image in SQL, JDBC CRUD Application.	**6**	**Create CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE136.1	Understand object oriented programming concepts and implement in java.
22CSE136.2	Comprehend building blocks of OOPs language, inheritance, package and interfaces.
22CSE136.3	Identify exception handling methods.
22CSE136.4	Implement multithreading in OOP.
22CSE136.5	Create solutions for real world problems using JAVA

Text Books

1. The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, - TMH.
2. Java Fundamentals A comprehensive introduction By Herbert Schildt, Dale Skrien, McGraw Hill Education.
3. Programming with Java A Primer – E.Balaguruswamy, McGrawhill
4. Core Java Volume-I Fundamentals Horstmann& Cornell, - Pearson Education. - Eight Edition
5. Head First Java: A Brain-Friendly Guide, 2nd Edition- Kathy Sierra, Bert Bates

Marks Distribution for Assessment:

<table>
<tr><th>PBL</th><th>CIA</th><th>SEA</th><th colspan="3">CIA (50)</th><th>SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><td rowspan="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="3">Theory</td><td>I IA</td><td>II IA</td><td rowspan="3">Project
Assessed for 100 marks
reduced to 50 Marks</td></tr>
<tr><td>25</td><td>25</td></tr>
<tr><td colspan="2">Average of 2 tests – 25 M</td></tr>
<tr><td>Practical</td><td colspan="2">Weekly Assessment
(Record/Project) – 10 Marks
Lab IA test – 15 Marks</td><td></td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

SEA : 50%

Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
	Total	**50 Marks**

Note: Minimum 40% passing marks in all divisions

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Semester: III		
COURSE: Soft Skill-1		
Course Code: 22SFT138	**L:T:P:J: 0:0:2:0**	**CIA Marks:** 100
Credits:	**1**	
Hours:	**24 hrs**	

Course Learning Objectives: The students will be able	
1	To help students understand their strengths and weakness.
2	To develop analytical and creative ability to solve problems individually or as a team.
3	To make students industry ready through practice of corporate etiquettes.
4	To enhance public speaking and presentation skills.

Module No.	Contents of the Module	Hours	Cos
1	**Module-1 Understanding and Managing Self** Self-Awareness, Self-Management, Anger Management, Time management, Change management. Vision and goal setting - Diff between vision and goal, smart, stretched goal concept, case studies Knowledge, Skill, Attitude Personality analysis using Big 5 personality test Critical Thinking, Problem solving, Creativity and innovation Integrity, ethics, values	8	**1 &2**
2	**Module -2 Corporate etiquettes and Mannerism** Introduction to Etiquette and Mannerism, Personal Etiquette, Grooming etiquettes- professional styling, Body & personality styling, Video Interview Etiquettes, Personal Interview EtiquettesEffective meeting skills. Workplace behavior, Personal interview	6	**3**
3	**Module -3 Public Speaking and presentation skills** Introduction to public speaking, making ideas, illustrating and delivering ideas, overcoming fear of public speaking and developing great delivery. Advanced Business presentation skills, PowerPoint presentation, Group discussion	**6**	**4**
4	**Module -4 Team Work** Interpersonal skills, group work vs team work	**4**	**5**

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

CO1	Understand their strength and weaknesses.
CO2	Develop analytical and creative ability to solve problems.
CO3	Identify themselves as industry ready through the practice of corporate etiquettes.
CO4	Enhance public speaking and presentation skills.
CO5	Build team collaboration by working towards shared goals.

Mapping of Course Outcomes with Programme Outcomes:

COs	PO8	PO9	PO10	PO11
CO1	3	3		
CO2		3		3
CO3	3	3		3
CO4		3	3	
CO5			3	3

MOOC Course:

Communicate with impact - https://www.coursera.org/learn/communicate-with-impact

Leading Diverse Teams - https://www.coursera.org/learn/leading-diverse-teams

Practical component:

1. Mock GD and interview may be conducted at the end of the course to check their confidence. Students can prepare their SWOT analysis and present the same.
2. The students are to be involved in various activities and games such as Just a Minute or Pick and speak to demonstrate each topic.

B.N.M. Institute of Technology

An Autonomous Institution under VTU

For Internal Communication

Department of Computer Science & Engineering

IV SEMESTER

Scheme of Teaching for 2022-26 Batch

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week				Hours Per week	Credits	Examination		
					Theory Lecture	Tutorial	Practical	Project					
					L	T	P	J			CIA	SEA	Total
1	BSC	22MAT141	Statistics, Probability and Graph Theory	Mathematics	2	2	-	-	4	3	50	50	100
2	PCC	22CSE142	Microcontroller and Embedded Systems	CSE	2	1	1	-	4	3	50	50	100
3	PCI	22CSE143	Database Management System	CSE	3	-	1	1	5	4	50	50	100
4	PCI	22CSE144	Design and Analysis of Algorithms	CSE	3	-	2	-	5	4	50	50	100
5	PBL	22CSE145	Python Programming and applications	CSE	-	-	2	2	4	2	50	50	100
6	PBL	22CSE146	Web Technologies and its Application	CSE	-	-	2	2	4	2	50	50	100
7	HSS	22CIP147	Constitution of India and professional Ethics[CIPE]	HSS	-	2	-	-	2	1	100		100
8	AEC	22SFT148	Soft Skill-2	HSS	-	2	-	-	2	1	100		100
9	INT	22CSE149	Internship-1/IPL	CSE	-	-	2	2	4	2	100	-	100
TOTAL					10	7	10	7	34	22	600	300	900

CIE: Continuous Internal Evaluation, SEE: Semester End Examination, NCMC: Non Credit Mandatory Course

AICTE Activity Points to be earned by students admitted to BE day college programme (For more details refer to Chapter 6, AICTE Activity Point Programme, Model Internship Guidelines): Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other institutions and Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to BNMIT. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

Internship: All the students registered to III year of BE shall have to undergo mandatory internship of 4 weeks during II semester or III semester vacation. Semester End Assessment will be conducted in IV semester and the prescribed credit will be included. Internship shall be considered as a head of passing and shall be considered for the award of degree.

B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Department of Mathematics

Syllabus

Semester: IV		
Course: Statistics, Probability and Graph theory **Course Code: 22MAI141 (Common to CSE, ISE, AIML)**		
L:T:P:J	**2:2:0:0**	**CIA: 50**
Credits:	**03**	**SEA: 50**
Hours:	**40**	**SEA Duration: 03 Hours**

Course Learning Objectives: The students will be able to

1	Provide an insight into applications of Graph Theory, Curve fitting & Statistical methods.
2	Develop the knowledge of probability, joint probability distribution and Queuing theory occurring in digital signal processing, design engineering and micro wave engineering.

Module-1: Curve fitting & Statistical methods	No. of hours	Blooms cognitive Levels
Examples from Engineering that require curve fitting and statistical methods. **Curve Fitting:** Curve fitting by the method of least squares-fitting the curves of the form: $y = ax+b$, $y = ax^b$ and $y = ax^2 + bx + c$. **Statistical methods:** Introduction to Moments, Skewness, Kurtosis and problems. Karl Pearson's coefficient of correlation and lines of regression. *Experiential Learning component: Problems on curve fitting and statistical methods*	**L: 04** **T: 04**	**Apply**
Module-2: Probability distributions & Joint probability distribution		
Examples from Engineering that require Probability and Joint probability distribution **Probability distributions:** Review of basic probability theory. Discrete and continuous Random variables, probability mass/density functions (definitions only). Binomial, Poisson, exponential and normal distributions (without proof). **Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. *Experiential Learning component: Problems on Binomial, Poisson, Exponential and Normal distributions*	**L: 04** **T: 04**	**Apply**
Module-3:Markov chain & Sampling theory		
Examples from Engineering that require Markov Chain and Sampling Theory **Markov chain**: Introduction to Stochastic process, Probability vectors, Stochastic matrices, Regular stochastic matrices, Markov Chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markovian processes. **Sampling theory**: Introduction to sampling theory, testing of hypothesis, level of significance, confidence limits, test of significance of mean and difference of means for large samples-z-test, test of significance of small Samples-Student's t- distribution, Goodness of fit-Chi-Square test. *Experiential Learning component: Problems on Markovian processes and, Sampling Theory*	**L: 04** **T: 04**	**Apply**
Module-4: Queuing theory		
Examples from Engineering that require queueing theory Introduction, birth and death process, Kendall's Notation, Symbolic representation of a queuing model, single server Poisson queuing model with infinite capacity (M/M/1: ∞/FCFS), when $\lambda_n = \lambda$ and $\mu_n = \mu(\lambda < \mu)$, Multiple server Poisson queuing model with infinite capacity (M/M/S: ∞/ FCFS), when $\lambda_n = \lambda$ for all $n, (\lambda > S\mu)$, *Experiential Learning component: Problems on* (M/M/1: ∞/FCFS) and (M/M/S: ∞/ FCFS) queuing models	**L: 04** **T: 04**	**Apply**
Module-5: Graph theory		
Examples from Engineering that require graph theory Basic concepts, types of graphs, order and size of a graph, in-degree and out-degree, bipartite-graphs, connected and disconnected graphs, Eulerian graph, Hamiltonian graphs, sub-graphs, isomorphic graphs. Matrix representation of graphs, adjacency matrix, incidence matrix. Planar graphs: definition, characterization of planar graphs, Kuratowski's theorem, Euler's formula and consequences. *Experiential Learning component: Problems on detection of planar and non-planar graphs*	**L: 04** **T: 04**	**Apply**

Course Outcomes: After completing the course, the students will be able to

CO 1:	Make use of correlation and regression analysis to fit a suitable mathematical model for the statistical data.
CO 2:	Apply discrete and continuous probability and joint probability distributions in analyzing the probability models arising in engineering field.
CO 3:	Use Markov chain in prediction of future events and demonstrate the validity of testing the hypothesis.
CO 4:	Acquire skills in analyzing queuing models.
CO 5:	Apply the knowledge of Graph Theory in Network modeling, electrical network and computational algorithms.

Reference Books:

1. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition(Reprint), 2016.
2. B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2017.
3. S. D. Sharma : "Operations Research", Kedar Nath Ram Nath & Co. Meerut, 2014.
4. T. Veerarajan : Probability, Statistics and Random processes, McGraw Hill Education(India) Private Limited, Third edition, Nineteenth reprint 2017.
5. C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
6. James Stewart : Calculus-Early Transcendental, Cengage Learning India Private Ltd., 2017.
7. B. V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
8. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics", Oxford University Press, 3rd Reprint, 2016.
9. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall of India, 2000.

Web links and Video Lectures:

1. https://nptel.ac.in/courses/111104098
2. https://www.youtube.com/watch?v=1YkfeR05YXY
3. https://archive.nptel.ac.in/courses/111/104/111104079/
4. https://www.youtube.com/watch?v=xGkpXk-AnWU
5. https://archive.nptel.ac.in/courses/106/104/106104170/

Assessment Process:

<table>
<tr><th rowspan="2">PCC</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
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<tr><td colspan="2">Average of two tests – scaled down to 25 Marks</td></tr>
<tr><td>Assignment</td><td colspan="2">Two assignments – one for 10 marks and another for 5 marks = 15</td></tr>
<tr><td>AAT</td><td colspan="2">10</td></tr>
<tr><td colspan="4">Total – 50 marks</td><td>Total – 50 marks</td></tr>
</table>

Note: Minimum 40% passing marks in all divisions

BNM Institute of Technology

Dept. of Computer Science and Engineering

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

Semester: IV

Course Name: Microcontroller and Embedded Systems
Course Code: 22CSE142

L: T: P: J	2:1:1:0	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4 (40)**	**SEA Duration:** 03 Hours

Pre-Requisites: -

Course Learning Objectives: The students will be able to

1	Understand the fundamentals of ARM-based systems, including programming modules with registers and the CPSR.
2	Use the various instructions to program the ARM controller.
3	Program various embedded components using the embedded C program.
4	Identify various components, their purpose, and their application to the embedded system's applicability.

Module1: Microprocessors versus Microcontrollers	**No. of Hours**	**Blooms Cognitive Levels with CO mapping**
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.	**6**	**Understand CO1**
Laboratory Component: Using Keil software, observe the various registers, dump, CPSR, with a simple ALP programme.	**2**	
Module2: ARM Instruction Set		
Introduction to the ARM Instruction Set: Data Processing Instructions, Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants.	**6**	**Apply CO2**
Laboratory Component: 1. Write a program to find the sum of the first 10 integer numbers. 2. Write a program to find the factorial of a number.	**2**	
Module-3: ARM programming using Assembly language		
ARM programming using Assembly language: Writing Assembly code, Profiling and cycle counting, instruction scheduling, Register Allocation, Conditional Execution, Looping Constructs.	**6**	**Apply CO3**
Laboratory Component: 1. Write a program to add an array of 16-bit numbers and store the 32-bit result in internal RAM. 2. Write a program to find the square of a number (1 to 10) using a look-up table.	**2**	

3. Write a program to find the largest or smallest number in an array of 32 numbers. 4. Write a program to arrange a series of 32 bit numbers in ascending/descending order. 5. Write a program to count the number of ones and zeros in two consecutive memory locations		
Module4: I/O Subsystems and Hardware Interface		
Sensors, Actuators, LED, 7 segment LED display, DAC, ADC, Stepper motor, Keyboard, Push button switch, Communication Interface. ***Laboratory Component:*** 1. Interface and Control a DC Motor. 2. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction. 3. Interface a DAC and generate Triangular and Square waveforms. 4. Interface ADC to obtain Digital output for a given Analog input using Internal ADC of ARM controller. 5. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.	**4** **4**	**Apply CO4**
Module-5: Embedded System Components and Embedded Environment		
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 **Embedded system Development Environment** – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques, target hardware debugging, boundary scan.	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE142.1	Understand the fundamentals of ARM-based systems, including programming modules with registers and the CPSR.
22CSE142.2	Make use of Instruction sets and addressing modes learnt to write simple programs.
22CSE142.3	Apply the knowledge gained for Programming ARM controller for real time applications.
22CSE142.4	Apply the knowledge to interface external devices and I/O with ARM microcontroller.
22CSE142.5	Identify the importance of Embedded Systems in real time.

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

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

Marks Distribution for Assessment:

PCI	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M
				I	II	
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of two tests – 50 marks scaled down to 15 marks		
			Assignment	Average of 2 Assignments – 10M		
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)		
			Total – 50 Marks			**Total – 50 Marks**

i) CIA: 50%

Theory	**IA Test** (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1)** - 15 marks	Marks
	Total	**50 arks**

ii) SEA : 50%

Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M reduced to 50 M**
	Total	**50 Marks**

Note: Minimum 40% passing marks in all divisions

BNM Institute of Technology

Dept. of Computer Science & Engineering

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

Semester: IV

Course Name: Database Management System		**Course Code: 22CSE143**
L: T: P: J	3: 0 :1 :1	**CIA Marks:** 50
Credits:	4	**SEA Marks:** 50
Hours/Week (Total)	5	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Understand fundamental concepts, terminology and application of databases, SQL and NoSQL
2	Design concepts and creation of relational databases using relation algebra.
3	Practice SQL programming through a variety of database problems.
4	Demonstrate the use of Normalization, concurrency and transactions in database.

Module-1: Database System Concepts, Data Modeling	**No. of Hours**	**Blooms cognitive Levels**
Databases and Databases Users: Characteristics of database Approach, Advantages of using the DBMS Approach. Database System Concepts and Architecture: Data Models-Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces. Data Modeling Using the Entity-Relationship (ER) Model: Entity Types-Entity sets- Attributes and Keys, Relationship types – Relationship Sets – Roles and structural Constraints, Weak Entity Types. **Practical component:** Draw ER Diagram for the following Databases using GitMind software. Order Database Library Database Bank Database	10	**Understand CO1**
Module-2: Relational Data Model and Relational Algebra		
Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators: selection, projection, cross product, various types of joins, division, example queries, tuple relation calculus, domain relational calculus, converting the database specification in E/R notation to the relational schema **Practical component:** Create Schema, insert at least 5 records in each table and add appropriate constraints for the following Library Database using ORACLE or MySQL DBMS under LINUX/Windows environment BOOK (Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS (Book_id, Author_Name) PUBLISHER (Name, Address, Phone) BOOK_COPIES (Book_id, Branch_id, No-of_Copies) BOOK_LENDING (Book_id, Br_id, Card_No, Date_Out, Due_Date) LIBRARY_BRANCH (Branch_id, Branch_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 branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2020 to Jun 2022.	**10**	**Apply CO2**

3. Delete a book in BOOK table. Update the contents of other tables toreflect this data manipulation operation.		
Module-3: SQL		
Basic SQL: SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT – DELETE and UPDATE Statements in SQL, Additional features in SQL **More SQL: Complex Queries, Triggers, Views and Schema Modification:** Complex SQL Retrieval Queries, Specifying Constraints as Assertions and actions as Triggers, Views (Virtual Tables) in SQL. **Practical component:** Create Schema, insert at least 5 records for each table and add appropriate constraints for the following Order Database using ORACLE or MySQL DBMS under LINUX/Windows environment. SALESMAN (Salesman_id, Name, City, Commission) CUSTOMER (C_id, Cust_Name, City, Grade, Salesman_id) ORDERS (Ord_No, Purchase_Amt, Ord_Date, C_id, S_id) Write SQL queries to 1. 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.	**10**	**Apply CO3**
Module-4: Functional Dependencies and Normalization		
Basics of Functional Dependencies and Normalization for Relational Database: Functional Dependencies, Armstrong's axioms for FD's, Equivalent Decompositions, closure of a set of FDs, minimal covers, Normal forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce- Codd Normal Forms [BCNF] **Practical component:** Create Schema, insert at least 5 records for each table and add appropriate constraints for the following Company Database using ORACLE or MySQL DBMS under LINUX/Windows environment. EMPLOYEE (SSN, Name, Address, Sex, Salary, Super SSN, D No) DEPARTMENT (D No, D Name, Mgr. SSN, Mgr. Start Date) DLOCATION(D No,D Loc) PROJECT (P No, P Name, P Location, D No) WORKS_ON(SSN, P No, Hours) Write SQL queries to 1. 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. 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. **3.** Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary and the average salary in this department.	**10**	**Analyze CO4**

Module-5: Transaction Processing, Concurrency Control, NoSQL		
Introduction to Transaction Processing – Introduction to Transaction Processing, Desirable Properties on Transactions (ACID) **Concurrency Control Techniques:** Transactions and Schedules, Serializability, Precedence Graphs, Concurrency, Lock Based Protocols: 2PL, Strict 2PL Protocols, Deadlocks - Detection and Prevention **NoSQL:** SQL v/s NoSQL, The Emergence of NoSQL, BASE Properties, Data Models: Relationships, Graph Database, Schema less Database.	**10**	**Analyze CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE143.1	Understand the Database System Concepts along with Data Modeling Using the Entity-Relationship (ER) Model
22CSE143.2	Apply the concepts of relations on RDBMS, constraints, joints using relational algebra operators.
22CSE143.3	Apply Structured Query Language for database manipulation.
22CSE143.4	Analyze functional dependencies to normalize relations of relational database
22CSE143.5	Analyze transactions processing, schedules protocols, serializability issues, deadlocks in DBMS and concepts of NoSQL with its advantages

Text Books	
1.	Ramez Elmasari, Shamkant B Navathe "Fundamentals of Database Systems", Pearson, Seventh Edition 2017.
2.	"Database System Concepts", Silberschatz, H Korth, S Sudarshan, 6th Edition, McGraw-Hill, 2010
3.	Pramod J Sadalage, Martin Fowler, "NOSQL Distilled", Pearson, 2013

Marks Distribution for Assessment:

PCI	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M
				I	II	
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of two tests – 50 marks scaled down to 15 marks		
			Assignment	Average of 2 Assignments – 10M		
			Practical	eekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)		
			Total – 50 Marks			**Total – 50 Marks**

i) CIA: 50%

Theory	**IA Test** (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1)** - 15 marks	25 Marks
	Total	**50 arks**

ii) SEA : 50%

Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M** **reduced to 50 M**
	Total	**50 Marks**

Note: Minimum 40% passing marks in all divisions

BNM Institute of Technology

Dept. of Computer Science & Engineering

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

Semester: IV

Course Name: Design and Analysis of Algorithms		**Course Code: 22CSE144**
L: T: P: J	**3 : 0 :2 :0**	**CIA Marks:** 50
Credits:	**4**	**SEA Marks:** 50
Hours/Week (Total)	**5 (50)**	**SEA Duration:** 03 Hours

Pre-Requisites:

Course Learning Objectives: The students will be able to

1	Analyze the asymptotic performance of algorithms.
2	To understand the concept of designing an algorithm.
3	Synthesize efficient algorithms in common engineering design situations.
4	Analyze the efficiency of programs based on time complexity

Module-1:	**No. of Hours**	**Blooms Cognitive Levels**
Introduction: Notion of algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency: Analysis frame work, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. **Practical Programs:** 1. Implement Coin Changing problem method and find the time required. 2. Write a program to find maximum profit using Knapsack technique. 3. Implement Job Sequence problem using Greedy method. Apply brute force/divide and conquer technique to recursively implement the following concepts: a. Linear Search or Binary Search. b. To find the maximum and minimum from a given list of n elements using Brute Force Method. 4. There are 5 books in the shelf, find the number of ways to select 3 books from 5 books on the shelf using the NCR with recursion. 5. Find the next three terms of the sequence 15, 23, 38, 61, … Fibonacci series of the given number using recursion. 6. Demonstrate through a program how a sequence of characters is taken and checked for the possibility of the presence of the required string. If the possibility is found then, character matching is performed else no using Rabin Karp method.	**6 hours (Theory) 4 hours (Practical)**	**Apply CO1**
Module-2:		
Brute Force: Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching **Divide and Conquer**: General method, Binary search, Recurrence equation for divide and conquer, Finding the Maximum and Minimum, Merge sort, Quick sort, Strassen's matrix multiplication. Decrease and Conquer Approach: Topological Sort.	**6 hours (Theory) 4 hours (Practical)**	**Apply CO2**

Practical Programs: 1. Implement the Selection sort algorithm. 2. Implement Bubble sort algorithm. 3. Implement the Sequential Search algorithm. 4. Implement the String Matching algorithm. 5. Write a program to search a key in a given set of elements using Binary search method and find the time required to find the key. 6. Write a program to find Maximum and Minimum using divide and conquer technique and find the time required to find the elements. 7. Sort a given set of elements using Merge Sort method and determine the time required sort the elements. Plot a graph of number of elements versus time taken. Specify the time efficiency class of this algorithm. 8. Sort a given set of elements using Quick Sort method and determine the time required sort the elements. Plot a graph of number of elements versus time taken. Specify the time efficiency class of this algorithm. 9. Implement Topological sort using source removal method find the time required to sort the elements.		
Module-3:		
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines. Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm. Single source shortest paths: Dijkstra's Algorithm. Optimal Tree problem: Huffman Trees and Codes. **Practical Programs:** 1. Implement Coin Changing problem method and find the time required. 2. Write a program to find maximum profit using Knapsack technique. 3. Implement Job Sequence problem using Greedy method. 4. Implement Prim's algorithm and Find Minimum Cost Spanning Tree of a given connected undirected graph. 5. Implement Kruskal's algorithm and Find Minimum Cost Spanning Tree of a given connected undirected graph. 6. Implement Dijkstra's algorithm find shortest paths to other vertices from a given vertex in a weighted connected graph.	**6 hours (Theory) 4 hours (Practical)**	**Apply CO3**
Module-4:		
Dynamic Programming: General method with Examples, Multistage Graphs. Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem, Bellman-Ford Algorithm, Travelling Sales Person problem, Reliability design. **Practical Programs:** 1. Implement all-pairs shortest paths problem using Floyd's algorithm. 2. Implement all-pairs shortest paths problem using Warshal's algorithm. 3. Implement 0/1 Knapsack using Dynamic Programming. 4. Implementation of Bellman Ford Algorithm using a directed graph.	**6 hours (Theory) 4 hours (Practical)**	**Apply CO4**

5. Implement Travelling Sales man problem using Dynamic Programming.		
Module-5:		
General method (T2:7.1), N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles. Programme and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem: LC Programme and Bound solution, FIFO Programme and Bound solution. NP-Complete and NP-Hard problems: Basic concepts, nondeterministic algorithms, P, NP, NP-Complete and NP-Hard classes **Practical Programs:** 1. Implementation of N Queen Problem using Backtracking technique. 2. Implementation of SUM-SUBSET Problem. 3. Design and implement to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using the backtracking principle. 4. Implementation Assignment Problem using Backtracking technique. 5. Implementation of Travelling Sales Man Problem using Branch and Bound method. 6. Implementation of Knapsack problem using Branch and Bound method.	**6 hours (Theory) 4 hours (Practical)**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE144.1	Apply and Analyze the asymptotic runtime complexity of algorithms by using mathematical relations that helps to identify them in specific instances.
22CSE144.2	Apply and solve problems using brute force, divide and conquer techniques
22CSE144.3	Apply various problem solving methodologies such as greedy, decrease and conquer to solve a given problem.
22CSE144.4	Apply the dynamic programming to estimate the computational complexity of different algorithms.
22CSE144.5	Apply and Analyze the efficient algorithm design approaches in a problem specific manner in terms of space and time complexity

Text Books
1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2rd Edition, 2009. Pearson. 2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
Reference Books
1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, CliffordStein, 3rd Edition, PHI. 2. Data Structures and Algorithms using C, R.S.Salaria, 5th Edition, Khanna Publication.

Marks Distribution for Assessment:

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<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th colspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th><th>PART A</th><th>PART B</th></tr>
<tr><td rowspan="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="2">IA Test</td><td>30</td><td>30</td><td rowspan="3">30 Marks</td><td rowspan="3">70 Marks</td></tr>
<tr><td colspan="2">Average of two tests – 30 M</td></tr>
<tr><td>Continuous Assessment</td><td colspan="2">Weekly Assessment -20 marks</td></tr>
<tr><td colspan="3">Total – 50 Marks</td><td colspan="2">Total – 50 Marks</td></tr>
</table>

i) CIA: 50%

IA Test: 2 IA tests - each of 30 Marks	Average of 2 tests – 30 M
Practical Lab record – 10 Marks Performance – 05 Marks Viva – 05 Marks	20 Marks
	Total 50 Marks

ii) SEA : 50%

Question Paper:

Theory part	5 questions to answer each of 6 Marks questions from each module with internal choice Student should answer one full question from each module	6 M x 5 = 30 Marks
Execution part	Write up - 20 Marks Conduction - 40 Marks Viva-Voce - 10 Marks	70 Marks
	Total	**100 Marks reduced to 50 M**

Note:

- No Assignment and AAT
- **Minimum 40% passing marks in all divisions**

BNM Institute of Technology

Dept. of Computer Science and Engineering

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

Semester: IV

Course Name: Python Programming and Applications		**Course Code: 22CSE145**
L: T: P: J	0:0:2:2	**CIA Marks:** 50
Credits:	**2**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Take a new computational problem and develop a plan to solve it through problem understanding and decomposition.
2	Follow a design creation process that includes specifications, algorithms, and testing.
3	Code, test, and debug a program in Python, based on your design.

Module-1: Introduction to Python	**No. of Hours**	**Blooms Cognitive Levels with CO mapping**
Introduction to Python: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number Textbook 1: Chapter 1-3	**6**	**Apply CO1**

Sample Programs:

1. Develop a python code to check whether the given input is odd or even number.
2. Develop a python code to compare two number using nested conditionals.
3. Develop a python code to find out the largest of 3 numbers.
4. Develop a python code to find the factorial of a given number.
5. Develop a python code to generate the Fibonacci series up to n numbers.

Module-2: Data Structures		
Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, **Dictionaries and Structuring Data:** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, Textbook 1: Chapter 4-5	**6**	**Apply CO2**

Sample Programs:

1. Ask user to give name and marks of 10 different students. Store them in dictionary.
2. Take a list containg only strings. Now, take a string input from user and rearrange the elements of the list according to the number of occurence of the string taken from user in the elements of the list. E.g.-LIST : ["no bun","bug bun bug bun bug bug","bunny bug","buggy bug bug buggy"] STRING TAKEN : "bug" OUTPUT LIST:["bug bun bug bun bug bug","buggy bug bug buggy","bunny

bug","no bun"].
3. Count the number of occurrence of each letter in word "MISSISSIPPI". Store count of every letter with the letter in a dictionary.
4. Take 10 integer inputs from user and store them in a list. Again ask user to give a number. Now, tell user whether that number is present in list or not. (Iterate over list using while loop).

Module-3: Strings and Files

Manipulating Strings: Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup. **Reading and Writing Files:** Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the print.format() Function, Project: Generating Random Quiz Files, Project: Multiclipboard. Textbook 1: Chapter 6, 8	**6**	**Apply CO3**

Sample Programs:
1. Develop a code to convert binary to decimal number, pass input as parameter to the function.
2. Develop a code to print calendar of a given month pass input as parameter to the function.
3. Develop a code to find the length of the string & "refrigerator" without using len function.
4. Write a program that takes your full name as input and displays the abbreviations of the first and middle names except the last name which is displayed as it is. For example, if your name is Pathireddy Santosh Reddy, then the output should be P.S.Reddy.
5. Develop a code to find the line starts with "T" from the file.
6. Write a program to read the contents of the file. If the file does not exist then raise appropriate exception.

Module-4: Classes & Objects

Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying. **Classes and functions:** Time, Pure functions, Modifiers, Prototyping versus planning. **Classes and methods:** Object-oriented features, Printing objects, Another example, A more complicated example, The __init__ method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation. Textbook 2: Chapter 15-17	**6**	**Apply CO4**

Sample Programs:
1. Develop a definition for a class named Circle with attributes center and radius, where center is a Point object and radius is a number. Instantiate a Circle object that represents a circle with its center at (150, 100) and radius 75.Write a function named point_in_circle that takes a Circle and a Point and returns True if the Point lies in or on the boundary of the circle.
2. Develop a python code to Calculate the Arc Length of an Angle by Assigning Values to the Radius and Angle Data Attributes of the class ArcLength.
3. Write a Program that prints the sum, difference and product of two complex numbers by creating a class named 'Complex' with separate functions for each operation where the real and imaginary parts are entered by user.

Module-5: NumPy and Pandas		
Introduction to NumPy: creating Array in NumPy, Accessing of Array Elements, NumPy Array Shape, Iterating Arrays, NumPy Built in Functions, NumPy ufuncs, Creating own ufunc, Arithmetic Functions, Rounding Decimals, Finding LCM and GCD. **Introduction to Pandas:** Series, Key/Value as Series, Data Frames, Loading a file into Data Frame, Viewing Data, Cleaning Data, Data Visualization using Matplotlib package. Link 1: https://www.w3schools.com/python/numpy/numpy_intro.asp Link 2: https://www.w3schools.com/python/default.asp	**6**	**Apply CO5**
Sample Programs: 1. Develop a code to create a series from a list, NumPy array and dictionary. 2. Develop a code for the following functions using pandas. 1.head() #Print starting 5 lines of information. 2.tail() #Print last 2 lines of information. 3.info() #Print the information. 3. Develop a code to multiply and add a 2D array. 4. Develop a python to plot a graphs(Scatter, Histogram, Bar, Pie) for any given dataset.		

Course Outcomes: After completing the course, the students will be able to	
22CSE145.1	Apply the Python Syntax and Semantics to understand the flow controls.
22CSE145.2	Develop python programs using core data structure.
22CSE145.3	Apply the concepts of Strings and file systems for problem solving.
22CSE145.4	Examine the OOP concepts for Application using python.
22CSE145.5	Interpret the NumPy and Pandas concepts for analysis and visualizations.

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. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2 nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf

Reference Books

1. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372
2. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1 st Edition, O'Reilly Media, 2016. ISBN-13: 978-1491912058
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1 st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014
4. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365

Marks Distribution for Assessment:

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Assessed for 100 marks
reduced to 50 Marks</td></tr>
<tr><td>25</td><td>25</td></tr>
<tr><td colspan="2">Average of 2 tests – 25 M</td></tr>
<tr><td>Practical</td><td colspan="2">Weekly Assessment
(Record/Project) – 10 Marks
Lab IA test – 15 Marks</td><td></td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

i) CIA: 50%

Theory - 2 IA tests - Each of 25 Marks	25 Marks
Practical **Weekly Assessment -** Lab record/Project – 10 Marks **Lab IA test –** 15 Marks	25 Marks
Total	**50 Marks**

ii) SEA : 50%

Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
	Total	**50 Marks**

Note: Minimum 40% passing marks in all divisions

BNM Institute of Technology

Dept. of Computer Science and Engineering

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

Semester: IV

Course Name: Web Technology and its Applications **Course Code: 22CSE146**

L: T: P: J	**0: 0: 2: 2**	**CIA Marks:** 50
Credits:	**2**	**SEA Marks:** 50
Hours/Week (Total)	**4 (30)**	**SEA Duration:** 03 Hours

Pre-Requisites: Fundamentals of Programming and Networking

Course Learning Objectives: The students will be able to

1	To explain web application development procedures
2	To impart servlet technology for writing business logic
3	To teach students the basics of server-side scripting using PHP
4	To facilitate students to connect to databases using JDBC

Module-1:	No. of Hours	BLL with CO mapping
Introduction to HTML: The development process, Html tags and simple HTML forms, web site structure Introduction to XHTML: XML, Move to XHTML, Meta tags, Character entities, frames and frame sets.	6	1 Understand
Module-2:		
Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2.	6	2 Understand
Module-3:		
JavaScript: Client-side scripting, what is JavaScript, how to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition DHTML: Combining HTML, CSS and JavaScript, events and buttons, controlling your browser	6	3 Apply
Module-4:		
XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements.	6	4 Apply
Module-5:		
PHP: Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions. Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables.	6	5 Create

Handson Practice sets	
Practical Set -1 HTML	
✓	Design web pages for your college containing a description of the courses, departments, faculties, library etc, use href, list tags.
✓	Create your class timetable using table tag.
✓	Create user Student feedback form (Use textbox, text area, checkbox, radio button, select box etc.)

✓	Create your resume using HTML tags also experiment with colors, text, link, size and also other tags you studied.
✓	At the bottom create a link to take user to the top of the page
Practical Set -2 CSS	
✓	Design a web page of your home town with an attractive background color, text color, an Image, font etc. (use internal CSS).
✓	Use Inline CSS to format your resume that you created.
✓	Use External CSS to format your class timetable as you created.
✓	Use External, Internal, and Inline CSS to format college web page that you created.
Practical Set -3 JavaScript	
✓	Develop a JavaScript to display today's date.
✓	Develop simple calculator for addition, subtraction, multiplication and division operation using JavaScript
✓	Create HTML Page with JavaScript which takes Integer number as input and tells whether the number is ODD or EVEN.
✓	Create HTML Page that contains form with fields Name, Email, Mobile No,Gender, Favorite Color and a button now write a JavaScript code to combine and display the information in textbox when the button is clicked.
✓	Implement Validation in above Feedback Form.
✓	Use regular expression for validation in Feedback Form.
✓	Write a JavaScript program to change background color after 5 seconds of page load.
Practical Set -4 XML	
✓	Create XML file to store student information like Enrollment Number, Name, Mobile Number, Email Id.
Practical Set -5 PHP	
✓	Write a php program to display today's date in dd-mm-yyyy format.
✓	Write a php program to check if number is prime or not.
✓	Create HTML page that contain textbox, submit / reset button. Write php program to display this information and also store into text file.
✓	Write a PHP Script for login authentication. Design an html form which takes username and password from user and validate against stored username and password in file.
✓	Write PHP Script for storing and retrieving user information from MySql table. 1. Design A HTML page which takes Name, Address, Email and Mobile No. From user (register.php) 2. Store this data in Mysql database / text file. 3. Next page display all user in html table using PHP (display.php)
✓	Write a PHP script for user authentication using PHP-MYSQL. Use session for storing username.
Mini Project: Website	
Students have to create a website which contains above topics in Website.	

Course Outcomes: After completing the course, the students will be able to	
22CSE146 .1	Understand the HTML tags and use them to develop the user-friendly web pages.
22CSE146 .2	Understand the CSS with its types and use them to provide the styles to the web pages at various levels
22CSE146 .3	Develop the dynamic web pages by using the JavaScript
21CSE146 .4	Build the web pages dynamically using the database connectivity and applying server-side scripting with XML and PHP
21CSE146 .5	Create the modern Web applications using the client and server-side technologies and the web design fundamentals.

Reference Books
• Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India • Web Technologies, Black Book, dreamtech Press • HTML 5, Black Book, dreamtech Press • Developing Web Applications in PHP and AJAX, Harwani, McGrawHil

Marks Distribution for Assessment:

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Lab IA test – 15 Marks</td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

i) CIA: 50%

Theory - 2 IA tests - Each of 25 Marks	25 Marks
Practical **Weekly Assessment -** Lab record/Project – 10 Marks **Lab IA test –** 15 Marks	25 Marks
Total	**50 arks**

ii) SEA : 50%

Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
	Total	**50 arks**

Note: Minimum 40% passing marks in all divisions

B.N.M. Institute of Technology

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Semester: IV		
COURSE: CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS		
Course Code: 22CIP147	**L:T:P:J: 0:2:0:0**	**CIA Marks:** 100
Credits:	**1**	**SEA Marks:**
Hours:	**15 hrs**	

Course Learning Objectives: The students will be able to

1	know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
2	know the Indian top civil service positions and the exams conducted by UPSC and SPSC for the same
3	Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.

MODULE 1: Introduction to Indian Constitution	**RBT**	**Hrs**
The Necessity of the Constitution, Introduction to Indian Constitution, The Making of the Constitution, Role of Constituent Assembly, Preamble and Salient features of the Constitution of India, Fundamental Rights and its Restriction and limitations in different complex situations, Directive Principles of State Policy, Fundamental Duties.	**1,2,3**	**3**
MODULE 2: System of Government, Central Government, State Government	**RBT**	**Hrs**
System of Government-Parliamentary System, Federal System. Central Government-Basic details, Powers and Functions of Union Executive. Parliament- LS and RS (Composition, Duration, Membership and Presiding officers of Parliament and their functions). Leaders in Parliament (Leader of the House and Leader of the Opposition). Sessions of Parliament (Summoning, Adjournment, Adjournment Sine Die, Prorogation, Dissolution). Quorum of House, Language in Parliament, Joint sitting of two Houses. State Government-Basic details, Powers and Functions of State Executive. State Legislature (Composition, Duration, Membership and Presiding officers of Parliament and their functions).	**1,2,3**	**3**
MODULE 3: Judiciary, Amendments and Emergency Provisions	**RBT**	**Hrs**
Supreme Court, High Court, Judicial Review, Judicial Activism. Methods in Constitutional Amendments (How and Why). Types of Emergencies and its Consequences, Recent Amendments to the Constitution.	**1,2,3**	**3**
MODULE 4: Elections, Constitutional and Non Constitutional Bodies	**RBT**	**Hrs**
Elections- Election Commission of India, Electoral Process. Constitutional Bodies- Election Commission, Union Public Service Commission, State Public Service Commission, Goods and Service Tax Council. Non Constitutional Bodies- Central Information Commission, State Information Commission.	**1,2,3**	**3**

MODULE 5: Professional Ethics	RBT	Hrs
Scope & Aims of Engineering & Professional Ethics, Positive and Negative Faces of Engineering Ethics, Responsibilities in Engineering, the impediments to Responsibility. Trust and Reliability in Engineering, Risks, Safety and liability in Engineering, Clash of Ethics, IPRs (Intellectual Property Rights)	**1,2,3**	**3**

Course outcome: On completion of this course, students will be able to,
CO1: Have constitutional knowledge and legal literacy.
CO2: Have knowledge on All India Services and State Civil Services.
CO3: Understand Engineering and Professional Ethics and responsibilities of Engineers.

Reference Books

Suggested Learning Resources:

1. **Title of the Book - Indian Polity**
   Name of the Author - M Lakshmikanth
   Name of the Publisher-Mc Graw Hill Education
   Edition and Year- 2019
2. **Title of the Book - Engineering Ethics**
   Name of the Authors - M. Govindarajan, S.Natarajan, V.S. Senthilkumar
   Name of the Publisher- Prentice-Hall
   Edition and Year-2004

3. Durga Das Basu (DD Basu): "Introduction to the Constitution on India", (Students Edition.) Prentice –Hall EEE, 19th / 20th Edn., (Latest Edition) or 2008.

4. Shubham Singles, Charles E. Haries, and Et al : "Constitution of India and Professional Ethics" byCengage Learning India Private Limited, Latest Edition – 2018.

5. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice –Hall of India Pvt. Ltd. New Delhi, 2004

6. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

7. Latest Publications of **NHRC - Indian Institute of Human Rights**, New Delhi.

Web Links and Video Lectures

www.unacademy.com/lesson/future-perfect-tense/YQ9NSNQZ https://successesacademy

BNM Institute of Technology

Syllabus for Softskills-2

SEMESTER – IV

Subject Name	Softskills-2 (Aptitude Quantitative & Logical)	**Weekly Assessment Marks**	10
Subject Code	22SFT148	**Internal Assessment Marks**	60
Number of Contact Hours/Week	2	**Company Simulation Tests Marks**	30
Total Number of Contact Hours	36	**Credits**	1
Module 1 (Quantitative Aptitude - 1)	**Number System -** Classification of Numbers, Multiple and factors, Divisibility Rules		
	HCF & LCM, Squares and Cubes.		
	Profit & Loss - Concepts of SP, CP, Profit, Loss, Gain or Loss %.		
	Profit & Loss - Marked Price & Discount problems, Successive Discount.		
	Percentages – Percent To Decimal Or Fraction Conversion, Inverse Case – Value From Percentage, relative Percentage		
	Averages - Understanding Averages & solving problems.		
Module 2 (Quantitative Aptitude - 2)	**Ratios -** Duplicate and Triplicate Ratio, Direct and Indirect variation		
	Proportion - Direct Indirect proportion and relation.		
	Simple Interest - Simple Interest, Basic Difference b/w both the Interests		
	Compound Interest - CI with a Fractional Rate, to find Instalments.		

	Speed Time & Distance - Important formulas, Relative Speed.
	Speed Time & Distance - Understanding Units & Conversion of units
Module 3 (Quantitative Aptitude - 3)	**Time & Work -** Introduction and Concept, Important Time and Work Formula, Work Done
	Time & Work - Rate of Work, Time Taken, If a piece of work is done in x number of days
	Data Interpretation - Bar Graph, Tabular Form, Line Chart, case let Form
	Data Interpretation - Pie Chart, Radar/Web, and Missing Data Interpretation.
	Probability – Understanding concepts and important formulas.
	Probability – Understanding types of problems on probability
Module 4 (Logical - 1)	Problems on Syllogisms
	Problems on Assumptions
	Logical Puzzles - K-level thinking
	Logical Puzzles - Arithmetic Puzzles
	Stick Puzzles
	Series Completion - Basics of Next no, Missing no and Wrong no and problems on that.
	Solving various types of Letter series and understanding different types.
Module 5 (Logical - 2)	**Problem on Ages -** Understanding concepts and basic formula along with solving different types of problems.
	Problem on Ages - Tips and Tricks to Solve Problems on Ages

	Blood Relation - Generation Tree, Family Tree Problems.
	Blood Relation - Statement Based Questions, Coded Blood Relation Question.
	Coding & Decoding - Concept of EJOTY, Opposite Letter, Reversing the alphabets.
	Coding & Decoding - Jumbling of Letter, Finding Codes of Derivatives.
Module 6 (Logical - 3)	**Clocks –** Understanding concepts and basic formula along with solving different types of problems.
	Calendar - Understanding concepts and basic formula along with solving different types of problems.
	Image Analysis - Paper cutting & Folding, Mirror & Water Image, Cubes and Dice, Analogy, Find the odd one out, Rule Detection
	Odd Man Out - Following certain patterns and groups.
	Identifying the errors/odd one in the group.
	Seating Arrangement - Linear and Circular seating Arrangements as well as problems of sitting around Square and Rectangular.
	Distance & Direction - Distance and Displacement between any two points as well as puzzles based on that, Concept of Shadows.

B.N.M. Institute of Technology

An Autonomous Institution under VTU

For Internal Communication

Department of Computer Science & Engineering

V SEMESTER

Scheme of Teaching for 2022-26 Batch

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week				Hours Per week	Credits	Examination		
					Theory Lecture	Tutorial	Practical	Project					
					L	T	P	J			CIA	SEA	Total
1	PCC	22CSE151	Software Project Management and Finance	CSE	2	2	-	-	4	3	50	50	100
2	PCC	22CSE152	Automata Theory and Computation	CSE	2	2	-	-	4	3	50	50	100
3	PCI	22CSE153	Computer Networks	CSE	3	-	2	-	5	4	50	50	100
4	PCI	22CSE154	Computer Graphics and Visualization	CSE	3	-	2	-	5	4	50	50	100
5	PBL	22CSE155	Data Science	CSE	-	-	2	2	4	2	50	50	100
6	OEC	22CSE156X	Open Elective -1	CSE	2	-	2	-	4	3	50	50	100
7	AEC	22CSE157	Employability Skills-1(Technical)	T&P	-	2	-	-	2	1	100	-	100
8	INT	22CSE158	Internship-2	CSE	-	-	2	2	4	2	100	-	100
TOTAL					**12**	**6**	**10**	**4**	**32**	**22**	**500**	**300**	**800**

Open Elective - 1			
22CSE1561	Data Structures and its Application	22CSE1563	Mobile Application Development
22CSE1562	Java and its Applications	22CSE1564	Data Analytics

Internship-2 (21CSE158)- All the students registered to III year of BE shall have to undergo mandatory internship of 4 weeks during IV semester vacation. Semester End Assessment will be conducted in V semester and the prescribed credit will be included. Internship shall be considered as a head of passing and shall be considered for the award of degree.

CIE: Continuous Internal Evaluation, SEE: Semester End Examination, NCMC: Non Credit Mandatory Course AICTE

Activity Points to be earned by students admitted to BE day college programme (For more details refer to Chapter 6, AICTE Activity Point Programme, Model Internship Guidelines): Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other institutions and Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to BNMIT. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

BSC-->Basic Science	MAT-->Mathematics	PCC--> Professonal Core course	PCCI--> Professional Core Integrated
PBL--> Project based learning	HUM--> Humanity and Social Science	UHV--> Universal Human Values	AEC--> Ability Enhancement course
PW--> Project Work	PEC--> Professional Elective	INT--> Internship	PEC--> Professional Elective
OEC-->Open Elective			

B. N. M. Institute of Technology

An Autonomous Institution under VTU

Dept. of Computer Science and Engineering

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

Semester: V

Course Name: Software Project Management and Finance (PCC) Course
Code: 22CSE151

L: T: P: J	2:2:0:0	**CIA Marks:** 50
Credit:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**3**	**SEA Duration:** 03 Hours

Course Learning Objectives:

This course will enable students to

- Identify ethical issues and explain why they are of concern to software engineers.
- Apply estimation techniques, schedule project activities and compute pricing.
- Identify software quality parameters and quantify software using measurements and metrics.
- Recognize the need for agile software development, describe agile methods, apply agile practices and plan for agility.

Module-1: Introduction, Software Process, Requirements Engineering	**No. of Hours**	**BLL, CO**
Introduction: Software Crisis, Need for Software Engineering. Software Engineering Ethics. Case Studies (Self Study Component). **Software Processes**: Models: Waterfall Model, Incremental Model, and Spiral Model, Process activities. **Requirements Engineering**: Requirements Engineering Processes, Functional and non-functional requirements. The Software Requirements Document. Requirements Specification. Requirements validation, Requirements Management.	**8**	**Apply CO1**
Module-2: System Models, Design & Implementation, Software Testing		
System Models: Structural models, Behavioral models, UML modeling using StarUML tool. **Design and Implementation**: Introduction to RUP, Design Principles. **Software Testing:** Development Testing, Test-driven development, Release Testing, User Testing	**8**	**Apply CO2**
Module-3: Project Management, Project Planning & Quality Management		
Project Management: Risk Management, Managing People, Teamwork **Project Planning:** Software pricing, Plan-driven development, Project scheduling. **Quality management:** Software quality, Reviews, and inspections. Software measurement and metrics, Software standards.	**8**	**Analyze CO3**
Module-4: Agile Software Development		
Agile Software Development: Agile Methods, SCRUM, Plan-driven and agile development, Extreme Programming, Agile Project Management, Scaling agile methods.	**8**	**Apply CO3**
Module-5: Project Financial Management		
How to Manage Project Finances: Cost Estimating-Work Breakdown Structure (WBS), Cost Budgeting-Cost Aggregation, Parametric Estimating, Infrastructure and Overheads, Cost Control- Change Control, Resource Management. **Performance Measurement and Analysis:** Cost Variance, Earned Value, Schedule variance, Cost Performance Index (CPI), Schedule Performance Index (SPI)	**8**	**Analyze CO4**

Course Outcomes: After completing the course, the students will be able to	
22CSE151.1	Ability to identify and apply various Software Process Models.
22CSE151.2	Apply various System Models for design, implementation and Software Testing.
22CSE151.3	Analyze Software Project management concepts for software development and develop project planning using a Gantt chart.
22CSE151.4	Utilize the need for agile software development, describe agile methods and apply agile practices.
22CSE151.5	Analyze the basic financial concepts for a project plan.

Text Books
1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1, 2, 4, 5, 7, 23, and 24)
2. Project Management Institute, "A Guide to the Project Management Body of Knowledge (PMBOK Guide)", 5th Edition, 2013, ISBN: 978-1-935589-67-9
3. Financial Management -Prasanna Chandra, 9/e, TMH.
Reference Books
1. Software Engineering Ian Sommerville Pearson Education 9th Edition, 2012
2. Software Engineering-A Practitioner approach Roger S. Pressman Tata McGraw Hil 7th Edition
3. An Integrated Approach to Software Engineering Pankaj Jalote Wiley India

Marks Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	• Total Number of Test: 3 • Each Theory test will be conducted for 30 marks • Average of 3 tests = 30 Marks	30
	Assignment	Activity to demonstrate all the phases of the software development life cycle (Poster Presentation)	10
	AAT	Conduct quiz after 1st IA /Assignments	10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	• Theory exam will be conducted for 100 marks and scaled down to 50 Marks • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Presentations, Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses

B. N. M. Institute of Technology

An Autonomous Institution Under VTU

Dept. of Computer Science & Engineering

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

Semester: V

Course Name: Automata Theory and Computability		**Course Code: 22CSE152**
L: T: P: J	**2 : 2 :0 :0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4 (40)**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Introduce core concepts in Automata and Theory of Computation
2	Identify different Formal language Classes and their Relationships
3	Design Grammars and Recognizers for different formal languages
4	Prove or disprove theorems in automata theory using their properties
5	Determine the decidability and intractability of Computational problems

Module-1: Introduction to theory of Computation, Languages and Strings	**No. of Hours**	**BLL, CO**
Basic terminologies used in Strings, Languages, A Language Hierarchy, **Finite State Machines (FSM)**: Deterministic FSM,Designing FSM, Nondeterministic FSMs, Minimizing FSMs, Finite State Transducers,.	**8**	**Understand /Apply CO1**
Module-2: Regular Expressions		
What is a RE?, Kleene's theorem, Applications of REs, Manipulating and Simplifying RE, Regular Grammars, Regular Languages (RL) and Non-regular Languages ,To show that a language is regular, Closure properties of RLs, to show some languages are not RLs.	**8**	**Apply CO2**
Module-3: Context Free Grammars		
Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Deterministic and Non-deterministic PDAs, alternatives that are not equivalent to PDA.	**8**	**Apply CO3**
Module-4: Context-Free Languages and Turing Machine		
Showing a language is context-free, Pumping theorem for CFL, Important closure properties of CFLs, **Turing Machine**: Turing machine model, Representation, Language acceptability by TM, design of TM	**8**	**Apply CO4**
Module-5: Decidability		
Variants of Turing Machines (TM), The model of Linear Bounded automata. halting problem of TM, Post correspondence Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis.	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE152.1	Understand the fundamental concepts in theory of computation, Design of finite state machines for the given language
22CSE152.2	Design of Regular expressions to recognize FSM
22CSE152.3	Design Grammars and Automata (recognizers) for different language classes
22CSE152.4	Use Reduction techniques for translating complex problems into a formal computational model like PDA and TM for better solution
22CSE152.5	Classify a problem with respect to different models of Computation.
22CSE152.6	Build automata for real time application and test using JFLAP tool

Text Books
1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson education,2012/2013 2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PhI, 2012.
Reference Books
1.John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education, 2013 2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning,2013 3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013 4. Peter Linz, "An Introduction to Formal Languages and Automata", 3rd Edition, Narosa Publishers, 1998 5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012

Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Average of 2 Assignments for 10 marks each	10
	AAT	Build automata for real time application and test using JFLAP tool	10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

B. N. M. Institute of Technology

An Autonomous Institution under VTU

Dept. of Computer Science and Engineering

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

Semester: V

Course Name: COMPUTER NETWORKS			**Course Code: 22CSE153**	
L:T:P:J	**2:2:2:0**	**CIA**	**:**	**50**
Credits:	**04**	**SEA**	**:**	**50**
Hours:	**50**	**SEA Duration**	**:**	**03 Hours**

Course Learning Objectives: The students will be able to

1	Explain with the basics of data communication and various types of computer networks.
2	Demonstrate Application layer protocols.
3	Apply transport layer services to understand UDP and TCP protocols.
4	Analyze the working of routers, IP and Routing Algorithms as part of network layer.
5	Demonstrate Medium Access Control protocols for reliable and noisy channels.

Module-1 Introduction	**No.of Hours**	**BLL, CO**
Introduction to networks, Data communication: Components, Data representation, Data Flow, Networks: Network criteria, physical structures, Network types, Switching, Internet, Network models: Protocol layering: Scenarios, principles, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. Switching: Circuit switching and Packet switching. **Chapter: 1.1, 1.2, 2.1,2.2,2.3,8.2,8.3** 1. Introduction to Network Tools such as Wireshark, ssh with sample experiments. 2. Introduction to Cisco packet tracer with sample experiments.	**10**	**Understand**
Module-2: Application Layer		
Application Layer: Network Application Principles, The Web and HTTP - Overview, HTTP Message Format, Web Caching, Cookies and Authentication, DNS Services, DNS Hierarchy, DNS Records, SMTP. **Chapter: 26.1, 26.3, 26.6** 1. Understand Persistent and Non Persistent HTTP Connections and Corresponding Performance Impact. 2. Understanding working of HTTP headers: Conditional GET, Cookies and Authentication. 3. DNS Server Implementation(using Apache server setup)	**10**	**Apply**
Module-3: Transport Layer		
Transport Layer: Introduction to Transport Layer Services, UDP Protocol, Principles of Reliable Data Transfer - Stop – N – Wait protocol, Sliding Window Concepts – Go Back N Protocol, TCP Features, Header,	**10**	**Apply**

Connection Management, Flow Control, Error Control and Congestion Control. **Chapter: 23.1,23.2, 24.1,24.2,24.3** 1. Write a program to create a simple web server - client system using socket programming. 2. Develop a simple Web server in Python that is capable of processing only one request. Specifically, your Web server will a) create a connection socket when contacted by a client (browser); b) receive the HTTP request from this connection; c) parse the request to determine the specific file being requested; d) get the requested file from the server's file system; e) create an HTTP response message consisting of the requested file preceded by header lines; and f) send the response over the TCP connection to the requesting browser. If a browser requests a file that is not present in your server, your server should return a "404 Not Found" error message.		
Module-4: Network Layer		
Network Layer and Internet Protocol: IPV4 and IPv6 Datagram Format, Fragmentation, Addressing, Subnet Principles, Forwarding Mechanisms, DHCP, NAT, ICMP, ARP, IP Static Routing, Hierarchical Addressing and Route Aggregation, Longest Prefix Match, Introduction to IPTABLES, Introduction to IPV6. **Chapter: 18.4,18.5,19.1, 22.1.22.2** 1. Designing and Simulation of Network Topology using Cisco Packet Tracer. 2. IPV4 Addressing: Configuring static IP addresses, Configuring automatic IP addressing (DHCP),Testing connectivity(ICMP) using Cisco packet tracer. 3. IPV6 Addressing (IPv6 Configuration and Static Routing) using a real router. 4. ICMP Redirect and Study: 5. Understanding TTL expiry: Using Cisco packet tracer understand the life of packet in internet.	**10**	**Analyze**
Module-5: Data link and Physical Layer		
Link Layer and Physical layer: Introduction to Link Layer, Introduction to Error Detection and correction-CRC, Datalink layer functions-framing, flow and error control, Introduction to MAC Protocols, Aloha, CSMA/CD, CSMA/CA. Introduction to Ethernet LAN and its characteristics, Wireless LAN and its characteristics. Introduction to Analog transmission and Digital transmission-line codings schemes (NRZ,Manchester,RZ), Transmission impairment, Data rate limits, Network performance parameters. **Chapter: 10.1,10.3.1,11.1,11.2,12.1,13.1.1,13.2.1,15.1,3.4,3.5,3.6,**	**10**	**Apply**

1. Use of Hubs, Switches and Routers in network using cisco packet tracer / real components. 2. Implementation of stop and wait protocol using C/Python. 3. Setup an Ethernet LAN using different types of cables and compare the throughput using cisco packet tracer. 4. Setup an ESS using cisco packet tracer and check the performance.		

Course outcomes: After completing the course, the students will be able to	
22CSE153.1	Understand the concepts of digital communication to and the working principles of physical layer
22CSE153.2	Apply principles of Application layer protocols.
22CSE153.3	Apply Transport Layer Services and infer TCP and UDP protocols.
22CSE153.4	Analyze IP and routing protocols in network layer.
22CSE153.5	Apply data link layer protocols with fundamentals of digital communication

Text Books

1. Data Communication and Networking, Behrouz A.Forouzan, McGraw Hill, 5th Edition, 2013.
2. James F. Kurose and Keith W. Ross: Computer Networking: A TopDown Approach, 8th edition, Addison-Wesley, 2021.
3. Data and Computer Communication, William Stallings, 10th Edition, Pearson Education, 2013.
4. Introduction to Data Communications and Networking – Wayne Tomasi, Pearson Education, 5thEdition, 2011.
5. Larry L. Peterson and Bruce S Davie: Computer Networks: A Systems Approach, Fifth Edition, Elsevier, 2011.
6. Tanenbaum: Computer Networks, 5thEdition, Pearson Education/PHI, 2010.

Web links and Video Lectures:

1. https://archive.nptel.ac.in/courses/106/105/106105183/
2. https://www.netacad.com/courses/packet-tracer
3. https://www.wireshark.org/docs/wsug_html_chunked/ChapterIntroduction.html

Marks Distribution for assessment

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="4">CIA (50)</th><th rowspan="2">SEA Conduction : 100marks Reduced to 50 marks</th></tr>
<tr><td></td><td>I</td><td>II</td><td>III</td></tr>
<tr><td rowspan="4">CONDUCT</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="3">Theory</td><td>30</td><td>30</td><td>30</td><td rowspan="4">Five questions with each of 20 Marks(with internal choice).student should answer one full question from each module.</td></tr>
<tr><td colspan="3">Average of 3 tests – 15 Marks</td></tr>
<tr><td colspan="3">AAT – 10 Marks</td></tr>
<tr><td>Practical</td><td colspan="3">Weekly assessment -10Marks
IA IA test - 15Marks</td></tr>
</table>

I O N				**Total – 50 Marks**	**Total – 50 Marks**

i) SEA : 50%

Question Paper:

Theory Exam	5 questions to answer each of 20marks 2 questions from each module with internal choice Student should answer one full question from each module	20 Marks x 5=100 M reduced to 50M
Total		**50 Marks**

ii) CIA: 50%

Theory	test (Theory): 3 IA tests - each of 30 Marks AAT - 10 Marks	Average of 3 tests 30 marks
Lab	Weekly assessment- 10Marks Practical test (1) - 15 Marks	25 marks
Total		**50 Marks**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: V

Course Name: Computer Graphics and Visualization **Course Code: 22CSE154**

L: T: P: J	**3 :0:2 : 0**	**CIA Marks:** 50
Credits:	**4**	**SEA Marks:** 50
Hours/Week (Total)	**5**	**SEA Duration:** 03 Hours

Pre-Requisites: Basic mathematics ,C programming and Computer aided design

Course Learning Objectives: The students will be able to

1	Overview of Computer Graphics along with its applications and OpenGL primitives and attributes
2	Illustrate different fill area attributes to animate the images
3	Exploring 2D and 3D graphics mathematics along with OpenGL API's.
4	Demonstrate clipping and illumination models on both 2D and 3D objects.
5	Explore various projections, 3D viewing and visibility detection methods

Module-1: Introduction	**No. of Hours**	**BLL, CO**
Overview: Basics of computer graphics, Application of Computer Graphics, Random Scan and Raster Scan displays, graphics software. OpenGL: Introduction to OpenGL, coordinate reference frames, OpenGL point functions, OpenGL line functions, point attributes, line attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham‟s**.** Color and gray scale, OpenGL Color Functions. **Laboratory Component:** 1. Design a line using DDA line drawing algorithm 2. Implement Bresenham‟s line drawing algorithm for all types of slope. 3. Design a real world picture using primitives such as points, lines, triangles and polygons. **4.** Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user	**5+5**	**Apply CO1**
Module-2:		
2D and 3D viewing pipeline, OpenGL 2D viewing functions. **Fill area Primitives**: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. Color and gray scale, OpenGL Color Functions. circle generation algorithms (Bresenham‟s). Input and Interaction: OpenGL interactive input device functions, Menus Picking, Animating Interactive programs. **Laboratory Component:** 1. Implement a circle drawing algorithm. 2. Develop a menu driven program to fill the polygon using scan line algorithm 3. Implement the program to draw a polygon that interact with interact with input functions.	**5+5**	**Apply CO2**
Module-3:		
2D and 3D Geometric Transformations: 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2D Composite transformations, other 2D transformations, OpenGL geometric transformations function. 3D Geometric Transformations: Translation,	**5+5**	**Apply CO3**

rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions. **Laboratory Component:** 1. Create and rotate a triangle about the origin and a fixed point. 2. Draw a colour cube and spin it using OpenGL transformation matrices. 3. Develop a program to show different transformations**.**		
Module-4:		
Clipping and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only - polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only. **Illumination Models**: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions. OpenGL Quadric Surfaces. **Laboratory Component:** 1. Clip a lines using Cohen-Sutherland algorithm. 2. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene 3. Develop a program to show the different quadric surfaces.	**5+5**	**Apply CO4**
Module-5:		
3D Viewing and Visible Surface Detection: 3DViewing:3D viewing concepts, 3D viewing coordinate parameters, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, depth buffer method only and OpenGL visibility detection functions. **Laboratory Component:** 1. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing	**6+4**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE154.1	Apply Computer Graphics along with its applications and OpenGL primitives and attributes
22CSE154.2	Apply different fill area attributes to animate the images
22CSE154.3	Apply 2D and 3D graphics mathematics along with OpenGL API's.
22CSE154.4	Apply clipping and illumination models on both 2D and 3D objects.
22CSE154.5	Apply various projections, 3D viewing and visibility detection methods

Text Books

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011
2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008

Reference Books

1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education
2. Xiang, Plastock : Computer Graphics , sham"s outline series, 2nd edition, TMG.
3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning
4. M M Raikar & Shreedhara K S Computer Graphics using OpenGL, Cengage publication

Marks Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	● Total Number of Test: 2 ● Each test will be conducted for 50 marks out of which 15 marks for theory and 35 marks for lab test. ● Average of 2 tests reduced to 30 Marks	30
	AAT	Presentation / Demonstration of mini project and weekly assessment.	20
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	External lab exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have two parts. Part A is for 30 marks theory. Part-B lab test of 70 marks(Write up+Execution+Viva=15+45+10).	**50**
		Total Marks	**100**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: V

Course Name: Data Science		**CourseCode:22CSE155**
L:T:P:J	**0:0:2:2**	**CIAMarks:**50
Credits:	**2**	**SEAMarks:**50
Hours/Week (Total)	**30**	**SEADuration:**03Hours

Course Learning Objectives: The students will be able to

1	Understand data science concepts and Big Data.
2	Analyze Basic tools of EDA, Data science process with case studies and Different algorithms.
3	Apply the concepts of data science& solve real life problems with different machine learning.
4	Design and implement project on Data science.

Module-1: INTRODUCTION TO DATA SCIENCE	**No. of Hours**	**BLL, CO**
What is Data Science? Big Data and Data Science Process, Current landscape of perspectives, A data Science Profile, Skill sets. Big Data and its characteristics, sources of data, History and Timeline of Big Data Analysis	**6**	**Understand CO1**
Module-2: STATISTICS AND DATA VISUALIZATION		
Statistical Measures: Mean, median, mode, Variance and standard deviation, Correlation and covariance. Data Visualization Tools – Power BI, Visualization with Pandas.	**6**	**Apply CO2**
Module-3: MACHINE LEARNING FUNDAMENTALS		
Machine Learning Introduction, Types of Learning, Machine Learning Workflow, Model Evaluation – Methods & Metrics, Hold out, Cross Validation, Bootstrap	**6**	**Apply CO3**
Module-4: ALGORITHMS		
Decision Tree Algorithm, Naïve Bayes Algorithm, K Nearest Neighbours, K Means,Neural Networks – Basics, Perceptrons, Activation functions, Weight Updation.	**6**	**Apply CO4**
Module-5: DATA SCIENCE APPLICATIONS AND CASE STUDIES		
Industry Use Cases: Finance, Healthcare, Retail, Manufacturing. Project Management: Data science project lifecycle, Collaboration and communication, Ethical considerations and data privacy **Project Preparation:** Project Planning: Problem definition, Data collection and preprocessing, Model selection and evaluation. Implementation: Developing the solution, Testing and validation, Presentation and reporting.	**6**	**Create CO5**

CourseOutcomes:Aftercompletingthecourse,thestudents willbeableto	
22CSE155.1	Understand the fundamental concepts of data science and its significance across various industries.
22CSE155.2	Apply the basic statistical concepts and measures such as probability theory, random variables, and distributions to various problems.
22CSE155.3	Build basic machine learning models and evaluate the performance of the same.
22CSE155.4	Implement various machine learning algorithms for performing various data mining tasks.
22CSE155.5	Develop a comprehensive data science solution, including implementation, testing, validation, and reporting for various real time application & societal problems.

ReferenceBooks

- Cathy O Neil, Rachel Schutt, 2014, "Doing Data Science-Straight Talk from the Frontline", Orielly
- Jure Leskovek, AnandRajaraman, Jeffrey Ullman, 2014 Mining of Massive Data Sets, Cambridge University Press
- Think Stats: Exploratory Data Analysis in Python by Allen B. Downey
- Kevin Murphy, 2013, Machine learning: A Probabilistic Perspective
- Introduction to Machine Learning with Python: A Guide for Data Scientists by Andreas C. Müller and Sarah Guido
- Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython by Wes McKinney

Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written & Practical Test	Total Number of Lab Test: 2 Each Theory test will be conducted for 40 marks Average of 2 tests = 40 Marks	40
	Assessment	Weekly Assessment	10
		Total Marks	50
SEA (50)	**Component**	**Description**	**Marks**
	Project	Write up – 15 marks Project Report – 25 marks Presentation and demonstration – 50 marks Viva – voce – 10 marks	100 marks reduced to 50 marks
		Total marks for the Course	**100**

BNM Institute of Technology

An Autonomous Institution under VTU

Dept. of Computer Science and Engineering

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

Semester: 5

Course Name: Data Structures and its Applications
Course Code: 22CSE1561

L: T: P: J	**2:0:2:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4 hrs/ week (40)**	**SEA Duration:** 03 Hours

Pre-Requisites: Basic Concepts of C

Course Learning Objectives: The students will be able to

1	Understand the basics of C programming language to study data structures
2	Acquire knowledge on Various types of data structures, operations and algorithms ,Sorting and searching operations
3	Analyze the performance of Stack, Queue, Lists, Trees, Hashing, Searching and Sorting techniques
4	Implement all the applications of Data structures in a high-level language
5	Design and apply appropriate data structures for solving computing problems.

	No. of Hours	**Blooms Cognitive Levels with CO mapping**
Module-1: Introduction		
Functions: Categories of functions, call by Value, call by reference. Arrays: Passing arrays to functions, passing strings to functions Pointers: Pointer as function arguments, Functions returning pointers, Structures: Declaring and using structure types. Searching and Sorting: Bubble sort, Insertion Sort, Selection sort, Quick sort, Linear Search and Binary search **Lab Session:** **1. Implement call by value and Call by reference** **2. Programs on passing arrays to a function** **3. Programs on function with pointers as an argument** **4. Searching and sorting Programs.**	**5 hours (Theory) 3 hours (Practical)**	**Apply CO1 CO2 CO3**
Module-2: Classification of Data Structures		
Primitive and Non- Primitive, Linear and Nonlinear; Data structure Operations, ADT, Array as ADT, Operations - Insert, Delete, Search, Sort, String Definition, Representation, String as ADT, Operations – Insert, Delete, Concatenate, Comparing, Substring. Conversion **Recursion** - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi **Lab Session:** **1. Array Operations** **2. Programs on Recursion**	**5 hours (Theory) 3 hours (Practical)**	**Apply CO2**
Module-3: Stacks and queues		
Stack: Definition, Representation, Stack as ADT, Operations and Applications: Polish and reverse polish expressions, Infix to postfix conversion, evaluation of postfix expression, infix to prefix, postfix to infix **Queue:** Definition, Representation, Queue as ADT, Operations, Queue Variants: Circular Queue, Priority Queue, Double Ended Queue; Applications of Queues. **Lab session:** **1. Implementation of stack and Queue data structure** **2. Application level program on stack and Queue DS**	**5 hours (Theory) 3 hours (Practical)**	**Apply CO3 CO4 CO5**

Module-4: Linked List		
Linked List: Limitations of array implementation, Memory Management: Static (Stack) and Dynamic (Heap) Memory Allocation, Memory management functions. Definition, Representation, Operations: getnode() and Freenode() operations **Types of linked lists:** Singly Linked List,Doubly Linked Lists,Circular Linked List**:** Application of Linked Lists: Stacks, Queues, Double-ended Queues, Priority Queues, **Lab session:** **1. Implementation of Linked Lists** 2. **Application level programs on LL**	**5 hours (Theory) 3 hours (Practical)**	**Apply CO3 CO4 CO5**
Module 5: Trees and Hashing		
Trees: Definitions, Terminologies, Array and linked Representation of Binary Trees, Types- Complete/full, Almost Complete, Strictly, Skewed. Traversal methods - Inorder, postorder, preorder. **Binary Search Trees** - Creation, Insertion, Deletion, Traversal, Binary Search and BST. **Hashing**: The Hash Table organizations, Hashing Functions, Static and Dynamic Hashing, Collision-Resolution Techniques, Programming Examples. **Lab Session:** 1. **Implementation of BST and all traversing techniques**	**5 hours (Theory) 3 hours (Practical)**	**Apply CO3 CO4 CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1561.1	Understand the basics of C programming language
22CSE1561.2	Acquire knowledge on Various types of data structures, operations and algorithms ,Sorting and searching operations
22CSE1561.3	Analyze the performance of Stack, Queue, Lists, Trees, Hashing, Searching and Sorting techniques
22CSE1561.4	Implement the applications of Data structures in a high-level language
22CSE1561.5	Design and apply appropriate data structures for solving computing problems.

Text Books

1. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
2. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012

Reference Books

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. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications,2nd Ed, McGraw Hill, 2013
4.A M Tenenbaum, Data Structures using C, PHI, 1989
5.Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.

Marks distribution for assessment

CIA (50)	Component	Description	Marks
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Average of 2 Assignments for 10 marks each	10
	AAT	Presentation / Module wise Lab activity	10
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Presentations, Term Paper, Open ended experiments, Mini Projects, Short MOOC courses

BNM Institute of Technology

Dept. of Computer Science and Engineering

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

Semester: V

Course Name: JAVA & It's Applications		**Course Code: 22CSE1562**
L: T: P: J	2:0:2:0	**CIA Marks:** 50
Credits:	3	**SEA Marks:** 50
Hours/Week (Total)	**4 hrs/ week (40)**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard
2	Learn the fundamental features of object-oriented language in JAVA.
3	Set up Java JDK environment to create, debug and run java programs.
4	Learn object-oriented concepts using programming examples.
5	Read and write data from/to files in JAVA.
6	Create multi-threaded programs and event handling mechanism.
7	Learn string handling & collections using programming examples

Module-1: Introduction to Java	**No. of Hours**	**Blooms Cognitive Levels with CO mapping**
Introduction to Java: Features of OOP, Characteristics/Buzz words of Java, Java Environment: JDK, JVM, JRE, Fundamental Programming Structure in Java, Variables, Data Types, Operators & Expressions, Control Statements, Iteration Statements, Command Line Arguments.	**5**	
Sample Programs: 1. Develop a program to print an int, a double and a char on screen. 2. Develop a program to print the area of a rectangle of sides 2 and 3 units respectively. 3. Develop a program to add 3 to the ASCII value of the character 'd' and print the equivalent character. 4. Develop a program to add 8 to the number 2345 and then divide it by 3. Now, the modulus of the quotient is taken with 5 and then multiply the resultant value by 5. Display the result.	**3**	**Understand CO 1**
Module-2: Classes & Objects		
Classes & Objects: Defining Classes & Objects, Access Specifies, Constructors, Overloading Constructor, Method Overloading, Passing and Returning object form Method, new operator, finalize() method, this keyword, Static Keyword, Encapsulation, Polymorphism. Array and String: Single and Multidimensional Array, Definition of String, String Literals, String Class, String Inbuilt Methods, StringBuffer & StringBuilder Class, Use of Wrapper class.	**5**	**Apply CO 2**
Sample Programs: 1. Develop a program to print the area of a rectangle by creating a class named 'Area' having two methods. First method named as 'setDim' takes length and breadth of rectangle as parameters and	**3**	

the second method named as 'getArea' returns the area of the rectangle. Length and breadth of rectangle are entered through keyboard. 2. Develop a program to check if elements of an array are same or not it read from front or back. 3. Input a string which contains some palindrome substrings. Find out the position of palindrome substrings if exist and replace it by *. (For example if input string is "bob has a radar plane" then it should convert in "*** has a ***** plane. 4. Write a program to reverse individual words in a string, where each word may be delimited by a dot, comma, space or tab, like www.google.com should become www.elgoog.moc.		
Module-3: Inheritance, Interfaces & Packages.		
Inheritance: Defining a Inheritance, Types of Inheritance, Constructor in subclass, Method Overriding, super keyword, abstract keyword, final keyword. Interfaces & Packages: Defining a Interface, Implementing a Interface, Difference between Interface & Classes, Extending a Interface, Usage of Package, Classpath, Importing a Package. **Sample Programs:** 1. Create a class with a method that prints "This is parent class" and its subclass with another method that prints "This is child class". Now, create an object for each of the class and call 1 - method of parent class by object of parent class. 2 - method of child class by object of child class. 3 - method of parent class by object of child class. 2. Create a class named 'Member' having the following members: Data members 1 - Name 2 - Age 3 - Phone number 4 - Address 5 - Salary It also has a method named 'printSalary' which prints the salary of the members. Two classes 'Employee' and 'Manager' inherits the 'Member' class. The 'Employee' and 'Manager' classes have data members 'specialization' and 'department' respectively. Now, assign name, age, phone number, address and salary to an employee and a manager by making an object of both of these classes and print the same. 3. Develop a program to define two interfaces "student" and "faculty" containing one method each ("Listen" and "Teach").both of these interfaces should be implemented by a class called "College". Demonstrate the above implementation by writing a main method in a new class called "DemoMultiInterface". 4. Create a package named "BNMIT". Under this create two packages named "Employee" and "Student". Under the employee package create a class called "EmployeeDetails" having required member fields and methods. Under the Student package create a class called "StudentDetails" having required member fields and methods. Demonstrate the above by creating objects of StudentDetails and EmployeeDetails inside another class which	**5** **3**	**Apply CO 3**

resides in another package.Hint: You can assume the relevant fields and methods to be written inside the Employee Details and Student Details class.		
Module-4: Multithreading & IO Programming		
Multithreading: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization. IO Programming: Introduction to Stream, Byte Stream, Character stream, Readers and Writers, File Class, File InputStream, File Output Stream, InputStreamReader. **Sample Programs:** 1. Develop a program to create two threads, one thread should print only even numbers and another thread should print only prime numbers upto a given number. 2. Develop a program to write and read the contents from a file, and count the vowels in a file.	**5** **3**	**Apply CO 4**
Module-5: Exceptions, Collections		
Exceptions: Definition of Exception, Classification of Exception, Structure of Try & catch block, Error Vs Exception, Throw Keyword, Throws Keyword, Finally Keyword, Custom Exception. Collections: Collections Overview, Iterators, Collection Interfaces: List: ArrayList, Linked List & Vector, Set: Hashset, Linked Hashset , Map: Hashmap, Linked Hashmap, & Hash table. Comparator & Comparable Interface. **Sample Programs:** 1. Develop an application for Bank with instance variables acno, name, and balance. Instance methods deposit (amt), withdraw (amt). If balance is less than 500 then throw user defined exception "insufficient balance". (hint: exception Handling). 2. Create a class Student with attributes roll no, name, age and course. Initialize values through parameterized constructor. If age of student is not in between 15 and 21 then generate user-defined exception "Age Not Within Range Exception". If name contains numbers or special symbols raise exception "NameNotValidException". Define the two exception classes. 3. Srusti went for shopping and purchased many items. Each item is in the range Rs.500 to 2000. After purchasing the items from the shop, she started listing the items in some order. Design a java application program to perform this task. (Hint: ArrayList). 4. Shyam has to submit an assignment on SET interface, the assignment is to perform union ,intersection and difference operation on SET , help Shyam complete the assignment.	**5** **3**	**Apply CO 5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1562.1	Understand the basic core concepts of JAVA.
22CSE1562.2	Apply object-oriented programming concepts and to develop applications
22CSE1562.3	Make use of inheritance, interface, and package to solve problems.
22CSE1562.4	Apply multithreading and IO Programming concept to solve real time concurrent applications.
22CSE1562.5	Apply Exception and Collections to develop applications.

Textbooks
1. The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, - TMH. 2. Java Fundamentals A comprehensive introduction By Herbert Schildt, Dale Skrien, McGraw Hill Education. 3. Programming with Java A Primer – E.Balaguruswamy, Mc Grawhill
Reference Books
1. Core Java Volume-I Fundamentals Horstmann & Cornell, - Pearson Education. - Eight Edition 2. Head First Java: A Brain-Friendly Guide, 2nd Edition- Kathy Sierra, Bert Bates

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Average of 2 Assignments for 10 marks each	10
	AAT	Presentation / Demonstration of mini project	10
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Presentations, Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses

Dept. of Computer Science and Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE)

Semester : 5

Course Name: Mobile Application Development
Course Code: 22CSE1563

L: T: P: J	**2 : 0 : 2 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**40**	**SEA Duration:** 03 Hours

Pre-Requisites:
1. C programming
2. Java programming

Course Learning Objectives: The students will be able to

1	Learn to setup Android application development environment
2	Illustrate user interfaces for interacting with apps and triggering actions
3	Interpret tasks used in handling multiple activities
4	Identify options to save persistent application data
5	Appraise the role of security and performance in Android applications

Module-1:	**No. of Hours**	**Blooms Cognitive Levels with CO mapping**
Get started, Build your first app, Activities, Testing, debugging and using support libraries Textbook 1: Lesson 1,2,3 RBT: L1, L2 Lab Component : Create an application to design a Visiting Card. The Visiting card should haves company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number.	**8**	**L3**
Module-2:		
User Interaction, Delightful user experience, Testing your UI Textbook 1: Lesson 4,5,6 RBT: L1, L2 Lab Component : Develop an Android application using controls like Button, Text View, Edit Text for designing a calculator having basic functionality like Addition, Subtraction, Multiplication and Division.	**8**	**L3**
Module-3:		
Background Tasks, Triggering, scheduling and optimizing background tasks Textbook 1: Lesson 7,8 RBT: L1, L2 Lab Component : Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds.	**8**	**L3**
Module-4:		

All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders Textbook 1: Lesson 9,10,11,12 RBT: L1, L2 Lab Component : Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name.	**8**	**L3**
Module-5:		
Permissions, Performance and Security, Firebase, Publish. Textbook 1: Lesson 13,14,15 RBT: L1, L2 Lab Component: Projects in Android studio.	**8**	**L4**

Course Outcomes: After completing the course, the students will be able to	
22CSE1563.**1**	Apply the steps involved in setting up Android development environment using Android studio.
22CSE1563.2	Develop application with multiple activities and delightful user interface
22CSE1563.3	Build user interfaces for interacting with apps and triggering actions
22CSE1563.4	Apply the methods in storing, sharing and retrieving data in Android applications
22CSE1563.5	Analyze performance of android applications and understand the role of permissions and security

Text Books
1. Google Developer Training, "Android Developer Fundamentals Course Google Developer Training Team, 2017.
Reference Books
1. Erik Hellman, " Android Programming – Pushing the Limits", 1 st Edition, Wiley India Pvt Ltd, 2014.

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arks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	AAT	Presentation / Demonstration of mini project	20
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20	**50**

		marks. Students have to answer 5 full questions	
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Presentations, Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses

BNM Institute of Technology

Dept. of Computer Science and Engineering

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

Semester: V

Course Name: Data Analytics **Course Code:** 22CSE1564

L:T:P:J	**2: 0 :2 :0**	**CIA Marks:**50
Credits:	**3**	**SEA Marks:**50
Hours/Week (Total)	**4**	**SEA Duration:**03Hours

Pre-Requisites: Basics of Mathematical and Statistical Methods, Object Oriented Programming, familiarity and program writing skills in Java and knowledge of python libraries, Cloud platform for storage and applications.

Course Learning Objectives: The students will be able to

1	To explain introductory concepts, a brief methodological description and some descriptive statistics of data.
2	To explain multivariate descriptive statistics methods of data analytics, methods used in data preparation phase of the CRISP-DM methodology, concerning data quality issues, converting data to different scales or scale types and reducing data dimensionality.
3	To explain methods involving clustering, frequent pattern mining, which aims to capture the most frequent patterns.
4	To explain cheat sheet and project on descriptive analytics and generalization, performance measure for regression and the bias-variance trade-off.

Module	**No. of Hours**	**Blooms Cognitive Levels with CO mapping**
Module-1: Introduction		
Introduction to Data, Big Data and Data Science , Big Data Architectures, Small Data, What is Data? A Short Taxonomy of Data Analytics, Examples of Data Use, A Project on Data Analytics. **Descriptive Statistics:** Scale Type, Descriptive Univariate Analysis, Descriptive Bivariate Analysis. **Practical Component:** Data Collection and Cleaning 1. **Data Collection Exercise:** Provide students with a dataset (e.g., CSV file) from a real-world source, such as a government website or a public data repository. Instruct students to collect additional relevant data, clean the dataset (handle missing values, outliers), and document the data collection process. 2. **Data Exploration:** Have students perform basic exploratory data analysis (EDA) on the cleaned dataset. They should generate summary statistics, visualizations (histograms, scatter plots), and draw initial insights from the data.	**8**	**Understand CO1**
Module-2: Multivariate Analysis, Data Quality and Preprocessing		
Multivariate Analysis: Multivariate Frequencies, Multivariate Data Visualization, Multivariate Statistics, Infographics and Word Clouds. **Data Quality and Preprocessing:** Data Quality, Converting to a Different Scale Type, Converting to a Different Scale, Data Transformation, Dimensionality Reduction. **Practical Component:** Data Analysis Techniques Provide students with datasets containing multiple variables. Have them perform multivariate analysis, including multivariate frequencies, data	**8**	**Apply CO2**

visualization (scatter plots, heatmaps), and computation of relevant multivariate statistics (e.g., covariance, correlation).		
Module-3:Clustering and Frequent Pattern Mining		
Clustering: Distance Measures, Clustering Validation, Clustering Techniques. **Frequent Pattern Mining:** Frequent Itemsets, Association Rules, Behind Support and Confidence, Other Types of Pattern. **Practical Component: Clustering and Frequent Pattern Mining** 1. **Clustering Exercise:** Provide datasets and guide students in performing clustering analysis. They should calculate distance measures, validate the clusters, and experiment with different clustering techniques (e.g., K-means, hierarchical clustering). 2. **Frequent Pattern Mining:** Introduce students to frequent itemsets and association rule mining. Provide datasets with transactional data and have students identify frequent itemsets and derive association rules with various support and confidence thresholds.	**8**	**Apply CO3**
Module-4:Cheat Sheet and Project on Descriptive Analytics		
Cheat Sheet and Project on Descriptive Analytics: Cheat Sheet of Descriptive Analytics, Project on Descriptive Analytics. **Regression:** Predictive Performance Estimation, Finding the Parameters of the Model, Technique and Model Selection. **Practical Component: Descriptive Analytics Cheat Sheet and Regression Project** 1. **Cheat Sheet Development:** Instruct students to create a comprehensive cheat sheet summarizing key concepts and techniques in descriptive analytics. This can serve as a reference for their ongoing work. 2. **Regression Project:** Assign students a regression analysis project. They should estimate predictive performance, find model parameters, and perform technique and model selection. Provide datasets with both numerical and categorical predictors.	**8**	**Apply CO4**
Module-5: Classification		
Classification: Binary Classification, Predictive Performance Measures for Classification, Distance-based Learning Algorithms, Probabilistic Classification Algorithms. **Practical Component:** **Binary Classification Project:** Assign students a binary classification project where they have to predict a target variable. Provide datasets with labeled examples, and have students apply distance-based learning algorithms and probabilistic classification algorithms. Evaluate their models using appropriate performance measures (accuracy, precision, recall, etc.).	**8**	**Analyze CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1564.1	Understand the fundamentals of descriptive analytics of data.
22CSE1564.2	Apply for multivariate analysis, data preparation and data transformation and reducing.
22CSE1564.3	Apply various clustering techniques for pattern mining.
22CSE1564.4	Apply predictive analytics and performance measures for model selection
22CSE1564.5	Analyze various algorithms for classification problems.

Text Books

1. A General Introduction to Data Analytics , Joao Mendes et al, Wiley, 2019

Reference Books

2. Raj Kamal and Preeti Saxena, Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
3. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1stEdition, Pearson Education, 2016. ISBN-13: 978-9332570351
4. Tom White, "Hadoop: The Definitive Guide", 4 th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672
5. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Average of 2 Assignments for 10 marks each	10
	AAT	Open ended experiments	10
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

B.N.M. Institute of Technology

An Autonomous Institution under VTU

For Internal Communication

Department of Computer Science & Engineering

VI SEMESTER

Scheme of Teaching for 2022-26 Batch

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week				Hours Per week	Credits	Examination		
					Theory Lecture	Tutorial	Practical	Project					
					L	T	P	J			CIA	SEA	Total
1	PCC	22CSE161	System Software and Compiler Design	CSE	2	2	-	-	4	3	50	50	100
2	PCI	22CSE162	Artificial Intelligence and Machine Learning	CSE	3	-	2	-	5	4	50	50	100
3	PCI	22CSE163	Cryptography and Cyber security	CSE	3		2		5	4	50	50	100
4	PCI	22CSE164	Gen AI	CSE	2	-	2		4	3	50	50	100
5	PEC	22CSE165X	Professional Elective-1	CSE	2	-	2	-	4	3	50	50	100
6	PEC	22CSE166X	Professional Elective -2	CSE	-	-	2	2	4	2	50	50	100
7	OEC	22CSE167X	Open Elective-2	CSE	3	-	-	-	3	3	50	50	100
8	AEC	22CSE168	Employability Skills -2(Technical)	T&P	-	-	2	-	2	1	100	-	100
TOTAL					**15**	**2**	**12**	**2**	**31**	**23**	**450**	**350**	**800**

Open Elective - 2			
22CSE1671	Computer Graphics and Visualization	22CSE1673	Storage Area Network
22CSE1672	Operating Systems and RTOS	22CSE1674	Information and Network Security
		22CSE1675	Technology and Transformation
Professional Elective - 1			
22CSE1651	Digital Image Processing	22CSE1654	Advanced Java Programming
22CSE1652	Wireless Sensor Networks	22CSE1655	Cryptography Hash and Integrity Protection
22CSE1653	Data Wearhousing and Data Mining	22CSE1656	High Performance Computing in Cloud

Professional Elective - 2			
22CSE1661	Computer Vision: Algorithms and Application	22CSE1664	Cloud Computing
22CSE1662	Mobile Adhoc Networks	22CSE1665	Cyber Security and Digital Forensics
22CSE1663	DevOps	22CSE1666	High Performance Computer Architecture and Parallel Computing

CIE: Continuous Internal Evaluation, SEE: Semester End Examination, NCMC: Non Credit Mandatory Course

AICTE Activity Points to be earned by students admitted to BE day college programme (For more details refer to Chapter 6, AICTE Activity Point Programme, Model Internship Guidelines): Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other institutions and Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to BNMIT. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only

BSC-->Basic Science	MAT-->Mathematics	PCC--> Professonal Core course	PCCI--> Professional Core Integrated
PBL--> Project based learning	HUM--> Humanity and Social Science	UHV--> Universal Human Values	AEC--> Ability Enhancement course
PW--> Project Work	PEC--> Professional Elective	INT--> Internship	PEC--> Professional Elective

B. N. M .Institute of Technology

An Autonomous Institution under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: System Software and Compiler Design **Course Code: 22CSE161**

L: T: P: J	**2 : 2 : 0 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Understand the various system softwares by learning their working techniques
2	Familiarize with source file, object file and executable file structures and libraries
3	Describe the front-end and back-end phases of compiler and their importance to students
4	Apply SDT and describe various IR techniques
5	Describe the various code optimization techniques employed by the compiler

Module-1 : System Software	No. of Hours	BLL, CO
Introduction to System Software, Machine Architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, Basic loader functions	**8**	**Apply CO1**
Module-2: Introduction & Lexical Analysis		
Introduction: Language Processors, The structure of a compiler, The, Applications of compiler technology **Lexical Analysis:** The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens	**8**	**Apply CO2**
Module-3: Syntax Analysis		
Introduction, Role Of Parsers, Context Free Grammars, Writing a grammar, Derivation, Ambiguity, Left Recursion, Top Down Parsers, Bottom-Up Parsers: Shift Reduce Parser, Simple LR and Canonical LR	**8**	**Apply CO3**
Module-4: Semantic Analysis		
Syntax directed translation: Syntax directed definitions, Evaluation orders for SDD, Applications of syntax directed translations **Intermediate code Generation** : Variants of syntax trees, three-address code ,type declarations, type checking, IR for switch statements and procedures	**8**	**Analyse CO4**
Module-5: Target Code Generator		
Issues in the Design of a Code Generator, The target Language, Addresses in the target code, Basic blocks and Flow graphs, Optimization of basic blocks, A simple code generator.	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE161.1	Apply the concepts and algorithms for design system softwares like assemblers, linkers and loaders.
22CSE161.2	Apply the concepts of lexical analysis for token recognition and token specification.
22CSE161.3	Apply the parsing techniques and grammar transformation techniques for Syntax analysis.
22CSE161.4	Analyze Syntax directed Translations, Intermediate Representation for generating target code.
22CSE161.5	Apply algorithms that code generators utilize to translate the IR into a sequence of target language instructions for simple register machines and generate optimal codes

Text Books

1. System Software by Leland. L. Beck, D Manjula, 3rd edition, 2012
2. Compilers-Principles, Techniques and Tools by Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman. Pearson, 2nd edition, 2007

Reference Books

1. Systems programming – Srimanta Pal , Oxford university press, 2016
2. System programming and Compiler Design, K C Louden, Cengage Learning
3. System software and operating system by D. M. Dhamdhere TMG
4. Compiler Design, K Muneeswaran, Oxford University Press 2013.

Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Average of 2 Assignments for 10 marks each	10
	AAT	Presentation / Demonstration of mini project	10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
Total marks for the Course			**100**

B. N.M. Institute of Technology

An Autonomous institution under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Artificial Intelligence and Machine Learning Course
Code: 22CSE162

L:T:P:J	**3:0:2:0**	**CIA Marks:**50
Credits:	**4**	**SEA Marks:**50
Hours/Week (Total)	**5**	**SEA Duration:**03Hours

Pre-Requisites: Linear Algebra, Probability and Statistics, Data Mining, and Python Programming

Course Learning Objectives: The students will be able to

1	Understand the types of classifications and dimensionality reduction techniques.
2	To become acquainted with regression, classification, and error functions.
3	To become acquainted with the concepts of ensemble, clustering and reinforcement learning.
4	Show scholarly expertise in the application of and analysis of machine learning algorithms to address various learning challenges.

Module-1:	**No. of Hours**	**BLL. CO**
Introduction to Learning, Machine learning- Types- Classification- Regression- Multi-class classification. Dimensionality reduction – Linear and Logistic Regression, Principal Component Analysis. Laboratory Component: 1. Apply multi-class classification on suitable datasets. 2. Apply PCA on a suitable dataset.	**6** **4**	**Apply CO1**
Module-2:		
Singular Value Decomposition and Linear Discriminant Analysis. Naive Bayes, Sequential Pattern Classification. Neural Network Basics: Perceptron, Error Functions. Laboratory Component: 1. Analyze the working of Naive Bayes using a suitable dataset. 2. Analyzse the working of perceptron and error functions using suitable datasets.	**6** **4**	**Analyze CO2**
Module-3:		
Optimization – Gradient Descent, Multilayer Perceptron, Nonlinearities, Learning, Backpropagation, Overfitting, Underfitting. Support Vector Machines (SVM), Kernel methods, Bias-Variance tradeoff. Laboratory Component: 1. Construct a Multilayer Perceptron. 2. Construct Backpropagation.	**6** **4**	**Apply CO 3**
Module-4:		
Regularization and Model/Feature Selection. Decision Tree-Entropy, Information Gain, Ensemble Methods: Boosting, Bagging, Random Forests. Unsupervised learning – K-Means Clustering, Hierarchical. EM Algorithm. Laboratory Component: 1. Apply the Decision Tree algorithm on suitable datasets.	**6** **4**	**Apply CO 4**

measurement and real-time tracking. Analysis of IoT- enabled wearable devices data, smart cities data, and smart agriculture data. Laboratory Component: 1. Apply machine learning techniques on datasets collected using IoT devices.		
Note*: 1. For Laboratory component, use any platforms such as MATLAB or ANACONDA 2 Sample laboratory components is specified in each model.		
2. Apply the Random Forest algorithm on suitable datasets.		
Module-5:		
Applications of ML on IoT. IoT Data Acquisition System. How to prepare data for machine learning algorithms. Exploratory Data Analysis (EDA) for IoT data. Anomaly detection on IoT data. Working principle & Use of Geographical Information System (GIS), GPS module for vehicle speed	**6** **4**	**Apply CO 5**

Course Outcomes: After completing the course, the students will be able to	
22CSE162.1	Apply the fundamentals of machine learning techniques using suitable datasets.
22CSE162.2	Analyze the strength and weakness of different machine learning models to solve real world problems.
22CSE162.3	Apply supervised learning models on real world applications.
22CSE162.4	Apply unsupervised learning models on real world applications.
22CSE162.5	Apply machine learning techniques to solve IoT based real world applications.

Text Books

1. Understanding Machine Learning, Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press, 2017.
2. Tom M. Mitchell, -Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
3. Ethem Alpaydin, "Introduction to machine learning", second edition, PHI publication, 2010

Reference Books

1. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
2. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. John L. Semmlow, Benjamin Griffel, Biosignal and Medical Image Processing, 3rd Ed, CRC Press, 2014.
4. Pattern recognition and machine learning by Christopher Bishop, Springer Verlag, 2006
5. Stephen Marsland, - Machine Learning: An Algorithmic Perspective, Second Edition, 2014.

Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	• Total Number of Test: 2 • Each test will be conducted for 50 marks. • Average of 2 tests = 30 Marks	30
	Practical	• Conduction of experiments, Record writing, viva in each lab 5 Marks • Project Implementation/Article Writing 15 Marks	20
		Total Marks	**50**

SEA (50)	Component	Description	Marks
	Written Exam	The theory exam will be conducted for 100 marks and scaled down to 50 Marks. The question paper will have 10 full questions. Students must answer 5 full questions	**50**
Total marks for the Course			**100**

B. N. M. Institute of Technology

An Autonomous Institution under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name:Cryptography and Cyber Security		**Course Code: 22CSE163**
L: T: P: J	**3: 0: 2: 0**	**CIA Marks:** 50
Credits:	**4**	**SEA Marks:** 50
Hours/Week (Total)	**5hrs/week (50hrs)**	**SEA Duration:** 03 Hours

Pre-Requisites: Nil

Course Learning Objectives: The students will be able to

1	Enable to learn the fundamental concepts of cryptography, and steganography and make use of these techniques in computing systems.
2	Choose between symmetric and asymmetric encryption techniques depending on the application.
3	Summarize the policies and laws in cyber security.
4	Analyze the security issues and risks in Computer Networks.
5	Analyze the security issues and risks in software and web.

Module-1:	No. of Hours	BLL, CO
Classical Ciphers: Introduction to cryptography, cryptanalysis, and cryptology, Overview of cryptography, Basic Cryptographic primitives, Classical ciphers: substitution cipher – Caesar, Playfair and Hill cipher, Transposition cipher – Rail fence, Columnar and Double columnar, One-time-pad encryption, Limitations of One-Time-Pad, Steganography. ***Laboratory Component:*** 1. Make use of Steganographic tools to hide text in an image. 2. Make use of Steganographic tools to hide image in an image.	**6** **4**	**Apply CO3**
Module-2:		
Modern Cryptography: Modern cryptography: Perfectly secret encryption, Symmetric Key Ciphers: AES, Asymmetric Key Ciphers-Key distribution and Key Management, Diffie Hellman Protocol, RSA Encryption, Digital Signature, Cryptanalysis **Laboratory Component:** 1. Installing openssl package 2. Execute openssl commands for AES encryption and decryption with image and text as input. 3. Write a simple program to find a key from a wordlist, given a plaintext, an IV and the corresponding ciphertext.	**6** **4**	**Apply CO3**
Module-3:		
What is cyber security? Need for cyber security, data privacy, Risk Management, Digital Forensics- Incident response, Security operations. The legal perspectives: Cyber-crime and legal landscape around the world, Why do we need cyber laws: The Indian context **Laboratory Component:** 1. Installation of Wire shark, tcpdump 2. Capturing and analyzing packets	**6** **4**	**Apply CO3**
Module-4:		
Network Security: Wired Security Issues: Firewalls, Intrusion Detection, Intrusion Prevention Systems, Honeypots, DoS and DDOS attack, Wireless Security issues-Android and iOS Security, App Security, Secure Boot, Data Exfiltration, Wireless Protected Access	**6**	**Analyze CO4**

(WPA), IEEE 802.1x, 802.11i/ WPA2, Wireless Network Threats, Cloud and IoT Application Security **Laboratory Component:** 1. Use of scapy tool for DOS attack 2. Nmap and nc commands	**4**	
Module-5:		
Software and Web Security: Operating system security: Attack Surfaces of Set-UID Programs, Principle of Least Privilege; Environment variables attack surface, Control Hijacking– Buffer overflow and Countermeasures, Web security: Cross-Site Request Forgery, Cross-Site Scripting, SQL Injection, Threat Modelling-design, Types of Security testing: Fuzz testing, Vulnerability scanning, Penetration Testing; Static and Dynamic analysis. **Laboratory Component:** 1. SQL injection attack	**6** **4**	**Analyze CO4**

Course Outcomes: After completing the course, the students will be able to	
22CSE163.1	Make use of steganography to hide data.
22CSE163.2	Choose appropriate private or public key encryption techniques depending on the application.
22CSE163.3	Make use of Wireshark and TCPdump tools to Analyse the network traffic.
22CSE163.4	Analyze the security issues and risks in Computer Networks.
22CSE163.5	Analyze the security issues and risks in software

Textbooks

1. **"Introduction to Modern Cryptography",** Jonathan Katz, Yehuda Lindell, 2nd Edition, CRC Press, 2015.
2. Wenliang Du,Computer Security A Hands-on Approach,2017

Reference Books

1. **"Cryptography and Network Security"** Behrouz A.Foruzan, 3rd Edition, Tata McGraw Hill, 2017
2. William Stallings, Lawrie Brown, "Computer Security: Principles and Practice", Indian Edition,Pearson, 2010.
3. Jonathan Rosenoer,"Cyber Law: The law of the Internet", Springer-Verlag, 1997.
4. Mark F Grady, Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge University Press, 2006.

Marks Distribution for Assessment:

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th colspan="2">SEA
Conduction: 100M
Reduced to:50M</th></tr>
<tr><td></td><td>I</td><td>II</td><td>Part A</td><td>Part B</td></tr>
<tr><td rowspan="4">CONDUCTION</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="2">IA Test</td><td>30</td><td>30</td><td rowspan="3">30 Marks</td><td rowspan="3">70 Marks</td></tr>
<tr><td colspan="2">Average of 2 tests – 30 Marks</td></tr>
<tr><td>Continuous Assessment</td><td colspan="2">Weekly assessment - 20Marks</td></tr>
<tr><td></td><td colspan="2">Total – 50 Marks</td><td colspan="2">Total – 50 Marks</td></tr>
</table>

B. N. M. Institute of Technology

An Autonomous Institution under VTU
Department of Computer Science and Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE)

III (PCI)

Course Name: Gen AI		**Course Code: 22CSE164**
L: T: P: J	**2:0:2:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Learn the techniques in natural language processing.
2	Be familiar with the natural language generation
3	Understand the key components in transformers architectures and its role in language generation.
4	Enhance the Large Language Model (LLM) performance through human interaction.

Module-1:	**No. of Hours**	**Blooms cognitive Levels with CO mapping**
OVERVIEW AND LANGUAGE MODELING: Overview: Origins and challenges of NLP Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. Transformer-based language models, such as GPT, BERT, and T5. Introduction on fine-tuning of pre-trained models for NLP tasks, Various Grammar- based Language Models, N-gram model, Statistical Language Model. **Sample Programs**: - 1. Implement N-Grams using Python spaCy/NLTK 2. Write a Python program to fine-tune a pre-trained model (e.g., BERT or GPT-2) for text classification using Transformers.	8	L3 (Apply)
Module-2:		
WORD LEVEL AND SYNTACTIC ANALYSIS: Modern transformer-based approaches to tasks like PoS tagging and parsing. Tokenization and embeddings, including contextual embeddings (e.g., Word2Vec vs BERT embeddings). Syntactic analysis and dependency parsing, Context-free Grammar, Constituency- Parsing-Probabilistic Parsing, PCFG, CYK- parsing. **Sample Programs**: - 1. Hands-on stemming and lemmatization examples using spaCy/NLTK 2. Generate a syntax tree for any English sentence using spaCy's dependency parser or pretrained parsing models.	8	L3 (Apply)
Module-3:		
Introduction to Generative AI: Introduction to Generative Models, Concept, Evolution, & Technology of Generative AI, Types of Generative AI, Conversational AI vs Discriminative AI, text-to-image models like DALL-E, Stable Diffusion, and MidJourney. Fine-tuning large pre-trained generative models, Introduction to GANs. **Sample Programs: -** **1.** Implement Diffusion Models for image generation using tools like HuggingFace Diffusion library. **2.** Compare image generation performance using StyleGAN2 vs Diffusion Models	8	L4 (Analyze)
Module-4:		

Generating Text with Transformers: Variational Autoencoders (VAEs) with a focus on large language models (LLMs), Attention mechanisms, Introduction to GPT-4, PaLM, and LLaMA, Retrieval-augmented generation (RAG) frameworks. **Sample Programs: -** 1. Build a text generation model using HuggingFace Transformers and a pretrained GPT model. 2. Experiment with prompt engineering for GPT-based summarization or Q&A	8	L4 (Analyze)
Module-5:		
Generative AI Project Life Cycle: RLHF (Reinforcement Learning with Human Feedback), Multimodal generative models like GPT-4 (text + image) and CLIP. Responsible AI practices, Introduction of frameworks for deployment, such as Vertex AI, Azure OpenAI, or HuggingFace Inference API. **Sample Programs: -** 1. Summarize a long text using Transformers. 2. Create an image from a text prompt using Stable Diffusion and integrate it with LangChain for automation	8	L4 (Analyze)

COs	**Statement**	**Bloom's Cognitive level**	POs/PSOs
22CSE164.1	Identify the challenges of NLP and various grammar-based and Statistical-based language models	L3 (Apply)	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PSO2
22CSE164.2	Develop syntactic parser using Context-free Grammar, Constituency-Parsing and Probabilistic-Parsing.	L3 (Apply)	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PSO2
22CSE164.3	Discover the Types of Generative AI and text-to-image models like DALL-E	L4 (Analyze)	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PSO2
22CSE164.4	Examine on generating text with Transformers architecture	L4 (Analyze)	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PSO2
22CSE164.5	Analyze Generative AI Project Life Cycle and reinforcement learning.	L4 (Analyze)	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO12, PSO2

Text Books

1. **"Speech and Language Processing" by Daniel Jurafsky and James H. Martin**
   - Covers fundamentals of NLP, including language modeling and syntactic analysis.
   - Topics: N-gram models, probabilistic models, context-free grammar.
2. **"Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper**
   - Focuses on practical NLP applications using Python (spaCy, NLTK).
   - Topics: Tokenization, stemming, lemmatization, syntactic parsing.
3. **"Transformers for Natural Language Processing" by Denis Rothman**
   - Explains transformer-based architectures like GPT, BERT, and fine-tuning models.
   - Topics: Text classification, embeddings, and transformers.
4. **"Deep Learning for Natural Language Processing" by Palash Goyal, Sumit Pandey, and Karan Jain**
   - Provides insights into deep learning techniques for NLP tasks.
   - Topics: Embeddings, generative models, and neural networks for NLP.

Reference Books

1. **"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville**
   - A foundational book for understanding generative models, GANs, and deep learning.
   - Topics: Variational autoencoders, GANs, attention mechanisms.
2. **"Generative Deep Learning" by David Foster**
   - Explores concepts like GANs, VAEs, and diffusion models.
   - Topics: Generative AI applications, image generation, and text-to-image models.
3. **"Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze**
   - Detailed coverage of information retrieval and language modeling.
   - Topics: Statistical language models, search engine principles.

Online Study Resources and Tutorials

1. **NLP and Language Modeling**
   - "Introduction to NLP" (Stanford NLP Lecture): YouTube Video
   - "Understanding N-grams": Medium Article
2. **Transformer Models (GPT, BERT, T5)**
   - "Attention is All You Need Explained" (Jay Alammar): Visual Guide
   - "Fine-Tuning Pre-trained Models for NLP" (Hugging Face): Documentation
3. **Syntactic Analysis**
   - "Dependency Parsing with spaCy": Official Guide
   - "PCFG and CYK Parsing": Detailed Tutorial
4. **Generative AI and Applications**
   - "Introduction to Generative Models": YouTube Video
   - "Text-to-Image Models like DALL-E and Stable Diffusion": Hugging Face Guide

CO to PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE164.1	3	3	3	3	3	3		3						3
22CSE164.2	3	3	3	3	3	3		3						3
22CSE164.3	3	3	3	3	3	3		3						3
22CSE164.4	3	3	3	3	3	3		3	3	3				3
22CSE164.5	3	3	3	3	3	3		3				3		3

Marks Distribution for Assessment:

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th></th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 Marks
Reduced: 50 Marks</th></tr>
<tr><th></th><th>I</th><th>II</th><th>III</th></tr>
<tr><td rowspan="5"></td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="2">Written Test</td><td>30</td><td>30</td><td>30</td><td rowspan="4">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module</td></tr>
<tr><td colspan="3">Average of three tests – 30 marks (scaled down to 15 marks)</td></tr>
<tr><td>Mini Project</td><td colspan="3">10 Marks</td></tr>
<tr><td>Practical</td><td colspan="3">Weekly Assessment – 10 Marks
Lab IA Test – 15 Marks
(IA test to be conducted for 30 M and scaled down to 15M)</td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Digital Image Processing		**Course Code:22CSE1651**
L: T: P: J	**2 :0 : 2: 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Pre-Requisites: Computer graphics, Computer aided design

Course Learning Objectives: The students will be able to

1	Understand the fundamentals of digital image processing
2	Explore the image transform techniques to enhance the image used in digital image processing
3	Use image restoration techniques and methods in digital image processing
4	Illustrate various coloring and morphological concepts in digital image processing
5	Apply different compression technique to store the image efficiently.

Programming tools preferred: SCILAB, Python, Java or any other relevant platform.
Real Time Images can be used to demonstrate the work.

Module-1:	**No. of Hours**	**BLL, CO**
Introduction to Digital Image Processing Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Light and the Electromagnetic Spectrum. Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels. **Sample programs** 1. Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left. 2. Implementation of Relationships between Pixels 3. Write a program to show rotation, scaling, and translation of an image.	**8**	**Understand CO1**
Module-2:		
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering. **Sample programs** 1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale) 2. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization 3. Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)	**8**	**Apply CO2**
Module-3:		
A Model of the Image Degradation /Restoration Process. Noise models, Restoration in the Presence of Noise Only using Spatial Filtering. Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering,	**8**	**Apply CO3**

Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. **Sample programs** 1. Implementation of image restoring techniques. 2. Implementation of Image Intensity slicing technique for image enhancement		
Module-4:		
Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing. Wavelets: Background, Multiresolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit or-Miss Transforms, Some Basic Morphological Algorithms-Boundary extraction, Hole filling and extraction of connected component. **Sample programs** 1. Read an image, first apply erosion to the image and then subtract the result from the original. Demonstrate the difference in the edge image if you use dilation instead of erosion. 2. Compression of Color Image	**8**	**Apply CO4**
Module-5:		
Image Compression: Fundamentals, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Golomb Coding, Arithmetic Coding, LZW coding, Block Transform Coding, Run length coding. **Sample programs** 1. Demonstrate enhancing and segmenting low contrast 2D images. 2. Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left.	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1651.1	Understand the fundamentals of digital image processing
22CSE1651.2	Apply the image transform techniques to enhance the image used in digital image processing
22CSE1651.3	Apply image restoration techniques and methods used in digital image processing
22CSE1651.4	Apply various coloring and morphological concepts in digital image processing
22CSE1651.5	Apply different compression technique to store the image efficiently.

Text Books

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008.

Reference Books

1. Milan Sonka,"Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 15 Marks	15
	Practical	Lab IA / Continuous Evaluation	25
	AAT	Online Courses / quiz / presentations	10

Total Marks			50
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks. The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Wireless Sensor Networks		**Course Code: 22CSE1652**
L: T: P: J	**2:0:2:0**	**CIA Marks:** 50
Credits:	3	**SEA Marks:** 50
Hours/Week (Total)	4	**SEA Duration:** 03 Hours

Pre-Requisites: Computer Networks

Course Learning Objectives: The students will be able to

1	To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.
2	To study the various protocols at various layers and its differences with traditional protocols.
3	To study MAC Protocols and their issues.
4	To analyze the different routing protocols in wireless sensor network.
5	To analyze the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

Module-1: Introduction	**No. of Hours**	**BLL, CO**
Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet	**6**	**Understand CO1**
Lab Component: 1. Installing Cisco packet tracer 2. Designing and simulation of network topology using Cisco packet tracer.	**2**	
Module-2: adhoc/sensor networks		
Introduction to adhoc/sensor networks: Key definitions of adhoc/sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.	**6**	**Understand CO2**
Lab Component: 1. Understanding and working of HTTP headers and understanding persistent and non-persistent HTTP connections.	**2**	
Module-3: MAC Protocols		
MAC Protocols : Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.	**6**	**Apply CO3**
Lab Component: 1. Working on different sensors data communication using Cisco packet tracer	**2**	
Module-4: Routing Protocols		

Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols. **Lab Component:** IPv6 configuration and static routing commands	**6** **2**	**Analyze CO4**
Module-5: QoS and Energy Management		
QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes. **Lab Component:** Using Cisco packet tracer understand the life of packet in Internet.	**6** **2**	**Analyze CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1652.1	Illustrate the fundamentals of wireless communication technology
22CSE1652.2	Outline advantages and issues of adhoc sensor networks
22CSE1652.3	Identify the different MAC protocols in wireless sensor networks
22CSE1652.4	Analyze the different routing protocols
22CSE1652.5	Examine Issues and Challenges in providing QoS in wireless sensor networks

Text Book

1. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks", Pearson Education - 2008.

Reference Books

1. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication - 2004.
2. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003.
3. William Stallings, "Wireless Communications and Networks ", Pearson Education – 2004

Marks distribution for assessment

CIA(50)	Component	Description	Marks
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Average of 2 Assignments for 10 marks each	10
	AAT	Presentation / Demonstration of mini project	10
		Total Marks	**50**
SEA(50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	50
		Total marks for the Course	100

B. N. M .Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Data Warehousing & Data Mining		**Course Code: 22CSE1653**
L: T: P: J	**2 : 0 : 2 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Pre-Requisites:

- Basic concepts from Database management
- SQL Practice

Course Learning Objectives: The students will be able to

1	Demonstrate different Data Warehouse Implementations.
2	Interpret the features of Data Mining and Data Mining Applications.
3	Implement Association Mining Methods.
4	Implement Classification Methods.
5	Implement Cluster Analysis and recent trends in Data Mining Applications.

Module-1: Data Warehousing	**No. of Hours**	**BLL, CO**
Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Implementation, Data Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. **Lab Component:** Create an application to design a for a schema and OLAP operation	**6+2=8**	**Apply CO 1**
Module-2: Data Mining		
Why Data Mining? What Is Data Mining? What Kinds of Data Can Be Mined? Major Issues in Data Mining, Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity, Data Mining Applications. **Lab Component***:* Create an application for a data preprocessing activities	**6+2=8**	**Apply CO2**
Module-3: Association Mining		
Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods, Frequent Item set Mining Methods, Which Patterns Are Interesting?—Pattern Evaluation Methods, Constraint-Based Frequent Pattern Mining, Mining High-Dimensional Data and Colossal Patterns **Lab Component :** Create an application to show the working progress of Association mining	**6+2=8**	**Analyse CO3**
Module-4: Classification		
Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Holdout Method and Random Sub sampling, Cross-Validation, Bootstrap, Boosting, Random Forests, Bayesian Belief Networks, Classification by Back propagation. **Lab Component :** Create an application for the decision tree using B+ tree	**6+2=8**	**Analyse CO4**
Module-5: Cluster Analysis and recent trends		

Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Outlier Detection Methods, Visual and Audio Data Mining. **Lab Component :** Create an application to show the working progress of Visual and Audio Data Mining.	**6+2=8**	**Analyse CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1653.1	Apply the data warehouse concepts for data cube problems.
22CSE1653.2	Apply the data mining solutions with data visualization techniques.
22CSE1653.3	Analyze the association rules for the data set using mining concepts.
22CSE1653.4	Analyze between the classification Algorithm methods.
22CSE1653.5	Analyze data mining problems in recent trends

Text Books

1. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.

Reference Books

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry, Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edition,2012.

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 15 Marks	15
	Practical	Lab IA / Continuous Evaluation	25
	AAT	Online Courses	10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks. The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Advanced Java Programming **Course Code: 22CSE1654**

L: T: P: J	2:0:2:0	**CIA Marks:** 50
Credits:	3	**SEA Marks:** 50
Hours/Week (Total)	4	**SEA Duration:** 03 Hours

Pre-Requisites: Java Programming Language and Basic concepts of Java.

Course Learning Objectives: The students will be able to

1	Identify the need for advanced Java concepts like Collections.
2	Adapt Servlets to build server-side programs.
3	Make use of JDBC & Hibernate Framework to access database through Java Programs.
4	Make use of Spring Framework for Integrating Different Technology.

Module-1: Collections	No. of Hours	BLL, CO
Collections Overview, Iterators, Collection Interfaces: List: ArrayList, Linked List & Vector, Set: Hashset, Linked Hashset, Map: Hashmap, Linked Hashmap, & Hash table. Comparator & Comparable Interface. **Sample Programs:** 1. Srusti went for shopping and purchased many items. Each item is in the range Rs.500 to 2000. After purchasing the items from the shop, she started listing the items in some order. Design a java application program to perform this task. (Hint: ArrayList). 2. There are 10 elements stored in two different Arraylist. Each of those elements are stored in an unordered manner. Perform following set operations for this list using Hashset. (Hint: use Hashset) i) Union ii) Intersection iii) Set Difference	**6** **2**	**Apply CO 1**
Module-2: JSP		
Introduction to JSP, Creating simple JSP Programs, How JSP is processed, JSP Scripting Constructs, Predefined Variables, JSP Directives, Simple JSP Program to fetch database records, Case Study: Browsing Database Tables. **Sample Program:** 1. Develop a JSP program calculates factorial values for an integer number, while the input is taken from an HTML form. 2. Develop a JSP program shows the System date and time.	**6** **2**	**Apply CO 2**
Module-3: Servlets		
Introduction, Life Cycle of a Servlet(Init(), Service(),Destroy()), using Tomcat for servlet development, simple servlet: create and compile servlet source code, start tomcat, start a web browser and request the servlet, servlet API, Handling HTTP Requests and Responses: Handling HTTP GET requests and POST request, Using Cookies, Session Tracking. **Sample Programs:** 1. Develop a Servlet application to print current date & time. 2. Develop a Servlet application to Auto refresh a page.	**6** **2**	**Apply CO 3**
Module-4: JDBC		

Basic SQL, Introduction to JDBC, JDBC Architecture & Drivers, Create a Database, Table, CRUD Operations, Java Application Using JDBC Connectivity, Driver Manager, Result Set, Connection, Statement, Prepared Statement, DB Connectivity Steps, Store & Retrieving Image in SQL, JDBC CRUD Application. **Sample Programs:** 1. Develop a code create a connection between database to Java Program. 2. Develop a code to create a database table using Java. 3. Develop a program to perform CRUD operations.	**6** **2**	**Apply CO 4**
Module-5: Hibernate & Springs		
Hibernate: Introduction, Hibernate Architecture, Hibernate Session, Hibernate Configuration, Hibernate With Annotation, Hibernate Validator, Hibernate CRUD. **Springs:** Introduction, Spring Framework, Spring Basics, Inversion of Control, Dependency Injection, Spring Annotations, Spring MVC, Spring MVC Annotations, Spring MVC Hello World Applications. **Sample Programs:** 1. Develop a program to create a database and perform CRUD operation using hibernate framework. 2. Develop a program to validate the input using spring framework.	**6** **2**	**Apply CO 5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1654.1	Apply the concept like collections in developing modular & efficient programs.
22CSE1654.2	Develop Server-Side applications using JSP.
22CSE1654.3	Develop Server-Side applications using Servlets.
22CSE1654.4	Make use of database access and details for managing information using the JDBC API.
22CSE1654.5	Apply different frameworks like Hibernate & spring for solving real time problems.

Text Books

1. The Complete Reference in Java – Seventh Edition.
2. Jim Keogh: J2EE-The Complete Reference, McGraw Hill, 2007.
3. Hibernate:
   3.1 https://www.tutorialspoint.com/hibernate/index.htm
   3.2 https://www.javatpoint.com/hibernate-tutorial
4. Springs:
   4.1 https://www.javatpoint.com/spring-mvc-tutorial
   4.2 https://www.tutorialspoint.com/spring/spring_web_mvc_framework.htm

Reference Books

1. Y. Daniel Liang: Introduction to JAVA Programming, 7thEdition, Pearson Education, 2007.
2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.
3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.

Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 15 Marks	15
	Practical	Lab IA / Continuous Evaluation	25
	AAT	Online Courses	10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks. The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

B. N. M .Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: 6

Course Name: Cryptography Hash and Integrity Protection **Course Code: 22CSE1655**

L: T: P: J	**2 :0 : 2 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Pre-Requisites: Nil

Course Learning Objectives: The students will be able to

1	Learn about the three tenants of the CIA triad—confidentiality, integrity, and availability—and how they can be used to secure data.
2	Introduce message authentication and hash function.
3	To explain the basic properties that a digital signature algorithm must satisfy
4	TLS cryptographic protocol to secure network communications.

Module-1:	**No. of Hours**	**BLL, CO**
Introduction to cryptography, cryptanalysis, and cryptology, Overview of cryptography, Basic Cryptographic Primitives, Vulnerabilities, Threats, and Attacks. Cryptographic attacks: CCA, COA, KPA, CPA. Objectives of Information Security: CIA triad, Confidentiality, Integrity, and Availability. Trapdoor	**6**	**CO1 Understand**
Laboratory Component: 1. Columnar Transposition involves writing the plaintext out in rows and then reading the ciphertext off in columns one by one. Write a Python program to perform cryptanalysis of single columnar transposition with key size varying from 3-6.	**2**	
Module-2:		
Message Integrity, Message digest algorithm (MD5), Cryptographic Hash Function Requirements: One-Way and Collision Properties, Collision resistant hash function (CRHF), Secure Hash Algorithm (SHA), Birthday attack, Zero-knowledge protocols, Hash functions: Merkle-Damgard and Davies Meyer.	**6**	**CO2 Apply**
Laboratory Component: 1. MD5 collision attack lab (ref: https://seedsecuritylabs.org/Labs_16.04/Crypto/Crypto_MD5_Collision)	**2**	
Module-3:		
Entity authentication, device authentication, Message Authentication Code (MAC) – Definition, Message Integrity, Cipher Block Chaining (CBC-MAC), Constructing Secure message Authentication codes, Authenticated Encryption, Generic Attacks on Hash Functions, Random Oracle Model, Applications,	**6**	**CO3 Apply**
Laboratory Component: 1. Hash length extension attack Ref: https://seedsecuritylabs.org/Labs_16.04/Crypto/Crypto_Hash_Length_Ext/	**2**	
Module-4:		

Identification protocols, Digital Signature (DS): Certificates and Public Infrastructure, Attacks, Schemes, Applications, Signatures from Hash Functions. Elliptic Curve cryptography-based signature (ECDSA), RSA-based signature, **Laboratory Component:** 1. RSA signature and encryption lab Ref: https://seedsecuritylabs.org/Labs_16.04/Crypto/Crypto_RSA/	**6** **2**	**CO4 Evaluate**
Module-5:		
Case Study: TLS, Hash Tree (Merkle Tree), Cryptographic Hash Applications: blockchain, cryptocurrency, and Bitcoin **Laboratory Component:** 1. Create self-signed certificates in Python.	**6** **2**	**CO5 Apply**

Course Outcomes: After completing the course, the students will be able to	
22CSE1655.1	Classify cryptographic attacks.
22CSE1655.2	Make use of the hash for data integrity.
22CSE1655.3	Make use of authentication algorithms for message authentication
22CSE1655.4	Choose an appropriate digital signature.
22CSE1655.5	Utilize TLS for data security.

Text Books
1. **"Introduction to Modern Cryptography",** Jonathan Katz, Yehuda Lindell, 2nd Edition, CRC Press, 2015.
Reference Books
1. **"Cryptography and Network Security"** Behrouz A.Foruzan, 3rd Edition, Tata McGraw Hill, 2017

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 15 Marks	15
	Practical	Lab IA / Continuous Evaluation	25
	AAT	Quiz, Presentations.	10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks. The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VI (Professional Elective)

Course Name: High Performance Computing in Cloud		**Course Code: 22CSE1656**
L: T: P: J	**2 : 0 :2:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Pre-Requisites:

Course Learning Objectives: The students will be able to

1	Understand the basics about High performance computing
2	Identify the challenges involved in distributed computing and understand the need for cluster computing
3	Apply the concepts of Grid computing to improve the overall system performance
4	Define the basic concepts of cloud computing
5	Provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.

Module-1: INTRODUCTION TO HPC	**No. of Hours**	**BLL, CO**
Introduction to high performance computing, basic definitions: cluster, grid, meta-computing, middleware etc., examples of representative applications. Programming models: shared memory, message passing, peer-to-peer. Development of parallel and distributed applications, Design phases, Performance metrics and profiling	**8**	**Understand CO1**
Module-2: OVERVIEW OF CLUSTER COMPUTING		
The Role of Clusters, Definition and Taxonomy, Distributed Computing, Limitations, Architecture of cluster-based systems, Design Decisions, Protocols Distributed File Systems, Virtualization technologies, Issues in cluster design	**8**	**Apply CO2**
Module-3: INTRODUCTION OF GRID COMPUTING		
Introduction, Evolution of the Grid, Definitions of Grid Computing, Grid models, Applications, Examples of usage, Research possibilities / scope in Grid Computing, HPC and Grids, Scheduling HPC applications in Grids, Grid Monitoring Architecture (GMA) – An Overview of Grid Monitoring Systems.	**8**	**Apply CO3**
Module-4: INTRODUCTION TO CLOUD COMPUTING		
Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics - Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualization	**8**	**Apply CO4**
Module-5: CLOUD SERVICE MODELS		
Service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network - Case studies. Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies – Anything as a service (XaaS).	**8**	**Analyze CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1656.1	Understand the fundamental concepts of High Performance computing.
22CSE1656.2	Identify the issues present in the distributed systems and overcome the limitations with cluster computing concepts.
22CSE1656.3	Apply the concepts of various grid models to improve the performance of the system.
22CSE1656.4	Identify the main concepts, key technologies, strengths, and limitations of cloud computing.
22CSE1656.5	Analyze the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.

Text Books

1. High Performance Cluster Computing, Volume 1, Architecture and Systems, Rajkumar Buyya, Pearson Education.
2. D. Janakiram, Grid Computing, Tata McGraw-Hill, 2005
3. R. Buyya, C. Vecchiola and S. T. Selvi, Mastering Cloud Computing Foundations and Applications Programming, Morgan Kaufmann, Elsevier, 2013.

Reference Books

1) C. S. R. Prabhu, Grid and Cluster Computing, PHI, 2008.
2) B. Sosinsky, Cloud Computing Bible, Wiley, 2011
3) A. Chakrabarti, Grid Computing Security, Springer, 2007
4) . (Edited By) I. Foster and C. Kesselman, The Grid: Blueprint for a New Computing Infrastructure, Morgan Kaufmann, Elsevier, 2004.

Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 15 Marks	15
	Practical	Lab IA / Continuous Evaluation	25
	AAT	Quiz, Presentations	10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks. The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Presentations, Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Computer Vision: Algorithms and Applications
Course Code: 22CSE1661

L: T: P: J	**0:0 : 2 : 2**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**40**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Provide an insight into the applications of Computer Vision.
2	Understand the fundamentals of Object Recognition, Image Classification.
3	Identify and Analyze the Adversarial Attacks and Defense mechanisms.

Module-1:	**No. of Hours**	**BLL, CO**
Introduction: Background, requirements and issues, human vision. Image formation: geometry and photometry	**8**	**Understand CO1,**
Module-2:		
Geometry, brightness, quantization, camera calibration, photometry, Image segmentation, Region segmentation, Edge detection, Point features (SIFT) , Multi-view Geometry :Shape from stereo and motion, feature matching, Active ranging	**8**	**Apply CO2,**
Module-3:		
Object Recognition: Traditional Methods, Bag of Words, Bayes classifiers, Linear classifiers Neural Network Basics: Neural nets, CNNs, Backpropagation, SGD, Batch Normalization, COLO.	**8**	**CO3, Apply**
Module-4:		
Image Classification: Variety of networks, possibly some coverage of semi-supervised methods, Object Detection and Semantic Segmentation: Variety of approaches (Faster/Mask RCNN, YOLO and related); Human pose estimation, Face ID	**8**	**CO4, Apply**
Module-5:		
Adversarial Attacks and Defense: Motion Analysis and activity Recognition - Optical flow, motion features, classification network, Selected Topics–Vision and language, Vision Transformers.	**8**	**CO5, Analyze**

Course Outcomes: After completing the course, the students will be able to

22CSE1661.1	Utilize the toolbox of the most powerful Computer Vision models.
22CSE1661.2	Illustrate the theory behind the concepts of Computer Vision.
22CSE1661.3	Apply Object Recognition by utilizing the traditional methods.
22CSE1661.4	Apply Image Classification by making use of different approaches.
22CSE1661.5	Create powerful Computer Vision applications.

Text Books

1. Computer Vision: Algorithms and Applications by Richard Szeliski. A Modern Approach-ISBN – 9789332550117.
2. Computer Vision: A Modern Approach by David Forsyth and Jean Ponce. International 2nd edition Available for free online.

Reference Books

1. *Elements of Statistical Learning* by Trevor Hastie, Robert Tibshirani, and Jerome Friedman. Available for free online
2. *Multiple View Geometry in Computer Vision (Second Edition)* by Richard Hartley and Andrew Zisserman. Available for free online through the UM Library.

Marks Distribution for Assessment:

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SEA : 50%

Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
Total		**50 Marks**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Mobile Adhoc Networks		**Course Code: 22CSE1662**
L: T: P: J	**0: 0: 2: 2**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**3**	**SEA Duration:** 03 Hours

Pre-Requisites: Basics of networking, Reference models, Network protocols

Course Learning Objectives: The students will be able to

1	Explain fundamental principles of Ad-hoc Networks
2	Discuss a comprehensive understanding of Ad-hoc network protocols
3	Outline current and emerging trends in Ad-hoc Wireless Networks.
4	Analyze energy management in ad-hoc wireless networks.

Module-1:	**No. of Hours**	**BLL, CO**
Basic Wireless Sensor Technology and Systems Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, Wireless Transmission Technology and Systems, Available Wireless Technologies	**8**	**Understand CO1**
Module-2:		
Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Adhoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols (MACAW, FAMA, BTMAMARCH), Contention- Based Protocols with Reservation Mechanisms (D-PRMA, CATA, HRMA) Contention-Based Protocols with Scheduling Mechanisms (DPS, DWOP).	**8**	**Understand CO2**
Module-3:		
Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of RoutingProtocols; Table Driven Routing Protocols (DSDV, WRP, CGSR); On-Demand Routing Protocols (DSR, AODV, LAR, ABR), Hybrid Routing Protocols (CEDAR, ZHLS).	**8**	**Apply CO3**
Module-4:		
Transport Layer and Security Protocols for Ad-hoc Networks Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol;Classification of Transport Layer, Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks.	**8**	**Apply CO4**
Module-5:		
Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer	**8**	**Analyze CO5**

Solutions, Network Layer Solutions (Ticket based, Predictive Location based, Trigger based); Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery ManagementSchemes.		

Course Outcomes: After completing the course, the students will be able to	
22CSE1662.1	Demonstrate appropriate knowledge to exploit the benefits of wireless Adhoc & sensor networks
22CSE1662.2	Summarize the protocol design issues of Adhoc and sensor networks
22CSE1662.3	Make use of appropriate routing protocols in Adhoc networks
22CSE1662.4	Identify the Issues and Challenges in Security Provisioning in Adhoc networks
22CSE1662.5	Analyze the challenges in providing the Quality of Service and Energy Management in Ad-hoc Wireless Networks

Text Books

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, Pearson Education,2014. ISBN 978-81-317-0688-6
2. Wireless Sensor Networks: Technology, Protocols and Applications, Kazem Sohraby, Daniel Minoli, Taieb Znati, WILEY, Second Edition (Indian), 2014, ISBN: 978-0-471-74300-2

Reference Books

1. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.
2. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002
3. Wireless Sensor Networks- An Information Processing Approach, Feng Zhao & Leonidas J. Guibas,
   Elsevier, 2007, ISBN-9781558609143.

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Total		**50 Marks**

B. N. M .Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Devops		**Course Code: 22CSE1663**
L: T: P: J	0:0:2:2	**CIA Marks:** 50
Credits:	3	**SEA Marks:** 50
Hours/Week (Total)	3	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Understand the challenges in Software Eng. and Continuous Integration and Continuous Delivery
2	Know how DevOps is applied and used in Software Development cycle.
3	Know how DevOps can be applied in testing phase of SDLC.
4	To understand the DevOps tools used in each phase of software development activity.
5	To appreciate the use of DevOps post software development and deployment..

Module1	**No. of Hours**	**BLL, CO**
Introduction to DevOps and Continuous Delivery: Introducing DevOps, how fast is fast? The Agile wheel of wheels, Beware the cargo cult Agile fallacy. **A View from Orbit:** The DevOps process and Continuous Delivery, Release management, Scrum, Kanban, and the delivery pipeline, wrapping up – a complete example, Identifying bottlenecks	**08**	**Understand CO1**
Module 2		
Everything is Code: The need for source code control, The history of source code management, Roles and code, Which source code management system?, A word about source code management system migrations, Choosing a branching strategy, Branching problem areas, Artifact version naming. Choosing a client, Setting up a basic Git server, Shared authentication, Hosted Git servers.	**08**	**CO2 Apply**
Module 3		
Building the Code: Why do we build code?, The many faces of build systems, The Jenkins build server, Managing build dependencies, The final artifact, Continuous Integration, Continuous Delivery, Jenkins plugins, The host server, Build slaves, Software on the host, Triggers. Job chaining and build pipelines, A look at the Jenkins filesystem layout, Build servers and infrastructure as code, Build phases, Alternative build servers, Collating quality measures, About build status visualization, Taking build errors seriously	**08**	**CO3 Apply**
Module 4		
Testing the Code : Manual testing, Pros and cons with test automation, Unit testing, JUnit in general and JUnit in particular, A JUnit example, Mocking, Test Coverage, Automated integration testing, Performance testing, Automated acceptance testing, Automated GUI testing, JavaScript testing, Testing backend integration points, A complete test automation scenario	**08**	**CO4 Understand**
Module 5:Pipelining and Multiprocessors		
Deploying the Code: Why are there so many deployment systems?, Virtualization stacks, Executing code on the client, The Puppet master and Puppet agents, Cloud solutions, AWS, Azure.	**8**	**CO5 Apply**

Course Outcomes: After completing the course, the students will be able to	
22CSE1663.1	Understand the Software Engg process, and challenges
22CSE1663.2	Know how Devops is applied and used in Software Development cycle.
22CSE1663.3	Know the application of DevOps in Software Development activity
22CSE1663.4	Understand application of DevOps in Software Testing and Validation activity
22CSE1663.5	Build familiarity of application of DevOps in Software Deployment phase

Text Books
1. Joakum Verona, "Practical DevOps", Packt Publishing Limited, 2016
Reference Books
Jennifer Davis, Ryn Daniels, "Effective DevOps", O'reilly Publications, 2016.

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Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
Total		**50 Marks**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU
Dept. of Computer Science and Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE)

Semester: VI

Course Name: Cloud Computing		**Course Code: 22CSE1664**
L: T: P: J	**0 : 0 : 2 : 2**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**40**	**SEA Duration:** 03 Hours

Pre-Requisites:

Course Learning Objectives: The students will be able to

1	Understand the basics of Cloud Computing.
2	Obtain an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
3	Develop programs and do experiment with the various cloud computing environments.
4	Develop applications with the help of cloud infrastructure
5	Analyze about the different Cloud Standards and security measures.

Module-1: Introduction to Cloud Computing	**No. of Hours**	**BLL, CO**
Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics - Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization.	**8**	**Apply CO1**
Module-2: Service Models		
Service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network - Case studies. Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies – Anything as a service (XaaS).	**8**	**Apply CO2**
Module-3: Migrating into a Cloud		
Introduction, Challenges while migrating to Cloud, Broad approaches to migrating into the cloud why migrate -deciding on cloud migration, the Seven-step model of migration into a cloud, Migration Risks and Mitigation, relevant Deployment Models for Enterprise Cloud Computing.	**8**	**Analyse CO3**
Module-4: Cloud Programming and Software Environments		
Cloud Programming and Software Environments – Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine – Emerging Cloud software Environment.	**8**	**Apply CO4**
Module-5: Cloud Access & Cloud Security		
Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data - Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards.	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1664.1	Identify the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
22CSE1664.2	Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
22CSE1664.3	Analyze various methods to migrate into cloud & its associated challenges.
22CSE1664.4	Make use of the appropriate cloud computing solutions and recommendations according to the applications used.
22CSE1664.5	Identify the core issues of cloud computing such as security, privacy, and interoperability and apply solutions accordingly.

Text Books

1. 1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012.
2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008.

Reference Books

1. Barrie Sosinsky, " Cloud Computing Bible" John Wiley & Sons, 2010.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009.

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Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
Total		**50 Marks**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU
Dept. of Computer Science and Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE)

Semester: 6

Course Name: Cyber security and digital forensics		**Course Code: 22CSE1665**
L: T: P: J	**0 :0 : 2 : 2**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**40**	**SEA Duration:** 03 Hours

Pre-Requisites: Nil

Course Learning Objectives: The students will be able to

1	Provide a deep understanding of security issues, digital forensics & incident response.
2	Enhance knowledge and experience of various digital forensics techniques and incident response
3	To apply techniques to store incident evidence safely and securely.
4	Analyze various mail forensic tools
5	Apply various data recovery tools to get back deleted data.

Module-1:	**No. of Hours**	**BLL, CO**
Forensics Overview: Digital forensics: Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential, Concepts: computer/network/Internet forensic and anti-forensics, Digital Investigation, Data Acquisition, and Information Gathering.	**8**	**CO1 Understand**
Module-2:		
Cyber Crime and Computer Crime. Definition and types of cybercrimes, electronic evidence and handling, electronic media, collection, searching, and storage of electronic media, introduction to internet crimes, hacking and cracking, credit card and ATM frauds, web technology, cryptography, emerging digital crimes, and modules.	**8**	**CO2 Apply**
Module-3:		
Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at the scene, storing digital evidence, obtaining digital hash, and reviewing cases.	**8**	**CO3 Apply**
Module-4:		
Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.	**8**	**CO4 Analyse**
Module-5:		
Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, process of computer forensics and digital investigations, processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.	**8**	**CO5 Apply**

Course Outcomes: After completing the course, the students will be able to	
22CSE1665.1	Summarize security issues, digital forensics & incident response
22CSE1665.2	Apply various digital forensics techniques and incident response
22CSE1665.3	Apply techniques to store incident evidence safely and securely.
22CSE1665.4	Analyze various mail forensic tools
22CSE1665.5	Apply various data recovery tools to get back deleted data.

Text Books

1. Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.
2. Angus M.Marshall, John, " Digital forensics: Digital evidence in criminal investigation"

Reference Books

1. Gregory Kipper, "Wireless Crime and Forensic Investigation", Auerbach Publications, 2007
2. Iosif I. Androulidakis, " Mobile phone security and forensics: A practical approach", Springer publications, 2012
3. Andrew Hoog, " Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications, 2011

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Total		**50 Marks**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: High Performance Computer Architecture and Parallel Computing
Course Code: 22CSE1666

L: T: P: J	**0 : 0 : 2 : 2**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**40**	**SEA Duration:** 3 Hours

Pre-Requisites:
Students must have good knowledge on

- Computer organization
- Computer architecture

Course Learning Objectives: The students will be able to

1	To introduce the design, analysis, and implementation, of high performance computational science and engineering applications.
2	Illustrate on advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.
3	Be familiar with popular parallel programming paradigms.
4	Understand the means by which to measure, assess and analyse the performance of HPC applications.
5	Understand the mechanisms for evaluating the suitability of different HPC solutions to solving scientific problems.

Module-1:	**No. of Hours**	**BLL, CO**
Introduction: Computational Science and Engineering: Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multiscale, multi-discipline applications)	**8**	**Understand CO1**
Module-2:		
High-End Computer Systems: Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded and purpose-built.	**8**	**Apply CO2**
Module-3:		
Parallel Algorithms: Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques.	**8**	**Apply CO3**
Module-4:		
Parallel Programming: Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS)	**8**	**Apply CO4**

languages (UPC, Titanium, Global Arrays)		
Module-5:		
Achieving Performance: Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources using existing libraries, tools, and frameworks	**8**	**Analyze CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE166.1	Understand the underlying architecture of computing technology, different measures of computational complexity, and basic methods of parallel programming using real world case studies.
22CSE166.2	Apply memory hierarchy techniques of various computer systems and its purpose.
22CSE166.3	Identify different parallel algorithms used in the design of parallel models and various techniques in modern high performance architectures.
22CSE166.4	Apply the concept of functional parallelism, task scheduling and various synchronization methods of parallel programming for achieving parallelism.
22CSE166.5	Analyze hardware/software co-design for achieving performance.

Text Books

1. Introductions to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, Addison-Welsey, 2nd edition, 2003.
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC, Computational Science Series, 2007.

Reference Books

1. An Introduction to Parallel Computing, Design and Analysis of Algorithms, Rama, A. Gupta, G. Karypis, V. Kumar, Addison-Wesley 2/e, 2003.
2. Scalable Parallel Computing, Kai Hwang, McGraw Hill 1998.
3. Parallel Computer Architecture: A hardware/Software Approach, David Culler Jaswinder Pal Singh, Morgan Kaufmann, 1999.

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SEA : 50%

Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
Total		**50 Marks**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Computer Graphics and Visualization		**Course Code: 22CSE1671**
L: T: P: J	**3 : 0 : 0 :0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**3**	**SEA Duration:** 03 Hours

Pre-Requisites: Computer Aided design

Course Learning Objectives: The students will be able to

1	Overview of Computer Graphics along with its applications
2	Illustrate OpenGl primitives and attributes
3	Make use of different fill area attributes to animate the images.
4	Exploring 2D and 3D graphics mathematics along with OpenGL API's.
5	Demonstrate clipping and illumination models on both 2D and 3D objects.

Module-1:	**No. of Hours**	**BLL, CO**
Overview: Basics of computer graphics, Application of Computer Graphics, video display processor, Refresh Cathode Ray Tubes, Random Scan and Raster Scan displays, Input Devices, graphics software. coordinate reference frames, Specifying a two dimensional world coordinate reference frame in openGL. Introduction to OpenGL. Color and gray scale, OpenGL Color Functions.	**8**	**Understand CO1**
Module-2:		
OpenGL point functions, OpenGL line functions, point attributes, line attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham‟s), circle generation algorithms (Bresenham‟s). Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes. **Sample programs**: 1. Design a line using DDA line drawing algorithm 2. Implement Brenham‟s line drawing algorithm for all types of slope. **3.** Design a real world picture using primitives such as points, lines, triangles and polygons.	**8**	**Apply CO2**
Module-3:		
2D and 3D viewing pipeline, OpenGL 2D viewing functions, OpenGL Character Functions, OpenGL Display Lists, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. Polyhedra, OpenGL Polyhedra Functions, Curved Surfaces, Quadric Surfaces, OpenGL quadric surfaces and cubic surfacefunctions. **Sample programs**: 1. Implement a circle drawing algorithm. **2.** Develop a menu driven program to fill the polygon using scan line algorithm	**8**	**Apply CO3**
Module-4:		
2D and 3D Geometric Transformations: 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2D Composite transformations, other 2D transformations, OpenGL	**8**	**Apply CO4**

geometric transformations function. 3D Geometric Transformations: Translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions. **Sample programs:** 1. Create and rotate a triangle about the origin and a fixed point. 2. Draw a colour cube and spin it using OpenGL transformation matrices**.**		
Module-5:		
Clipping and Color and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only - polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only. Color Models, Light Sources, Basic illumination Models. Sample programs: 1. Clip a lines using Cohen-Sutherland algorithm. 2. Develop a program to show the different quadric surfaces.	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1671.1	Understand the fundamentals of computer graphics
22CSE1671.2	Design and implement algorithms for 2D graphics primitives and attributes
22CSE1671.3	Apply 2D viewing and quadric surfaces
22CSE1671.4	Apply Geometric transformations on both 2D and 3D objects.
22CSE1671.5	Apply various clipping and illumination models

Text Books

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011
2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008

Reference Books

1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education
2. Xiang, Plastock : Computer Graphics , sham‟s outline series, 2nd edition, TMG.
3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning
4. M M Raikar & Shreedhara K S Computer Graphics using OpenGL, Cengage publication

Marks Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Average of 2 Assignments for 10 marks each	10
	AAT	Presentation / Demonstration of mini project	10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions from each	**50**

		module.	
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Presentations, Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses

B. N. M. Institute of Technology

An Autonomous Institution under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Operating System and RTOS		**Course Code: 22CSE1672**
L: T: P: J	**3 : 0 : 0 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**3**	**SEA Duration:** 03 Hours

Pre-Requisites:

Before learning OS, you must have the

- Basic knowledge of C Programming Language.
- Basic knowledge of Computer hardware and software system.

Course Learning Objectives: The students will be able to

1	Introduce concepts and terminology used in OS
2	Apply concepts of threading and multithreaded systems
3	Apply process synchronization and concept of Deadlock
4	Analyze the memory management techniques.
5	Understand the various applications of RTOS

Module-1: Fundamental Concepts of Operating System	**No. of Hours**	**BLL, CO**
Fundamental Concepts of Operating System: Operating system functions and characteristics, historical evolution of operating systems, issues in operating system design. **Unix files:** Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands.	**8**	**Understand CO1**
Module-2: Process Management and CPU Scheduling		
Process Management: Process abstraction, process address space, process management, system calls, threads, process hierarchy. **CPU Scheduling:** Levels of scheduling, comparative study of scheduling algorithms, multiple processor scheduling.	**8**	**Apply CO2**
Module-3: Deadlocks and Concurrent Processes		
Deadlocks: Characterization, prevention and avoidance, deadlock detection and recovery. **Concurrent Processes:** Critical section problem, semaphores, monitors, inter-process communication, message passing mechanisms.	**8**	**Apply CO3**
Module-4: Memory Management		
Memory Management: Storage allocation methods, virtual memory concept, demand paging, page replacement algorithms, segmentation, thrashing and Disk Scheduling.	**8**	**Analyze CO4**
Module-5: Real Time Operating Systems		
Real Time Operating Systems: Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, Tasks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and	**8**	**Apply CO5**

Use,Defining Message Queue, States, Content, Storage, Operations and Use, Case studies of RTOS- Vx Works, Embedded Linux.		

Course Outcomes: After completing the course, the students will be able to	
22CSE1672.1	Understand the fundamental Concepts of Operating Systems to execute Shell Commands.
22CSE1672.2	Apply suitable techniques for management of different resources.
22CSE1672.3	Apply the concepts of deadlocks and concurrent process.
22CSE1672.4	Analyze the process of memory management.
22CSE1672.5	Apply the principles and characteristics of real time operating systems.

Text Books

1. Sumitabha Das., Unix Concepts and Applications., 4thEdition., Tata McGraw Hill.
2. Qing Li, "Real Time Concepts for Embedded Systems", 2011, Elsevier.

Reference Books

1.Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006
2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005
3. Unix System Programming Using C++ - Terrence Chan, PHI, 1999.
4. Rajkamal, "Embedded Systems- Architecture, Programming, and Design", 2007, TMH.
5. W. Richard Stevens, Stephan A. Rago, "Advanced UNIX Programming", 2006, 2nd Edition, Pearson.
6. Dr. Craig Hollabaugh, "Embedded Linux: Hardware, Software and Interfacing", 2008, 1st Edition, Pearson.

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Average of 2 Assignments for 10 marks each	10
	AAT	Presentation / Demonstration of mini project	10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Presentations,Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses

B. N. M .Institute of Technology

An Autonomous Institution under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Storage Area Networks		**Course Code: 22CSE1673**
L: T: P: J	**3: 0 : 0 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**40**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Define backup, recovery, disaster recovery, business continuity, and replication.
2	Examine emerging technologies including IP-SAN.
3	Understand logical and physical components of a storage infrastructure.
4	Identify components of managing and monitoring the data center.
5	Define information security and identify different storage virtualization technologies

Module-1:	**No. of Hours**	**BLL, CO**
Storage System: Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. **Data Center Environment:** Application Database Management System (DBMS), Disk Drive Components, Disk Drive Performance Direct-Attached Storage, Storage Design Based on Application.	**8**	**Understand CO1**
Module-2:		
Data Protection - RAID: RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison. **Intelligent Storage Systems:** Components of an Intelligent Storage System, Types of Intelligent Storage Systems**. Fibre Channel Storage Area Networks** - Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN.	**8**	**Understand CO2**
Module-3:		
Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance.	**8**	**Apply CO3**
Module-4:		
Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis. **Backup and Archive:** Backup Purpose, Backup Considerations, Backup and Restore Operations.	**8**	**Analyze CO4**
Module-5:		
Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica. **Remote Replication:** Modes of Remote Replication, Remote Replication Technologies.	**8**	**Analyze CO5**

Course Outcomes: After completing the course, the students will be able to

22CSE1673.1	Apply the knowledge of different storage Networking technologies and virtualization to identify key challenges in managing information.
22CSE1673.2	Apply the storage infrastructure and management activities of intelligent storage system and identify the Components of FC SAN.
22CSE1673.3	Analyze the knowledge of storage area network to key components and for implementation of Network Attached Storage.
22CSE1673.4	Analyze the concept of Storage Security Issues and the impact of storage architecture, types of archives and forms of virtualization.

22CSE1673.5	Analyze the information security and identify different storage virtualization technologies with business continuity, and replication.

Text Book:
1. EMC Education Services, Information Storage and Management, Wiley India Publications, 2009. ISBN: 9781118094839.
Reference Book:
1.Paul Massiglia, Richard Barker, Storage Area Networks Essentials: A Complete Guide to Understanding and Implementing SANs Paperback",1st Edition, Wiley India Publications,2008.

Marks Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Average of 2 Assignments for 10 marks each	10
	AAT	Presentation /Case Study	10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Case Study Report, Presentations, Short MOOC courses.

B. N. M. Institute of Technology

An Autonomous Institution under VTU

Dept. of Computer Science and Engineering

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

Semester: VI

Course Name: Information and Network Security **Course Code: 22CSE1674**

L: T: P: J	**3:0:0:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**3**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	To understand basics of Network Security.
2	To be able to learn about the process of securing secure a message over insecure channel part of computer networks by various means.
3	To learn about how to maintain the Confidentiality, Integrity and Availability of a data under transmission in computer networks.
4	To understand various protocols for network security to protect against the threats in the networks

Module-1: Introduction	**No. of Hours**	**BLL, CO**
Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, has algorithms. Secret Key Cryptography: Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES.	**8**	**Understand CO1**
Module-2: Hash Functions and Message Digests:		
Length of hash, uses, algorithms (MD2, MD4, MD5, SHS) MD2: Algorithm (Padding, checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.) SHS: Overview, padding, stages.	**8**	**Apply CO2**
Module-3: Public key Cryptography:		
Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures Authentication: Password Based, Address Based, Cryptographic, Authentication: Passwords in distributed systems, on-line vs offline guessing, storing. Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Interdomain, groups, delegation.	**8**	**Apply CO3**
Module-4: Security Policies and Security Handshake Pitfalls:		
What is security policy, high and low level policy, user issues? Protocol problems, assumptions, Shared secret protocols, public key protocols, mutual authentication, reflection attacks, use of timestamps, nonce and sequence numbers, session keys, one-and two-way public key based authentication	**8**	**Apply CO4**
Module-5: Example System:		
Kerberos: purpose, authentication server and ticket granting server, keys and tickets, use of AS and TGS, replicated servers, Network Security: Electronic mail security, IP security, Network management security. Security for electronic commerce: SSL, SET. System Security: Intruders and Viruses, Firewalls, Intrusion Detection	**8**	**Apply CO4**

22CSE1674.1	Identify the security issues in the network and resolve it.
22CSE1674.2	Apply hash functions to design and develop security solutions.
22CSE1674.3	Apply security mechanisms using rigorous approaches using public key ciphers.
22CSE1674.4	Identify security policies for authentication process.
22CSE1674.5	Identify network security protocols for IP security and its issues..

Text Books

1. 1. Atul Kahate, Cryptography and Network Security, McGraw Hill.
2. Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice Hall PTR., 2002.
3. Stallings, W.,.Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall PTR.,2003.

Reference Books

1. Stallings, W. Network security Essentials: Applications and standards, Prentice Hall, 2000.
2. Cryptography and Network Security; McGraw Hill; Behrouz A Forouzan.
3. Information Security Intelligence Cryptographic Principles and App. Calabrese Thomson. 7. Securing A Wireless Network Chris Hurley SPD

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Average of 2 Assignments for 10 marks each	10
	AAT	Presentation	10
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Presentations, Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses

Dept. of Computer Science and Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE)

Semester: 6

Course Name: Technology and Transformation
Course Code: 22CSE1675

L: T: P: J	**4 : 0 : 0 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**40**	**SEA Duration:** 03 Hours

Pre-Requisites:
Basic the concepts of IT Fundamentals.

Course Learning Objectives: The students will be able to

1	Learn the concepts of IT Fundamentals in different applications
2	Learn the concepts of RDBMS Using Oracle in diverse applications
3	Learn the concepts of Web responsive in diverse presentations
4	Learn the Programming Fundamentals Java in diverse applications
5	Learn the DevOps & Cloud Fundamentals in altered solicitations

Module-1: IT Fundamentals	**No. of Hours**	**Blooms Cognitive Levels with CO mapping**
. Topics include: Conditions, iterations and Arrays in a Pseudocode, features of Agile and its benefits, various tiers of an application, the difference between layered and tiered architecture and Object-Oriented Principles (OOP) - Abstraction, Encapsulation, Hierarchy, Polymorphism, Modularity, Typing and Persistence.	8	**Apply CO 1**
Module-2: RDBMS Using Oracle		
Topics include: Data is creation, organization, storage, to retrieve from a database and working with the Oracle database to perform various computations, and functions. RDBMS concepts Data definition, Data manipulation, select statements, Scalar & Aggregate functions, Joins and Subqueries, Views.	8	**Apply CO 2**
Module-3: Responsive Web Designing		
Topics include: web page with different layouts, styles with bootstrap, and perform validation, effects and animations and learn the Basics of web design fundamentals, HTML 5,CSS3, Bootstrap, JavaScript and jQuery.	8	**Analyse CO 3**
Module-4: Programming Fundamentals Java		
Topics include: You will be able to implement various object-oriented features and design and program stand-alone Java applications, and you will learn the basics of Java, Eclipse IDE, Classes and Objects, Array and Strings, Regular expression	8	**Analyse CO 4**
Module-5: DevOps & Cloud Fundamentals		

Topics include: You will understand the Cloud Computing Concepts and AWS Basics and will learn concepts like Intro to cloud, DevOps & GIT, Azure Fundamentals, AWS Cloud Practitioner, GCP Essentials	8	**Analyse CO 5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1675.1	Apply the concepts of IT Fundamentals in different applications.
22CSE1675.2	Apply the concepts of RDBMS Using Oracle in diverse applications.
22CSE1675.3	Apply the concepts of Web responsive in diverse presentations.
22CSE1675.4	Analyze the Programming Fundamentals Java in diverse applications.
22CSE1675.5	Analyze the DevOps & Cloud Fundamentals in altered solicitation.

Text Books
1. PwC learning platform - https://pwc.tekstac.com/login/index.php
Reference Books
1. The Java Programming Language, Ken Arnold, David Holmes, James Gosling, Prakash Goteti, 3rd Edition, Pearson 2. Java: The Complete Reference by Herbert Schildt, 9th Ed, 2017

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Micro certifications of PWC	10
	AAT	Java real time coder approach	10
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Presentations, Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses

B.N.M. Institute of Technology

An Autonomous Institution under VTU

For Internal Communication

Department of Computer Science & Engineering

VII SEMESTER

Scheme of Teaching for 2022-26 Batch

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week				Hours Per Week	Credits	Examination		
					Theory Lecture	Tutorial	Practical	Project					
					L	T	P	J			CIA	SEA	Total
1	PCI	22CSE171	Robotic Process Automation	CSE	2	-	2	-	4	3	50	50	100
2	PEC	22CSE172X	Professional Elective-3	CSE	2	-	2	-	4	3	50	50	100
3	PEC	22CSE173X	Professional Elective-4 (MOOC)	CSE	3	-	-	-	3	3	50	50	100
4	AEC	22CSE174	Research Methodology & IPR	CSE	2	1	-	-	3	2	50	50	100
5	PW	22CSE175	Project Work Phase – 1	CSE	-	-	-	8	8	4	100	-	100
TOTAL					**9**	**1**	**04**	**08**	**22**	**15**	**300**	**200**	**500**

Professional Elective - 3			
22CSE1721	Big Data Analytics	22CSE1724	Mobile Application Development
22CSE1722	Natural Language Processing	22CSE1725	Prompt Engineering
22CSE1723	Blockchain Technology	22CSE1726	Reinforcement Learning

Professional Elective - 4			
22CSE1731	Computer Architecture	22CSE1734	Machine Learning for Earth Systems
22CSE1732	Distributed Systems	22CSE1735	Design and Implementation of Human Computer Interface
22CSE1733	Ethical Hacking	22CSE1736	Artificial Intelligence for Ecomomics

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science and Engineering

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

Semester: VII

Course Name: Robotic Process Automation		**Course Code: 22CSE171**
L: T: P: J	**2:0:2:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Understand the purpose and benefits of Robotic Process Automation.
2	Learn the creation of process flows using RPA platforms.
3	Describe the various types of Sequence and Control flow.
4	Create software bots for automating tasks.
5	Apply the concepts of RPA for developing various application bots.

Module-1: Introduction to RPA	**No. of Hours**	**BLL, CO**
What is RPA, History of RPA, Scope and Benefits, Components of RPA, RPA Platforms- The future of automation, Record and Play, Downloading and installing UiPath Studio, Working with UiPath Studio, Task Recorder, Applications of RPA	**8**	**Understand CO1**

Sample Programs:

1. Program to Reversing a String

Module-2: Working with RPA Studio		
The User Interface, Variables - Managing Variables, Collections, Data Types, The Arguments Panel - Using Arguments -, Types of workflows/files, File operation with step-by-step example-CSV/Excel – Creating message boxes, Reading and writing data to applications.	**8**	**Apply CO2**

Sample Programs:

1. Creation of Message boxes and Assigning activities.

Module-3: RPA Workflows		
Sequencing the workflow Activities-Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation exercises.	**8**	**Apply CO3**

Sample Programs:

1. Programs using Control Flow statements – If – For – Whiles.

Module-4: Automation and Control		
Finding and attaching windows, Act on controls - mouse and keyboard activities - Performing automation tasks – Act on controls - mouse and keyboard activities, Exercises involving automating actions involving keyboard and mouse controls.	**8**	**Apply CO4**

Sample Programs:

1. Automating the Window Controls.
2. Automating Mouse and Keyboard controls.
3. Moving Files from Source to Destination.

Module-5: Advanced Automation Activities

Data Scrapping and Screen Scrapping, When to use OCR, Types of OCR available, How to use OCR, Scraping advanced techniques - Selectors - Defining and Assessing Selectors – Automation tasks with PDFs and Data tables – Web Scrapping and Extraction – Exercises involving OCR activity and Web scrapping.	**8**	**Apply CO5**
Sample Programs: 1. Web Scrapping. 2. Screen scrapping of Google Contacts. 3. Message Automation.		

Course Outcomes: After completing the course, the students will be able to	
22CSE171.1	Understand the basic concepts and platforms of RPA.
22CSE171.2	Experiment with RPA platforms and build activities.
22CSE171.3	Construct RPA workflows and perform data manipulation.
22CSE171.4	Apply various Screen control techniques to automate screen activities.
22CSE171.5	Build software bots to perform advanced automation tasks.

Textbooks

1. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems,2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher: A press
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940

Reference Books

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.

Marks Distribution for Assessment:

CIA	Component	Description	Marks
50	Test	Total Number of Test: 2 Each Theory test will be conducted for 30 Marks Average of 2 tests = 30 Marks	30
	Weekly Assignment	Lab Record	10
		Performance	5
		Viva	5
		Total Marks	**50**
SEA	**Component**	**Description**	**Marks**
50	Theory Exam	5 Questions to answer of 20 Marks (6M * 5= 30M) 2 Questions from each module with internal choice. Student should answer one full question from each module.	30
	Execution Part	Writeup – 20 Marks Conduction – 40 Marks Viva Voce – 10 Marks	70
		Total marks for the Course	**100**

B. E. COMMON TO ALL PROGRAMMES
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII (PE-PCI)

Subject : Big Data Analytics

Course Code	**22CSE1721**	CIE Marks	50
Teaching Hours/Week (L: T:P)	2:0:2	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Learning Objectives:

- Identify the core ideas of big data analytics.
- Examine the Hadoop framework and Hadoop Distributed File system
- Utilize the concepts of NoSQL using MongoDB for Big Data
- Apply MapReduce programming model to process the big data
- Create posters promoting machine learning algorithms for large, real-world data.

Module-1

Introduction to Big Data Analytics: Introduction, Big Data: Structured Data, Semi Structured Data, Unstructured Data; Definition of Big Data, Characteristics of Data, Challenges of Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Big Data Case study.

Practical:
Big Data Case study-Uber, Walmart, Netflix, etc.
Create Dashboard, Create Stories using Tableau.

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.

Practical:
Install, Configure and Run Hadoop and HDFS.
HDFS User Commands

- List Files in HDFS
- Make a Directory in HDFS
- Copy Files to HDFS
- Copy Files from HDFS
- Copy Files within HDFS
- Delete a File within HDFS
- Delete a Directory in HDFS
- Get an HDFS Status Report

Module-3

NoSQL Big Data Management, MongoDB : Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns ,MongoDB: Creating and Dropping database in MongoDB, MongoDB Query Language: Insert(), save(), update(), remove() and find() methods, Arrays, Aggregate Functions.

Practical:
Implement NoSQL Database Operations: Crud Operations, Arrays Using MongoDB.
Implement Functions: Count – Sort – Limit – Skip – Aggregate Using MongoDB**.**

Module-4

MapReduce and Hive: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution: Map Tasks, Key Value pair, Grouping by Key, Partitioning, Combiners, Reduce Tasks, Details of MapReduce processing steps, Coping with node Failures, Hive, HiveQL.

Practical:

Implement Word Count/ Frequency Programs Using Map Reduce.

Hive Commands: Data Definition Language (DDL) CREATE, DROP, TRUNCATE, ALTER, SHOW, DESCRIBE Statements.

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.

Practical:

Implement linear regression using Python.

To Implement Apriori algorithm in Python.

Implement an application that stores big data in MongoDB / using Hadoop / R.

Course Outcomes: After completing the course, the students will be able to	
22CSE1721.1	Understand the basic theories behind big data analytics.
22CSE1721.2	Examine Hadoop framework and Hadoop Distributed File system.
22CSE1721.3	Apply the concepts of NoSQL using MongoDB for Big Data.
22CSE1721.4	Apply the MapReduce programming model to process the big data along with Hadoop tools.
22CSE1721.5	Analyze machine learning algorithms for large, real-world data

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning	Raj Kamal and Preeti Saxena	McGraw Hill Education	2018
2	Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem	Douglas Eadline	Pearson Education	1st Edition ,2016
3	Hadoop: The Definitive Guide	Tom White	O"Reilly Media	4th Edition, 2015

Web links and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc20_cs92/preview
2. http://digimat.in/nptel/courses/video/106104189/L24.html

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	Total Number of Test: 3 Each Theory test will be conducted for 30 marks Average of 3 tests = 30 Marks (Scaled down to 15 marks)	15
	Lab Test		15
	Weekly Assessment		10
	Assignment / AAT		10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	5 Questions to answer, each of 20 marks. 2 Questions from each module with internal choice. Student should answer one full question from each module.	20*5=100 Scale down to **50**
		Total marks for the Course	**100**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU
Dept. of Computer Science and Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE)

VII (PE-PCI)

Course Name: NATURAL LANGUAGE PROCESSING **Course Code: 22CSE1722**

L: T: P: J	**2:0:2:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Learn the techniques in natural language processing.
2	Be familiar with the natural language generation
3	Be exposed to text mining
4	Understand the information retrieval techniques.

Module-1:	No. of Hours	BLL, CO
OVERVIEW AND LANGUAGE MODELING: Overview: Origins and challenges of NLP Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar-based Language Models-Statistical Language Model. **Sample Programs**: - 1. Implement N-Grams using Python NLTK. 2. Write a python program to remove stop words from English text using NLTK.	**8**	**L3 (Apply)**
Module-2:		
WORD LEVEL AND SYNTACTIC ANALYSIS: Word Level Analysis: Regular Expressions Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes, Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency- Parsing-Probabilistic Parsing, PCFG, CYK- parsing and Earley parsing algorithms. **Sample Programs**: - 1. Hands-on Stemming and Lemmatization Examples in Python with NLTK. 2. Develop a python program to generate Syntax tree for any English sentences using CYK parsing algorithm	**8**	**L3 Apply**
Module-3:		
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. **Sample Programs**: - 1. Implementing Dependency Parsing in Python **2.** Write a Python program to implement Semantic Role Labelling	**8**	**L4 Analyze**
Module-4:		
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions,	**8**	**L4 Analyze**

Results of Experiments. **Sample Programs**: - 1. Python program to illustrate with Latent Semantic Analysis		
Module-5:		
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: Word Net-Frame Net- Stemmers-POS Tagger- Research Corpora. **Sample Programs**: - 1. Develop a Python application for Information Retrieval	**8**	**L4 Analyze**

Course Outcomes: After completing the course, the students will be able to	
22 CSE1722.1	Identify the challenges of NLP and various grammar-based and Statistical-based language models
22 CSE1722.2	Develop syntactic parser using Context-free Grammar, Constituency-Parsing and Probabilistic-Parsing.
22 CSE1722.3	Discover the relations from word Sequences to dependency paths.
22 CSE1722.4	Examine Self-Explanations in Word Matching and Latent Semantic Analysis
22 CSE1722.5	Analyze Information Retrieval techniques.

Text Books
1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008. 2. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.
Reference Books
1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008. 2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995. 3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	Total Number of Test: 3 Each Theory test will be conducted for 30 marks Average of 3 tests = 30 Marks (Scaled down to 15 marks)	15
	Lab Test / Weekly Assessment		25
	Assignment / AAT		10
Total Marks			50
SEA (50)	Component	Description	Marks
	Written Exam	5 Questions to answer, each of 20 marks. 2 Questions from each module with internal choice. Student should answer one full question from each module.	20*5=100 Scale down to 50
		Total marks for the Course	**100**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU
Dept. of Computer Science and Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE)

Semester: VII

Course Name: Blockchain Technology **Course Code: 22CSE1723**

L: T: P: J	**2: 0 : 2: 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**40**	**SEA Duration:** 03 Hours

Pre-Requisites:
Basic the concepts of security Fundamentals.

Course Learning Objectives: The students will be able to

1	Learn the concepts of security Fundamentals in different applications
2	Learn the concepts of e-blockchain decentralization and cryptography concepts
3	Learn the concepts of the Bitcoin features and its alternative options.
4	Learn the Programming Fundamentals and deploy the smart contracts
5	Learn the blockchain features outside of currencies.

Module-1:	**No. of Hours**	**BLL, CO**
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, Benefits and limitations of blockchain	**8**	**Apply CO1**
Module-2:		
Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptographic primitives, Asymmetric cryptography, Public and private keys	**8**	**Apply CO 2**
Module-3:		
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, IOTA	**8**	**Analyse CO3**
Module-4:		
Smart Contracts and Ethereum: Smart Contracts: Definition, Ethereum; Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.	**8**	**Analyse CO4**
Module-5:		
Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media	**8**	**Analyse CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1723.1	Understand the types, benefits and limitation of blockchain.
22CSE1723.2	Explore the blockchain decentralization and cryptography concepts.
22CSE1723.3	Enumerate the Bitcoin features and its alternative options.
22CSE1723.4	Describe and deploy the smart contracts
22CSE1723.5	Summarize the blockchain features outside of currencies.

Text Books
1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017
Reference Books
1. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016 2. 2 Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017 3. 3 Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

Marks

Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	Total Number of Test: 3 Each Theory test will be conducted for 30 marks. Average of 3 tests = 30 Marks (Scaled down to 15 marks)	15
	Lab Test / Weekly Assessment		25
	Assignment / AAT		10
Total Marks			50
SEA (50)	Component	Description	Marks
	Written Exam	5 Questions to answer, each of 20 marks. 2 Questions from each module with internal choice. Student should answer one full question from each module.	20*5=100 Scale down to 50
		Total marks for the Course	100

B. N. M. Institute of Technology

An Autonomous Institute Under VTU
Dept. of Computer Science and Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE)

Semester : 7

Course Name: Mobile Application Development
Course Code: 22CSE1724

L: T: P: J	**2 : 0 : 2 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**40**	**SEA Duration:** 03 Hours

Pre-Requisites:
1. C programming Practice
2. Java programming Practice

Course Learning Objectives: The students will be able to

1	Learn to setup Android application development environment
2	Illustrate user interfaces for interacting with apps and triggering actions
3	Interpret tasks used in handling multiple activities
4	Identify options to save persistent application data
5	Appraise the role of security and performance in Android applications

Module-1:	**No. of Hours**	**Blooms cognitive Levels with CO mapping**
Get started, Build your first app, Activities, Testing, debugging and using support libraries Textbook 1: Lesson 1,2,3 RBT: L1, L2 *Lab Component :* Create an application to design a Visiting Card. The Visiting card should haves company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number.	**8**	**Apply CO 1**
Module-2:		
User Interaction, Delightful user experience, Testing your UI Textbook 1: Lesson 4,5,6 RBT: L1, L2 *Lab Component :* Develop an Android application using controls like Button, Text View, Edit Text for designing a calculator having basic functionality like Addition, Subtraction, Multiplication and Division.	**8**	**Apply CO2**
Module-3:		
Background Tasks, Triggering, scheduling and optimizing background tasks Textbook 1: Lesson 7,8 RBT: L1, L2 *Lab Component :* Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds.	**8**	**Apply CO3**
Module-4:		

All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders Textbook 1: Lesson 9,10,11,12 RBT: L1, L2 *Lab Component :* Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name.	**8**	**Apply CO4**
Module-5:		
Permissions, Performance and Security, Firebase, Publish. Textbook 1: Lesson 13,14,15 RBT: L1, L2 *Lab Component :* Create two files of XML and JSON type with values for City Name, Latitude, Longitude, Temperature, and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.	**8**	**Analyse CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE1724.1	Apply the steps involved in setting up Android development environment using Android studio.
22CSE1724.2	Develop application with multiple activities and delightful user interface
22CSE1724.3	Build user interfaces for interacting with apps and triggering actions
22CSE1724.4	Apply the methods in storing, sharing and retrieving data in Android applications
22CSE1724.5	Analyze performance of android applications and understand the role of permissions and security

Text Books
1. Google Developer Training, "Android Developer Fundamentals Course Google Developer Training Team, 2017.
Reference Books
1. Erik Hellman, “Android Programming – Pushing the Limits”, 1st Edition, Wiley India Pvt Ltd, 2014.

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	Total Number of Test: 3 Each Theory test will be conducted for 30 marks Average of 3 tests = 30 Marks (Scaled down to 15 marks)	15
	Lab Test / Weekly Assessment		25
	Assignment / AAT		10
Total Marks			**50**
SEA	**Component**	**Description**	**Marks**

(50)	Written Exam	5 Questions to answer, each of 20 marks. 2 Questions from each module with internal choice. Student should answer one full question from each module.	20*5=100 Scale down to **50**
		Total marks for the Course	**100**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science & Engineering

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

Semester: VII

Course Name: Prompt Engineering		**Course Code: 22CSE1725**
L: T: P: J	**2:0:2:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4 (40)**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Gather prompt engineering requirements
2	Identify prompt engineering techniques
3	Design prompt engineering models
4	Illustrate potential risks and misuse of prompt engineering
5	Explore different applications and tools within the field of prompt engineering.

Module-1: Mastering Prompts: Foundations, Formatting, Elements, and Effective Design	**No. of Hours**	**BLL, CO**
Basics of Prompting Prompt Formatting, Prompt Elements, General Tips for Designing Prompts: The Instruction, Specificity, Avoiding Impreciseness. - Examples of Prompts: Text Summarization, Information Extraction, Question Answering, Text Classification, Conversation, Code Generation.	**8**	**Understand CO1**
Module-2: Advanced Prompting Strategies - 1		
Zero-Shot Prompting, Few-Shot Prompting, Chain-of-Thought Prompting, Self-Consistency,Generate Knowledge Prompting, Tree of Thoughts (ToT), Retrieval Augmented Generation (RAG), Automatic Reasoning and Tool-use (ART), Automatic Prompt Engineer, Active-Prompt, Directional Stimulus Prompting, ReAct Prompting, Multimodal CoT Prompting, Graph Prompting.	**8**	**Apply CO2**
Module-3: Advanced Language Models: FLAN, ChatGPT, LLaMA, and GPT-4		
Fine-tuned LAnguage Net (FLAN), ChatGPT: Introduction, Reviewing the Conversation Task, Multi-turn Conversations, Single-turn tasks. - Large Language Model Meta AI (LLaMA), GPT-4: Introduction, Vision Capabilities, Steering GPT-4, Limitations. - Model Collection.	**8**	**Analyse CO3**
Module-4: Adversarial Prompting: Challenges, Strategies, and Ethical Considerations in AI		
Adversarial Prompting: Prompt Injection, Prompt Leaking, Jail breaking, Illegal Behavior, Do Anything Now(DAN), The Waluigi effect, Defense Tactics, Add Defense in the Instruction, Parameterizing Prompt Components, Quotes and Additional Formatting, Adversarial Prompt Detector. - Factuality, Biases: Distribution of Exemplars, Order of Exemplars.	**8**	**Evaluate CO4**
Module-5: Development with Program-Aided Language Models and		

AI-Powered Tools		
Program-Aided Language Models, Generating Data, Generating Code, Turn Comments into Code, Complete Functions, MySQL Query Generation, Explain Code, Editing Code, Debugging Code. Tools: AI Test Kitchen, ChatGPT Prompt Generator, DreamStudio, OpenAI Playground, Visual Prompt Builder.	**8**	**Create CO5**

CO-PO/PSO Mapping:

CO No.	Statement	Bloom's Cognitive Levels	POs/PSOs
22CSE1725.1	Understand the fundamentals of prompt design, including formatting, elements, and effective prompt construction for AI models.	Understanding	1,2,3,4,5,6/2
22CSE1725.2	Apply prompt optimization strategies for improving the accuracy and efficiency of AI systems.	Applying	1,2,3,4,5,6/2
22CSE1725.3	Analyse and implement advanced language models to perform multi-turn and single-turn tasks	Analyzing	1,2,3,4,5,6/2
22CSE1725.4	Evaluate and address adversarial prompting challenges and ethical considerations in AI, such as biases, prompt injection, and factuality	Evaluating	1,2,3,4,5,6,8, 10,12/2
22CSE1725.5	Design AI-driven solutions using program-aided language models for generating code, debugging, and developing data-driven applications.	Creating	1,2,3,4,5,6,7, 8,9,10,12/2
22CSE1725.6	Collaborate effectively in teams to create and optimize prompts and solutions that address real-world challenges in AI-driven applications	Creating	1,2,3,4,5,6,8, 10,12/2

Text Books:

1. The Art of Prompt Engineering with Chatgpt: A Hands-On Guide, Nathan Hunter, 2023

Reference Books

1. Prompt Engineering for Generative AI, James Phoenix, Mike Taylor, ISBN: 9781098153373, O'ReillyMedia, Inc., 2023
2. Prompt Engineering, Padmaraj Nidagundi, https://www.amazon.com/dp/B0BLR6T2MT, 2022

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	Total Number of Test: 3 Each Theory test will be conducted for 30 marks Average of 3 tests = 30 Marks (Scaled down to 15 marks)	15
	Lab Test / Weekly Assessment		25
	Assignment / AAT		10
Total Marks			**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	5 Questions to answer, each of 20 marks. 2 Questions from each module with internal choice. Student should answer one full question from each module.	20*5=100 Scale down to **50**
		Total marks for the Course	**100**

B. N. M. Institute of Technology

An Autonomous Institute Under VTU

Dept. of Computer Science & Engineering

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

Semester: VII

Course Name: Reinforcement Learning **Course Code: 22CSE1726**

L:T:P:J	**2:0:2:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03Hours

Course Learning Objectives: The students will be able to

1	Explore a computational approach to learn from the environment
2	Understand fundamental concepts in reinforcement learning, the different types of environments, the different types of reinforcement learning algorithms, and ways to chose.
3	Understand the finite Markov decision process.
4	Apply different basic reinforcement learning algorithms

Module 1	**No. of Hours**	**BLL, CO**
Introduction Introduction: Reinforcement Learning, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example- Tic-Tac-Toe.	**8**	**Understand CO1**
Module 2		
Multi-arm Bandits n-Armed Bandit Problem, Action Value Methods, Evaluation vs. Instruction, Incremental Implementation, Tracking non-stationary problems, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandits, Associative Search (Contextual Bandits).	**8**	**Apply CO2**
Module 3		
Finite Markov Decision Processes The Agent–Environment Interface, Goals and Rewards, Returns and Episodes , Unified Notation for Episodic and Continuing Tasks, Policies and Value Functions, Optimal Policies and Optimal Value Functions, Optimality and Approximation.	**8**	**Apply CO3**
Module 4		
Dynamic Programming Policy Evaluation, Policy improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming.	**8**	**Analyze CO4**
Module 5		
Monte Carlo Methods Monte Carlo Policy Evaluation, Estimation of Action Values, Monte Carlo Control, Incremental Implementations Temporal-Difference Learning: TD Prediction, Advantages of TD Prediction Methods, Optimality of TD	**8**	**Analyze CO4**

Course Outcomes : After completing the course, the students will be able to	
22CSE1726.1	Understand the basics of reinforcement learning. Its elements and limitations.
22CSE1726.2	Apply reinforcement learning methods to achieve an objective with an intelligent reinforcement learning agent.
22CSE1726.3	Apply finite Markov decision process to judge the suitability of a reinforcement learning paradigm for a given problem
22CSE1726.4	Analyze dynamic programming, temporal difference and Monte Carlo Methods

Reference Books
1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning:An Introduction, MIT Press, 2018. 2. Sudharsan Ravichandiran, Hand-on Reinforcement Learning with Python, Packt Publications, 2018. 3. Sayon Dutta, Reinforcement Learning with Tensor Flow: A beginner's guide, Packt Publications, 2018.

Marks Distribution for Assessment:

CIA (50)	Component	Description	Marks
	Written Test	Total Number of Test: 3 Each Theory test will be conducted for 30 marks Average of 3 tests = 30 Marks (Scaled down to 15 marks)	15
	Lab Test / Weekly Assessment		25
	Assignment / AAT		10
Total Marks			50
SEA (50)	Component	Description	Marks
	Written Exam	5 Questions to answer, each of 20 marks. 2 Questions from each module with internal choice. Student should answer one full question from each module.	20*5=100 Scale down to 50
		Total marks for the Course	**100**

BNM Institute of Technology

An Autonomous Institute Under VTU
Dept. of Computer Science and Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE)

Semester: VII

Course Name: Research Methodology and IPR **Course Code:** 22CSE174

L: T: P: J	**2 :0:0 : 0**	**CIA Marks:** 50
Credits:	**2**	**SEA Marks:** 50
Hours/Week (Total)	**2**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	To give an overview of the research methodology and explain the technique of defining a research problem
2	To explain the functions of literature review, carry out literature search and develop conceptual frameworks
3	To explain various experimental designs in research and data handling like data sampling and data collection methods
4	To interpret the research findings and prepare a research report
5	To build awareness on the various forms of IPR and to build the perspectives on the concepts and to develop the linkages in technology innovation and IPR.

Module-1: Introduction	**No. of Hours**	**Blooms Cognitive Levels with CO mapping**
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research Process, Criteria of Good Research Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.	**5**	**Understand CO1**
Module-2:		
Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, How to review the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, Developing a conceptual framework, writing about the literature reviewed. Research Design: Meaning of Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs.	**5**	**Apply CO2**
Module-3:		
Design of Sampling: Introduction, Sample Design, Sampling and Non- sampling Errors, Types of Sampling Designs. Data Collection: Qualitative and Quantitative Data, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection. Testing of Hypotheses: Hypothesis, Basic Concepts concerning Testing of Hypotheses, Procedure for Hypothesis Testing, P-Value approach, Limitations of the Tests of Hypothesis.	**5**	**Apply CO3**
Module-4:		
Interpretation: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation. Report Writing: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. Various templates for report and paper writing	**5**	**Analyze CO4**
Module-5:		

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied, Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, Copyright Act,1957, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property, Organisation (WIPO), WIPO and WTO, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Introduction to Patents and Copyrights. Case study on company IPR.	**5**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22CSE174.1	Understand and define research problem
22CSE174.2	Explain and carry out literature review based on the research problem
22CSE174.3	Apply sampling and data collection techniques and carry out parametric tests of Hypothesis for the research problem. Interpret the research findings and create a report
22CSE174.4	Interpret the research findings and create a report
22CSE174.5	Explain various forms of IPR and develop the linkages in technology innovation and IPR

Text Books

1. C.R. Kothari, Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International 4 th Edition, 2018.
2. Ranjit Kumar, "Research Methodology a step-by-step guide for beginners" (For the topic Reviewing the literature under module 2), SAGE Publications 3 rd Edition, 2011.
3. Firuza Karmali (Aibara), " A Short Introduction to LaTeX: A Book for Beginners", Create space Independent Publishing Platform, 2019.
4. Trochim, "Research Methods: the concise knowledge base", Atomic Dog Publishing 2005. 5. Fink A, "Conducting Research Literature Reviews: From the Internet to Paper", Sage Publications 2009.

Ma rks Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Review Paper Writing	10
	AAT	Case Study	10
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students must answer 5 full questions	**50**
		Total marks for the Course	**100**

B.N.M. Institute of Technology

An Autonomous Institution under VTU

For Internal Communication

Department of Computer Science & Engineering

VIII SEMESTER

Scheme of Teaching for 2022-26 Batch

Sl. No	Course and Course code		Course Title	Teaching Department	Contact Hours /Week					Credits	Examination		
					Theory Lecture	Tutorial	Practical	Project	Hours Per Week				
					L	T	P	J			CIA	SEA	Total
1	PEC	22CSE181X	Professional Elective - 5	CSE	3	-	-	-	3	03	50	50	100
2	INT	22CSE182	Internship-3	CSE	-	-	8	-	8	04	50	50	100
3	PW	22CSE183	Project Work Phase-2	CSE	-	-	-	20	20	10	50	50	100
TOTAL					**03**	**-**	**8**	**20**	**31**	**17**	**150**	**150**	**300**

Professional Elective - 5 (PCC)			
22CSE1811	Advanced Computer Arcitecture	22CSE1814	Games and Information
22CSE1812	Privacy and Security in Online Social Media	22CSE1815	Business Intellengence and Analysis
22CSE1813	Parallel Computer Architectre	22CSE1816	NPTEL- CSE Offered cources relating to our scheme

B N M Institute of Technology

An Autonomous Institution under VTU
Department of Computer Science and Engineering

Advanced Computer Architecture 22CSE1811

About the course:
This course is on Advanced Computer Architecture. It will introduce students to advanced aspects of processor design and will specifically focus on out-of-order pipelines, GPUs, and compiler techniques for enhancing ILP. The course will subsequently move on to cache design and main memory technologies such as DDR-4. A substantial portion of the course will be devoted to the theory of on-chip networks and memory models. The last part of the course will cover aspects of low-power design, hardware security, and reliability.

Course layout

Week-1:In-order pipelines overview
Week-2:Out-of-order pipelines, Branch prediction
Week-3:Advanced branch prediction techniques
Week-4:Issue, select, and commit
Week-5: Aggressive speculation
Week-6:Compiler techniques for enhancing ILP
Week-7:Caches: Design, modeling, and optimizations
Week-8:On-chip networks
Week-9: Theory of memory models
Week-10:Coherence Protocols
Week-11:Low power design
Week-12:Reliability and Hardware Security

Books and references

- Advanced Computer Architecture, Smruti R. Sarangi, McGrawHill 2021

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Parallel Computer Architecture 22CSE1813

ABOUT THE COURSE:

With the emergence of application domains requiring large data processing as well as faster compute performance, parallel computing has become a critical component. This involves the use of multi-core processors as well as tightly integrated clusters of PCs and workstations. The most exciting development is the convergence of traditionally disparate approaches of shared memory, message passing, and data driven computing onto the same platform.
As the parallel applications communicate with each other using shared data; it is important to correctly manage the shared data within the memory hierarchy to avoid inconsistency. Here, we need to understand the mechanisms used for data access, communication and coordination of work and its correct implementation.
This course will introduce the field of parallel architectures and discuss in-depth shared memory management for parallel architectures. We will also learn about the interconnection topologies and routing methods which are important for connection and communication of the multiple cores executing the parallel applications. The course will conclude with an overview of various parallel architectures and on-going research directions.

Course layout
Week 1 : Introduction to Parallel Architectures
Week 2 : Parallel Programming models and Architectures
Week 3 : Memory Hierarchy-Cache and Virtual memory
Week 4 : Overview of Cache coherence, Coherence Protocols- Snooping, Directory based protocols, VI protocol
Week 5 : MSI, MESI, Dragon protocol and Correctness of coherence protocols- Types of cache misses, update vs invalidate protocol
Week 6 : Snoop based muliprocessor design, Single and multi-level cache with atomic bus
Week 7 : Snoop based muliprocessor design, Single and multi-level cache with split transaction bus
Week 8 : Scalable shared memory systems: Directory coherence protocols- Memory based, cache based, correctness
Week 9 : Case study: Origin- Architecture, protocol, correctness; Sequent NUMA Q- Architecture, protocol, correctness
Week 10 : Memory consistency models- Sequential, Relaxed consistency models
Week 11 : Synchronization- LL-SC, point to point, barrier synchronization
Week 12 : Interconnects- Introduction, Topologies, routing, flow control

Books and references
1. D. E. Culler and J. P. Singh with A. Gupta. Parallel Computer Architecture. Morgan- Kaufmann publishers.
2. J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach. Morgan-Kaufmann publishers.
3. M. Dubois, M. Annavaram, Per Stenstrom. Parallel Computer Organisation and Design. Cambridge University Press

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Games and Information 22CSE1814

ABOUT THE COURSE:

This is an advanced course in game theory, with a particular emphasis on the role of information. We begin with static games and cover the basic notations there. About 65% of the course concerns dynamic games where we introduce information structures, role of information structure on equilibria, Bayesian games and information asymmetry. We then cover the basic concepts of mechanism design. We do a quick overview of signaling and screening, and introduce information design. As a final topic we do a study of pre-play communication – achievable payoffs and correlated equilibria. We finally end with a few applications of game theory in finance.

Course layout

Week 1: Outline of the course, Definition of a game, Nash equilibrium, Examples of Nash equilibrium, Weakly dominated strategies.
Week 2: Strictly dominated strategies, Aumann model of incomplete information, Knowledge operator, Common knowledge, Structure theorem of common knowledge.
Week 3: Dynamic games, Information structures, Commitment, Mixed and Behavioral strategies, Kuhn's theorem, Bayesian games, Bayesian Nash equilibrium. Mechanism design(ContdProof of the structure theorem of common knowledge, Aumann model of incomplete information with belief, Aumann's agreement theorem, Zero-sum game definition, Security strategies, Saddle point strategies.
Week 4: Further properties of saddle point strategies, Mixed strategies, Existence of mixed saddle point strategies, Von-Nuenmann minmax theorem.
Week 5: Computation of mixed saddle point strategies for various matrix games, Existence of nash equilibrium for non zero-sum game via Kakutani fixed point theorem
Week 6: Existence of Nash equilibrium for infinite strategy space via Brower's fixed point theorem, Quantal response: definition and examples, Dynamic game definition, solution concept, Standard normal form of a dynamic game, Threat equilibrium.
Week 7: Extensive Form Game, Single Acts Games, Informationally Inferior Games
Week 8: Information Structure in Single Act Games, Nested and Ladder Nested Extensive, Equilibrium Algorithm Lecture, Stagewise Multi-Act Game, Feedback Nash Equilibrium, Stagewise Multi-Act Game, Feedback Nash Equilibrium
Week 9: Mixed & Behavioral Strategies, Conditions for Equivalence of Mixed & Behavioral Strategies, Kuhn's Theorem, Equivalence of Mixed and Behavioral Strategies
Week 10: Games of Incomplete Information, Bayesian Nash Equilibrium, Self-enforcement of Nash Equilibrium, Stackelberg game
Week 11: Principal-Agent Models, Moral Hazard and Adverse Selection, Games with Contracts
Week 12: Correlated Equilibrium, Bayesian Game with Mediated Communication, Revelation Principle, Bayesian Nash Equilibrium

Books and references

R. Myerson, "Game theory: Analysis of Conflict", Harvard University Press, 2013;
D Fudenberg and J. Tirole, "Game Theory", Cambridge University Press, 1991
M. Maschler, E. Solan and S. Zamir, "Game Theory", Cambridge University Press, 2020
E. Rasmusen. Games and Information: An Introduction to Game Theory. Wiley-Blackwell, 2006

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Business Intelligence and Analysis 22CSE1815

ABOUT THE COURSE:
This course equips students with necessary knowledge and skills on the thought process, modelling approaches and tools required to use data from the enterprise databases and other sources for business decisions. In turn, the course prepares participants for a career in data science, business analytics and market research. This course will introduce the context of data mining, and cover important modelling techniques such as regression, decision trees, clustering, ANN and text mining.

Course layout
Week 1: Introduction to Business Intelligence & Analytics (BIA), drivers of BIA, types of analytics: descriptive to prescriptive, vocabulary of business analytics, course plan and resources
Books to refer : Text 1: Han et al. (2023) Chapter 1, Introduction
Week 2: Technical architecture of BIA, case analysis of AT&T Long distance, fundamentals of data management, OnLine Transaction Processing (OLTP), design process of databases
Books to refer : Text 1: Han et al. (2023), Chapter 3, Data Warehouse and Online Analytical Processing (pp. 85–108).
Week 3: Relational databases, normalisation, SQL queries, ShopSense case of management questions, data warehousing, OnLine Analytical Processing (OLAP), data cube
Books to refer : Tutorial: SQL tutorial on MySQL (https://www.mysqltutorial.org)
Week 4: Descriptive analytics, and visualization, customer analytics, survival analysis, customer lifetime value, case study
Books to refer :
a. Knowing When to Worry: Using Survival Analysis to Understand Customers: https://learning.oreilly.com/library/view/data-mining-techniques/9780470650936/9780470650936c 10.xhtml#c10_level1_1

b. Customer Lifetime Value (CLV): A Critical Metric for Building Strong Customer Relationships,

https://www.gartner.com/en/digital-markets/insights/what-is-customer-lifetime-value

Week 5: Data mining process, introduction to statistical learning, data pre-processing, data quality, overview of data mining techniques, case study using regression analysis
Books to refer :
a. Text 2: James et al. (2013) Chapter 1, Statistical learning, ISL
b. Text 2: James et al. (2013) Chapter 2, Linear regression, ISL
Week 6: Introduction to classification, classification techniques, scoring models, classifier performance, ROC and PR curves
Books to refer : Text 1: Han et al. (2023) Chapter 6, Classification: Basic concepts and methods
Week 7: Introduction to decision trees, tree induction, measures of purity, tree algorithms, pruning, ensemble methods
Books to refer : Text 2: James et al. (2013) Chapter 8, Tree- based models

Week 8: Tree implementation in Python: problem of targeted mailing
Books to refer :
a. https://scikit-learn.org/stable/modules/model_evaluation.html#roc-metrics
b. https://scikit-learn.org/stable/visualizations.html
Week 9: Cluster analysis, measures of distance, clustering algorithms, K-means and other techniques,
cluster quality
Books to refer : Text 2: James et al. (2013) Chapter 10, Unsupervised learning (pp. 385-400)
Week 10: A store segmentation case study using clustering, implementation in Python, profiling clusters, cluster interpretation and actionable insights, RFM sub- segmentation for customer loyalty
Books to refer : What Is Recency, Frequency, Monetary Value (RFM) in Marketing?: https://www.investopedia.com/terms/r/rfm-recency-frequency-monetary-value.asp
Week 11: Machine learning, Artificial Neural Networks (ANN), topology and training algorithms, back propagation, financial time series modelling using ANN, implementation in Python
Books to refer : Kaastra & Boyd (1996) Designing a neural network for forecasting financial and economic time series, JNC:
https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=bcbb8ca9d6a6ce6017710ebf6143da76b6edf98b
Week 12: Text mining, process, key concepts, sentiment scoring, text mining using R-the case of a movie discussion forum, summary
Books to refer : Silge and Robinson, Text Mining with R, A Tidy Approach: O'reilly: www.tidytextmining.com/index.html

Books and references

Text 1: Han, J., Pei, J. & Tong H. (2023). Data Mining Concepts and Techniques, 4th ed, New Delhi: Elsevier.
Text 2: James, G., Witten, D., Hastie, T. and Tibshirani,R. (2013) An Introduction to Statistical Learning with Applications in R, Springer: NY

Data sources

- "Adventure Works Cycles", SQL Server sample database
- "Retail Sense transaction data", real life data of a fashion retailer
- UCI Machine Learning Repository, http://archive.ics.uci.edu/ml/
- Financial/capital market data: Yahoo! Finance
- Text data: www.twitter.com
- ISL resources: http://www-bcf.usc.edu/~gareth/isl/
- Kaggle: www.kaggle.com