MVJCE CURRICULUM

for

Department of Information Science and Engineering

(2022 Scheme)

3rd semester to 7th semester syllabus

III Semester

Mathematics for Computer Science		Semester	3
Course Code	MVJ22CS31/AI31/CG31/IS31/DS31	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	30 hours Theory + 10 Hours Tutorial	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	**Theory**		

Course objectives: This course will enable the students to:

1. To introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
2. To Provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.
3. To Determine whether an input has a statistically significant effect on the system's response through ANOVA testing.

Teaching-Learning Process

Pedagogy (General Instructions):

Teachers can use the following strategies to accelerate the attainment of the various course outcomes.

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

Module-1: Probability Distributions

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. Exponential distribution. **(12 Hours)**

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem-based learning

Module-2: Joint probability distribution & Markov Chain

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. **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. **(12 Hours)** **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem-based learning
Module-3: Statistical Inference 1	
Introduction, sampling distribution, standard error, testing of hypothesis, levels of significance, test of significance, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples. **(12 Hours)** **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem-based learning
Module-4: Statistical Inference 2	
Sampling variables, central limit theorem and confidences limit for unknown mean. Test of Significance for means of two small samples, students 't' distribution, Chi-square distribution as a test of goodness of fit. F-Distribution. **(12 Hours)** **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem-based learning
Module-5: Design of Experiments & ANOVA	
Principles of experimentation in design, Analysis of completely randomized design, randomized block design. The ANOVA Technique, Basic Principle of ANOVA, One-way ANOVA, Two-way ANOVA, Latin-square Design, and Analysis of Co-Variance. **(12 Hours)** **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem-based learning

Test component, there are 25 marks.

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Textbooks:

1. **Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye** "Probability &Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
2. **Peter Bruce, Andrew Bruce & Peter Gedeck** "Practical Statistics for DataScientists" O'Reilly Media, Inc., 2nd edition **2020**.

Reference Books: (Name of the author/Title of the Book/ Name of the publisher/Edition andYear)

1. **Erwin Kreyszig**, "Advanced Engineering Mathematics", John Wiley & Sons,9th Edition, 2006.
2. **B. S. Grewal** "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
3. **G Haribaskaran** "Probability, Queuing Theory & Reliability Engineering", LaxmiPublication, Latest Edition, 2006
4. **Irwin Miller & Marylees Miller,** John E. Freund's "Mathematical Statistics withApplications" Pearson. Dorling Kindersley Pvt. Ltd. India, 8th edition, 2014.
5. **S C Gupta and V K Kapoor**, "Fundamentals of Mathematical Statistics", S Chand andCompany, Latest edition.
6. **Robert V. Hogg, Joseph W. McKean & Allen T. Craig**. "Introduction to Mathematical Statistics", Pearson Education 7th edition, 2013.
7. **Jim Pitman**. Probability, Springer-Verlag, 1993.
8. **Sheldon M. Ross,** "Introduction to Probability Models" 11th edition. Elsevier, 2014.
9. **A. M. Yaglom and I. M. Yaglom**, "Probability and Information". D.
10. Reidel PublishingCompany. Distributed by Hindustan Publishing

Corporation (India) Delhi, 1983.
11. P. G. Hoel, S. C. Port and C. J. Stone, “Introduction to Probability Theory”, Universal Book Stall, (Reprint), 2003.
12. S. Ross, “A First Course in Probability”, Pearson Education India, 6th Ed., 2002.
13. W. Feller, “An Introduction to Probability Theory and its Applications”, Vol. 1, Wiley, 3rd Ed.,
14. N.P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
15. Veerarajan T, Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010

Web links and Video Lectures (e-Resources):

http://nptel.ac.in/courses.php?disciplineID=111
http://www.class-central.com/subject/math(MOOCs)
http://academicearth.org/
http://www.bookstreet.in.
VTU EDUSAT PROGRAMME – 20
VTU e-Shikshana Program

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

- Programming Assignment
- Seminars

CO-PO/PSO Mapping																
CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	OPERATINGSYSTEMS	Semester	3
Course Code	MVJ22CS32/AI32/CG32/IS32/DS32	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 20 hours practical	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	**Theory**		

Course objectives:

- To Demonstrate the need for OS and different types of OS
- To discuss suitable techniques for management of different resources
- To demonstrate different APIs/Commands related to processor, memory, storage and file system management.

Teaching-Learning Process (General Instructions)

Teachers can use the following strategies to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
5. Role play for process scheduling.
6. Demonstrate the installation of any one Linux OS on VMware/Virtual Box

MODULE-1 **8 Hours**

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

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

Textbook 1: Chapter – 1 (1.1-1.12), 2 (2.2-2.11)

MODULE-2 **8 Hours**

Process Management: Process concept; Process scheduling; Operations on processes; Inter process communication

Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues.

Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling; Multiple-processor scheduling,

Textbook 1: Chapter – 3 (3.1-3.4), 4 (4.1-4.4), 5 (5.1 -5.5)

MODULE-3 **8 Hours**

Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization;

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

Textbook 1: Chapter – 6 (6.1-6.6), 7 (7.1 -7.7)

MODULE-4 **8 Hours**

Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

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

Textbook 1: Chapter -8 (8.1-8.6), 9 (9.1-9.6)

MODULE-5 **8 Hours**

File System, Implementation of File System: File system: File concept; Access methods; Directory and Disk structure; File system mounting; File sharing; **Implementing File system:** File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

Secondary Storage Structure, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; **Protection**: Goals of protection, Principles of protection, Domain of protection, Access matrix.

Textbook 1: Chapter – 10 (10.1-10.5) ,11 (11.1-11.5),12 (12.1-12.5), 14 (14.1-14.4)

PRACTICAL COMPONENT OF IPCC*(May cover all / major modules)*

Sl.NO	Experiments
1	Develop a c program to implement the Process system calls (fork (), exec(), wait(), create process, terminate process)
2	Simulate the following CPU scheduling algorithms to find turnaround time and waiting time a) FCFS b) SJF c) Round Robin d) Priority.
3	Develop a C program to simulate producer-consumer problem using semaphores.
4	Develop a C program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
5	Develop a C program to simulate Bankers Algorithm for DeadLock Avoidance.
6	Develop a C program to simulate the following contiguous memory allocation Techniques: a) Worst fit b) Best fit c) First fit.
7	Develop a C program to simulate page replacement algorithms: a) FIFO b) LRU
8	Simulate following File Organization Techniques a) Single level directory b) Two level directory

9	Develop a C program to simulate the Linked file allocation strategies.
10	Develop a C program to simulate SCAN disk scheduling algorithm.

11	Debug a given C program
	//Moving Disk head to the inner most requested cylinder because this is Circular LOOK.
	queue[i]=queue2[0];
	
	//Copying second array queue2[] after that first one is copied, into queue []
	for(i=temp1+1,j=0;j<temp2;i++,j++)
	{
	queue[i]=queue2[j];
	}
	
	//At this point, we have the queue[] with the requests in the
	//correct order of execution as per C-LOOK algorithm.
	//Now we have to set 0th index of queue[] to be the initial headposition.
	queue[0]=headposition;
	
	// Calculating SEEK TIME. seek is initially set to 0 in the declaration part.
	
	for(j=0; j<n; j++) //Loop starts from headposition. (ie. 0th index of queue)
	{
	// Finding the difference between next position and current position.
	difference = absoluteValue(queue[j+1]-queue[j]);
	
	// Adding difference to the current seek time value
	seek = seek + difference;
	
	// Displaying a message to show the movement of disk head
	printf("Disk head moves from position %d to %d with Seek %d \n",
	queue[j], queue[j+1], difference);
	}

Course outcomes (Course Skill Set):

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

CO 1. Explain the structure and functionality of operating system

CO 2. Apply appropriate CPU scheduling algorithms for the given problem.

CO 3. Analyse the various techniques for process synchronization and deadlock handling.

CO 4. Apply the various techniques for memory management

CO 5. Explain file and secondary storage management strategies.

CO 6. Describe the need for information protection mechanisms

Assessment Details (both CIE and SEE)

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

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

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

CIE for the practical component of the IPCC

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

SEE for IPCC

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

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

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a

- **CIE component only. Questions mentioned in the SEE paper may include questions from the practicalcomponent**.

Suggested Learning Resources:

Textbooks

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2015

Reference Books

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

Web links and Video Lectures (e-Resources):

1. https://youtu.be/mXw9ruZaxzQ
2. https://youtu.be/vBURTt97EkA
3. https://www.youtube.com/watch?v=783KAB-tuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_
4. https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeRn6mkO

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

- Assessment Methods
  - Case Study on Unix Based Systems (10 Marks)

Lab Assessment (25 Marks)

CO-PO/PSO Mapping																
CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Digital Design and Computer Organization		Semester	3
Course Code	MVJ22CS33/AI33/CG33/IS33/DS33	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40 hours	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- To demonstrate the functionalities of binary logic system
- To explain the working of combinational and sequential logic system
- To realize the basic structure of computer system
- To illustrate the working of I/O operations and processing unit

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and Talk
2. Live Demo with experiments
3. Power point presentation

MODULE-1 **8 Hr**

Introduction to Digital Design: Binary Logic, Basic Theorems And Properties Of Boolean Algebra, Boolean Functions, Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Other Hardware Description Language – Verilog Model of a simple circuit.

Text book 1: 1.9, 2.4, 2.5, 2.8, 3.1, 3.2, 3.3, 3.5, 3.6, 3.9

MODULE-2 **8 Hr**

Combinational Logic: Introduction, Combinational Circuits, Design Procedure, Binary Adder- Subtractor, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits – Adder, Multiplexer, Encoder. **Sequential Logic**: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops.

Text book 1: 4.1, 4.2, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 5.3, 5.4.

MODULE-3 **8 Hr**

Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.**Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes.

Text book 2: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5

MODULE-4 **8 Hr**

Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions.

Text book 2: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.1

MODULE-5 **8 Hr**

Basic Processing Unit: Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. **Pipelining:** Basic concepts, Role of Cache memory, Pipeline Performance.

Text book 2: 7.1, 7.2, 8.1

Assessment Details (both CIE and SEE)

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

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

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

SEE for PCC

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

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

The theory portion of the PCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only.

Suggested Learning Resources:

Books

1. M. Morris Mano & Michael D. Ciletti, Digital Design With an Introduction to Verilog Design, 5e, Pearson Education.

2. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill.

Web links and Video Lectures (e-Resources):

https://cse11-iiith.vlabs.ac.in/

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

Assign the group task to Design the various types of counters and display the output accordingly

Assessment Methods

- Lab Assessment (25 Marks)
- GATE Based Aptitude Test

CO-PO/PSO Mapping																
CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	DATA STRUCTURES AND APPLICATIONS		Semester	3
	Course Code	MVJ22CS34/AI34/CG34/IS34/DS34	CIE Marks	50
	Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
	Total Hours of Pedagogy	40	Total Marks	100
	Credits	03	Exam Hours	3
	Examination type (SEE)	**Theory**		

Course objectives:

CLO 1. To explain fundamentals of data structures and their applications.
CLO 2. To illustrate representation of Different data structures such as Stack, Queues, Linked Lists, Trees, and Graphs.
CLO 3. To Design and Develop Solutions to problems using Linear Data Structures
CLO 4. To discuss applications of Nonlinear Data Structures in problem solving.
CLO 5. To introduce advanced Data structure concepts such as Hashing and Optimal Binary Search Trees

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

Module-1 **8Hours**

INTRODUCTION TO DATA STRUCTURES: Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations
Review of pointers and dynamic Memory Allocation,
ARRAYS and STRUCTURES: Arrays, Dynamic Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, representation of Multidimensional Arrays, Strings
STACKS: Stacks, Stacks Using Dynamic Arrays, Evaluation and conversion of Expressions
Text Book: Chapter-1:1.2 Chapter-2: 2.1 to 2.7 Chapter-3: 3.1,3.2,3.6
Reference Book 1: 1.1 to 1.4

Module-2 **8Hours**

QUEUES: Queues, Circular Queues, Using Dynamic Arrays, Multiple Stacks and queues.
LINKED LISTS : Singly Linked, Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials
Text Book: Chapter-3: 3.3, 3.4, 3.7 Chapter-4: 4.1 to 4.4

Module-3 **8Hours**

LINKED LISTS : Additional List Operations, Sparse Matrices, Doubly Linked List.
TREES: Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees.
Text Book: Chapter-4: 4.5,4.7,4.8 Chapter-5: 5.1 to 5.3, 5.5

Module-4 **8Hours**

TREES(Cont..): Binary Search trees, Selection Trees, Forests, Representation of Disjoint sets, Counting Binary Trees,
GRAPHS: The Graph Abstract Data Types, Elementary Graph Operations
Text Book: Chapter-5: 5.7 to 5.11 Chapter-6: 6.1, 6.2

Module-5 **8Hours**

HASHING: Introduction, Static Hashing, Dynamic Hashing
PRIORITY QUEUES: Single and double ended Priority Queues, Leftist Trees
INTRODUCTION TO EFFICIENT BINARY SEARCH TREES: Optimal Binary Search Trees
Text Book: Chapter 8: 8.1 to 8.3 Chapter 9: 9.1, 9.2 Chapter 10: 10.1

Course outcome (Course Skill Set)

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

CO 1. Explain different data structures and their applications.
CO 2. Apply Arrays, Stacks and Queue data structures to solve the given problems.
CO 3. Use the concept of linked list in problem solving.
CO 4. Develop solutions using trees and graphs to model the real-world problem.
CO 5. Explain the advanced Data Structures concepts such as Hashing Techniques and Optimal Binary Search Trees.

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Textbook:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014

Reference Books:

1. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
2. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
3. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
4. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013
5. A M Tenenbaum, Data Structures using C, PHI, 1989
6. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.

Web links and Video Lectures (e-Resources):

- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
- https://nptel.ac.in/courses/106/105/106105171/
- http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
- https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
- https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html
- https://nptel.ac.in/courses/106/102/106102064/
- https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
- https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
- https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013501595428077568125 59/overview

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

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)
    - Case Study
    - Programming Assignment
    - Gate Based Aptitude Test
    - MOOC Assignment for selected Module

DATA STRUCTURES LABORATORY SEMESTER – III			
Course Code	MVJ22CSL35/AI/IS/CG/DS	**CIE Marks**	50
Number of Contact Hours/Week	0:0:2	**SEE Marks**	50
Total Number of Lab Contact Hours	28	**Exam Hours**	03
Credits – 1			

Course Learning Objectives:

This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of

- Dynamic memory management
- Linear data structures and their applications such as stacks, queues and lists
- Non-Linear data structures and their applications such as trees and graphs

Descriptions (if any):

- Implement all the programs in "C" Programming Language and Linux OS.

Programs List:

1.	Develop a Program in C for the following: a) Declare a calendar as an array of 7 elements (A dynamically Created array) to represent 7 days of a week. Each Element of the array is a structure having three fields. The first field is the name of the Day (A dynamically allocated String), The second field is the date of the Day (A integer), the third field is the description of the activity for a particular day (A dynamically allocated String). b) Write functions create (), read() and display(); to create the calendar, to read the data from the keyboard and to print weeks activity details report on screen.
2.	Develop a Program in C for the following operations on Strings. a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Don't use Built-in functions.
3.	Develop a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations

4.	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.
5.	Develop a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks

6.	Develop a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
7.	Develop a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: *USN, Name, Programme, Sem, PhNo* a. Create a SLL of N Students Data by using *front insertion.* b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack) e. Exit
8.	Develop a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with 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
9.	Develop a Program in C for the following operationson Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z-4yz^5+3x^3yz+2xy^5z-2xyz^3$ b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations
10.	Develop a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers . a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message d. Exit
11.	Develop 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 DFS/BFS method

12.	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. 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. Resolve the collision (if any) using linear probing.
Note: During the lab sessions the data structures using python codes will be demonstrated.	
Laboratory Outcomes: The student should be able to:	

- Analyze various linear and non-linear data structures
- Demonstrate the working nature of different types of data structures and their applications
- Use appropriate searching and sorting algorithms for the give scenario.
- Apply the appropriate data structure for solving real world problems

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Need to change in accordance with university regulations)*
  c) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  d) For laboratories having PART A and PART B
    i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

	Programming using Java		Semester	3
	Course Code	MVJ22CS361/AI361/CG361/IS361/DS361	CIE Marks	50
	Teaching Hours/Week (L: T:P: S)	2:0:2	SEE Marks	50
	Total Hours of Pedagogy	28 Hours of Theory + 20 Hours of Practical	Total Marks	100
	Credits	03	Exam Hours	03
	Examination type (SEE)	Theory		

Note - Students who have undergone " Basics of Java Programming- BPLCK105C/205C" in first year are not eligible to opt this course

Course objectives:

- To learn primitive constructs JAVA programming language.
- To understand Object Oriented Programming Features of JAVA.
- To gain knowledge on: packages, multi threaded programming and exceptions.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

1. Use Online Java Compiler IDE: https://www.jdoodle.com/online-java-compiler/ or any other.
2. Demonstration of programming examples.
3. Chalk and board, power point presentations
4. Online material (Tutorials) and video lectures.

Module-1

An Overview of Java: Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles), Using Blocks of Code, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, The Java Keywords).

Data Types, Variables, and Arrays: The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables.

Operators: Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses.

Control Statements: Java's Selection Statements (if, The Traditional switch), Iteration Statements (while, do-while, for, The For-Each Version of the for Loop, Local Variable Type Inference in a for Loop, Nested Loops), Jump Statements (Using break, Using continue, return).

Chapter 2, 3, 4, 5

Module-2

Introducing Classes: Class Fundamentals**,** Declaring Objects**,** Assigning Object Reference Variables**,** Introducing Methods**,** Constructors**,** The this Keyword**,** Garbage Collection.

Methods and Classes: Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes.

Chapter 6, 7

Module-3

	Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class. **Interfaces:** Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods. **Chapter 8, 9**

	Module-4
	Packages: Packages, Packages and Member Access, Importing Packages. **Exceptions:** Exception-Handling Fundamentals**,** Exception Types**,** Uncaught Exceptions**,** Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions**.** **Chapter 9, 10**
	Module-5
	Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State. **Enumerations, Type Wrappers and Autoboxing:** Enumerations (Enumeration Fundamentals**,** The values() and valueOf() Methods), Type Wrappers (Character, Boolean, The Numeric Type Wrappers), Autoboxing (Autoboxing and Methods, Autoboxing/Unboxing Occurs in Expressions, Autoboxing/Unboxing Boolean and Character Values). **Chapter 11, 12**

Course outcome (Course Skill Set)

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

1. Demonstrate proficiency in writing simple programs involving branching and looping structures.
2. Design a class involving data members and methods for the given scenario.
3. Apply the concepts of inheritance and interfaces in solving real world problems.
4. Use the concept of packages and exception handling in solving complex problem
5. Apply concepts of multithreading, autoboxing and enumerations in program development

Programming Experiments (Suggested and are not limited to)

1. Develop a JAVA program to add TWO matrices of suitable order N (The value of N should be read from command line arguments).
2. Develop a stack class to hold a maximum of 10 integers with suitable methods. Develop a JAVA main method to illustrate Stack operations.
3. A class called Employee, which models an employee with an ID, name and salary, is designed as shown in the following class diagram. The method raiseSalary (percent) increases the salary by the given percentage. Develop the Employee class and suitable main method for demonstration.
4. A class called MyPoint, which models a 2D point with x and y coordinates, is designed as follows:
   - Two instance variables x (int) and y (int).
   - A default (or "no-arg") constructor that construct a point at the default location of (0, 0).
   - A overloaded constructor that constructs a point with the given x and y coordinates.
   - A method setXY() to set both x and y.
   - A method getXY() which returns the x and y in a 2-element int array.
   - A toString() method that returns a string description of the instance in the format "(x, y)".
   - A method called distance(int x, int y) that returns the distance from this point to another point at the given (x, y) coordinates
   - An overloaded distance(MyPoint another) that returns the distance from this point to the given MyPoint instance (called another)
   - Another overloaded distance() method that returns the distance from this point to the origin (0,0)

   Develop the code for the class MyPoint. Also develop a JAVA program (called TestMyPoint) to test all the methods defined in the class.
5. Develop a JAVA program to create a class named shape. Create three sub classes namely: circle, triangle and square, each class has two member functions named draw () and erase (). Demonstrate polymorphism concepts by developing suitable methods, defining member data and main program.
6. Develop a JAVA program to create an abstract class Shape with abstract methods calculateArea() and calculatePerimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape.
7. Develop a JAVA program to create an interface Resizable with methods resizeWidth(int width) and resizeHeight(int height) that allow an object to be resized. Create a class Rectangle that implements the Resizable interface and implements the resize methods
8. Develop a JAVA program to create an outer class with a function display. Create another class inside the outer class named inner with a function called display and call the two functions in the main class.
9. Develop a JAVA program to raise a custom exception (user defined exception) for DivisionByZero using try, catch, throw and finally.
10. Develop a JAVA program to create a package named mypack and import & implement it in a suitable class.
11. Write a program to illustrate creation of threads using runnable class. (start method start each of the newly created thread. Inside the run method there is sleep() for suspend the thread for 500 milliseconds).
12. Develop a program to create a class MyThread in this class a constructor, call the base class constructor, using super and start the thread. The run method of the class starts after this. It can be observed that both main thread and created child thread are executed concurrently.

Assessment Details (both CIE and SEE)

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

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

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

CIE for the practical component of the IPCC

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

SEE for IPCC

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

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

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

Suggested Learning Resources:

Textbook:

Java: The Complete Reference, Twelfth Edition, by Herbert Schildt, November 2021, McGraw-Hill, ISBN: 9781260463422

Reference Books

1. Programming with Java, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill Education, ISBN: 9789353162337.

2. Thinking in Java, Fourth Edition, by Bruce Eckel, PrenticeHall, 2006 (https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf)

Web links and Video Lectures (e-Resources):

- Java Tutorial: https://www.geeksforgeeks.org/java/
- Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu): https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
- Java Tutorial: https://www.w3schools.com/java/
- Java Tutorial: https://www.javatpoint.com/java-tutorial

Activity Based Learning (Suggested Activities)/ Practical Based learning

1. Installation of Java (Refer: https://www.java.com/en/download/help/index_installing.html)
2. Demonstration of online IDEs like geeksforgeeks, jdoodle or any other Tools
3. Demonstration of class diagrams for the class abstraction, type visibility, composition and inheritance

Assessment Method

- Programming Assignment / Course Project

Data Analytics with R Programming		Semester	3
Course Code	MVJ22CS363/AI363/CG363 /IS363/DS363	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	02
Examination type (SEE)	Practical		

Course objectives:

- To explore and understand how R and R Studio interactive environment.
- To understand the different data Structures, data types in R.
- To learn and practice programming techniques using R programming.
- To import data into R from various data sources and generate visualizations.
- To draw insights from datasets using data analytics techniques.

Sl.NO	Experiments
1	Demonstrate the steps for installation of R and R Studio. Perform the following: a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type. b) Demonstrate Arithmetic and Logical Operations with simple examples. c) Demonstrate generation of sequences and creation of vectors. d) Demonstrate Creation of Matrices e) Demonstrate the Creation of Matrices from Vectors using Binding Function. f) Demonstrate element extraction from vectors, matrices and arrays **Suggested Reading** – Text Book 1 – Chapter 1 (What is R, Installing R, Choosing an IDE – RStudio, How to Get Help in R, Installing Extra Related Software), Chapter 2 (Mathematical Operations and Vectors, Assigning Variables, Special Numbers, Logical Vectors), Chapter 3 (Classes, Different Types of Numbers, Other Common Classes, Checking and Changing Classes, Examining Variables)
2	Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics: a. Profit for each month. b. Profit after tax for each month (Tax Rate is 30%). c. Profit margin for each month equals to profit after tax divided by revenue. d. Good Months – where the profit after tax was greater than the mean for the year. e. Bad Months – where the profit after tax was less than the mean for the year. f. The best month – where the profit after tax was max for the year. g. The worst month – where the profit after tax was min for the year. **Note:** a. All Results need to be presented as vectors b. Results for Dollar values need to be calculated with $0.01 precision, but need to be presented in Units of $1000 (i.e 1k) with no decimal points c. Results for the profit margin ratio need to be presented in units of % with no decimal point. d. It is okay for tax to be negative for any given month (deferred tax asset) e. Generate CSV file for the data. **Suggested Reading** – Text Book 1 – Chapter 4 (Vectors, Combining Matrices)
3	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication **Suggested Reading** – Text Book 1 – Chapter 4 (Matrices and Arrays – Array Arithmetic)
4	Develop a program to find the factorial of given number using recursive function calls. **Suggested Reading** – Reference Book 1 – Chapter 5 (5.5 – Recursive Programming) Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops), Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)

<table>
<tr><td>5</td><td>Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
Suggested Reading – Reference Book
1 - Chapter 5 (5.5 – Recursive Programming)
Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops), Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)</td></tr>
<tr><td>6</td><td>The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to:
a) Find the Pearson and Spearman correlation coefficients. Are they similar?
b) Plot the data using the plot command.
c) Plot the logarithm (log) of each variable and see if that makes a difference.
Suggested Reading – Text Book 1 –Chapter 12 – (Built-in Datasets) Chapter 14 – (Scatterplots)
Reference Book 2 – 13.2.5 (Covariance and Correlation)</td></tr>
<tr><td>7</td><td>Develop R program to create a Data Frame with following details and do the following operations.
<table>
<tr><th>itemCode</th><th>itemCategory</th><th>itemPrice</th></tr>
<tr><td>1001</td><td>Electronics</td><td>700</td></tr>
<tr><td>1002</td><td>Desktop Supplies</td><td>300</td></tr>
<tr><td>1003</td><td>Office Supplies</td><td>350</td></tr>
<tr><td>1004</td><td>USB</td><td>400</td></tr>
<tr><td>1005</td><td>CD Drive</td><td>800</td></tr>
</table>
a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
b) Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies”
c) Create another Data Frame called “item-details” with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames

Suggested Reading –Textbook 1: Chapter 5 (Lists and Data Frames)</td></tr>
<tr><td>8</td><td>Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements.
a) Assigning names, using the air quality data set.
b) Change colors of the Histogram
c) Remove Axis and Add labels to Histogram
d) Change Axis limits of a Histogram
e) Add Density curve to the histogram
Suggested Reading –Reference Book 2 – Chapter 7 (7.4 – The ggplot2 Package), Chapter 24 (Smoothing and Shading)</td></tr>
<tr><td>9</td><td>Design a data frame in R for storing about 20 employee details. Create a CSV file named “input.csv” that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.
a) Find the total number rows & columns
b) Find the maximum salary
c) Retrieve the details of the employee with maximum salary
d) Retrieve all the employees working in the IT Department.
e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these</td></tr>
</table>

	details into another file "output.csv" **Suggested Reading** – Text Book 1 – Chapter 12(CSV and Tab Delimited Files)
10	Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors Develop R program, to solve the following: a) What is the total number of observations and variables in the dataset? b) Find the car with the largest hp and the least hp using suitable functions c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness? d) What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations. e) Which pair of variables has the highest Pearson correlation? **References (Web links):** 1. https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html 2. https://www.w3schools.com/r/r_stat_data_set.asp 3. https://rpubs.com/BillB/217355
11	Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file. **Suggested Reading** – Reference Book 2 – Chapter 20 (General Concepts, Statistical Inference, Prediction)
Note: Data analytics part is also included in the mathematics.	
Course outcomes (Course Skill Set): At the end of the course the student will be able to: ● Explain the fundamental syntax of R data types, expressions and the usage of the R-Studio IDE ● Develop a program in R with programming constructs: conditionals, looping and functions. ● Apply the list and data frame structure of the R programming language. ● Use visualization packages and file handlers for data analysis..	

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.
The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

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

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

Semester End Evaluation (SEE):

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

rubrics shall be decided jointly by examiners.

- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

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

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
The minimum duration of SEE is 02 hours

Suggested Learning Resources:

Book:

1. Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc.

References:

1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.
2. Davies, T.M. (2016) The Book of R: A First Course in Programming and Statistics. No Starch Press.

MVJ22SCR37– Social Connect & Responsibility 2022 Scheme & syllabus for 3rd sem		Semester	3rd
Course Code	**BSCK307 Common for all dept**	CIE Marks	**100**
Teaching Hours/Week (L:T:P: S)	0:0:3:1	SEE Marks	------
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning	Total Marks	**100**
Examination nature (No SEE – Only CIE)	For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept / Any Dept.		
Credits	01 - Credit		

Course objectives: The course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

General Instructions - Pedagogy :

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

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

Contents :

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.

The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

In the following a set of activities planned for the course have been listed:

Social Connect & Responsibility – Contents

Part I:

Plantation and adoption of a tree:

Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.

Part II :

Heritage walk and crafts corner:

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives,Visit, case study, report, outcomes.

Part III :

Organic farming and waste management:

Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives,Visit, case study, report, outcomes.

Part IV:

Water conservation:

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

Part V :

Food walk:

City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

Course outcomes (Course Skill Set):

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

CO1: Communicate and connect to the surrounding. CO2: Create a responsible connection with the society.

CO3: Involve in the community in general in which they work.

CO4: Notice the needs and problems of the community and involve them in problem –solving.

CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledgein finding practical solutions to individual and community problems.

CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories withothers. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs/social sections will be a key part of the course. Will all leadto the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, basedon an in-depth understanding of a key social problem.

Duration :

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic ,and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines ofscheme & syllabus.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE):

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the socialconnect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below

Excellent : 80 to 100
Good : 60 to 79
Satisfactory: 40 to 59
Unsatisfactory and fail : <39

Special Note :

NO SEE – Semester End Exam – Completely Practical and activities based evaluation

Pedagogy – Guidelines :

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	**Plantation and adoption of a tree:**	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
2.	**Heritage walk and crafts corner:**	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
3.	**Organic farming and waste management:**	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
4.	**Water conservation:** & conservation techniques	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers / campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
5.	**Food walk: Practices in society**	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

Plan of Action (Execution of Activities)

Sl.NO	Practice Session Description
1	Lecture session in field to start activities
2	Students Presentation on Ideas
3	Commencement of activity and its progress
4	Execution of Activity
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Case study based Assessment, Individual performance
9	Sector/ Team wise study and its consolidation
10	Video based seminar for 10 minutes by each student At the end of semester with Report.

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Field Visit, Plan, Discussion	10 Marks	
Commencement of activities and its progress	20 Marks	
Case study based Assessment Individual performance with report	20 Marks	
Sector wise study & its consolidation 5*5 = 25	25 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report. **Activities 1 to 5, 5*5 = 25**	25 Marks	
Total marks for the course in each semester	**100 Marks**	

For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.

IV Semester

Course Title	ANALYSIS AND DESIGN OF ALGORITHMS	**Semester**	04
Course Code	MVJ22IS41	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

Course objective is to: ***This course will enable students to***

- Identify the importance of different asymptotic notation.
- Determine the complexity of recursive and non-recursive algorithms.
- Compare the efficiency of various design techniques like greedy method, backtracking etc.
- Apply appropriate method to solve a given problem.

Module-1	**RBT Level** L1,L2 , L3	**Hours 10**

Basic Concept of Algorithms: Introduction-What is an Algorithm, Algorithm Specification, Analysis Framework, Performance Analysis: Space complexity, Time complexity. Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples .

Applications: developing computational tools and bioinformatics software, Mathematics.

Video link / Additional online information (related to module if any):

- http://www.nptelvideos.com/video.php?id=1442
- https://nptel.ac.in/courses/106105085/

Module-2	**RBT Level** L2 , L3	**Hours 10**

Simple Design Techniques – Brute force : Selection sort, Bubble sort, Sequential Search and Brute-Force String Matching , Exhaustive search –Traveling Salesman problem, Knapsack problem , Assignment Problem.

Divide and Conquer: General method, Binary search, Finding the maximum and minimum , Merge sort, Quick sort , Strassen's matrix multiplication.

Applications: power distribution (electrical field), Online shopping and delivery (real time)

Video link / Additional online information (related to module if any):

- https://nptel.ac.in/courses/106102064/
- https://www.youtube.com/watch?v=MFfD57DTDQY

Module-3	**RBT Level** L2,L3 , L4	**Hours 10**

Decrease and Conquer approach: Topological Sort, Decrease-by-a-Constant-Factor

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. Huffman Trees and Codes.

Laboratory Sessions/ Experimental learning: Solving real time problems using Greedy Technique.

Applications: Optimization Problems.

Video link : https://nptel.ac.in/courses/106/106/106106131/

Module-4	**RBT Level** L3,L4 , L6	**Hours 10**

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.

Laboratory Sessions/ Experimental learning: Solving real time problems using Dynamic Programming.

Applications: Computer Networks.

Video link: https://nptel.ac.in/courses/106/106/106106131/

Module-5	**RBT Level** L4,L5 ,L6	**Hours 10**

Backtracking: General method, 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: P, NP, NP-Complete, and NP-Hard classes.

Laboratory Sessions/ Experimental learning: Solving real time problems using Backtracking Technique.

Applications: To solve puzzles such as crosswords, Sudoku etc.

Video link: **https://nptel.ac.in/courses/106/106/106106131/**

Course outcomes:	
CO1	Describe the need of algorithm and the notations used in design analysis.
CO2	Compare the efficiency of brute force, divide and conquer techniques for problem solving.
CO3	Ability to apply greedy algorithms, hashing and string matching algorithms.
CO4	Ability to design efficient algorithms using various design techniques.
CO5	Ability to apply the knowledge of complexity classes P, NP, and NP Complete and prove certain problems are NP-Complete.
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.	Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).
2.	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	--	--	--	1	--	--	--	--	--	--	2	2	-
CO2	2	3	--	--	2	--	--	--	--	--	--	--	2	-
CO3	3	3	2	2	--	--	--	--	--	--	--	2	2	2
CO4	3	3	3	--	--	--	--	--	1	--	--	2	3	2
CO5	2	2	2	1	3	--	--	--	--	--	--	3	3	3

High-3, Medium-2, Low-1

Semester:IV		
Advanced Java (Theory and Practice)		
Course Code:MVJ22IS42		**CIE Marks:50+50**
Credits:4 L:T:P: 3:0:2		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**

Course Learning Objectives: The students will be able to	
1	Understanding the fundamentals of collection framework
2	Demonstrate the fundamental concepts of String operations and Swing applications
3	Design and develop web applications using Java servlets and JSP
4	Apply database interaction through Java database Connectivity

UNIT-I	
The collections and Framework: Collections Overview, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Arrays,, The legacy Classes and Interfaces, Parting Thoughts on Collections. **Text Book 1: Ch. 17**	**9Hrs**
UNIT-II	
String Handling : The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, joining strings, Additional String Methods, StringBuffer , StringBuilder. **Text Book 1: Ch 15**	**9Hrs**
UNIT-III	
Introducing Swing: The Origin of Swing, Swing Is Built on AWT, Two Key Swing Features, The MVC Connection, Components and Containers, The Swing Packages, A Simple Swing Application, Event Handling, Painting in Swing. **Exploring Swing :** JLabel and ImageIcon,JTextField,The Swing Buttons-JButton, JToggleButton, Check Boxes, Radio Buttons. **Text Book 1: Ch 29 and Ch. 30**	**9Hrs**
UNIT-IV	
Introducing servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Jakarta. Servlet Package; Reading Servlet Parameter; The Jakarta.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. **Java Server Pages (JSP):** JSP tags, Variables and Objects, Methods, Control statements,	**9Hrs**

Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects. **Text Book 1: Ch 31** **Text Book2: Ch 11**	
UNIT-V	
JDBC Objects: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. **TextBook 2**: Ch 06	**Hrs**

LABORATORY EXPERIMENTS

1. Implement a java program to demonstrate creating an ArrayList, adding elements, removing elements,sorting elements of ArrayList. Also illustrate the use of toArray() method.
2. Implement a java program to illustrate the use of comparator.
3. Implement a java program to illustrate storing user defined classes in collection.
4. Implement a java program to illustrate the use of different types of string class constructors.
5. Implement a java program to illustrate the use of different types of character extraction, string comparison, string search and string modification methods.
6. Implement a java program to illustrate the use of different types of StringBuffer methods
7. Demonstrate a swing event handling application that creates 2 buttons Alpha and Beta and displays the text “Alpha pressed” when alpha button is clicked and “Beta pressed” when beta button is clicked.
8. A program to display greeting message on the browser “Hello UserName”, “How Are You?”, accept username from the client using servlet.
9. A servlet program to display the name, USN, and total marks by accepting student detail
10. A Java program to create and read the cookie for the given cookie name as “EMPID” and its value as “AN2356”.
11. Write a JAVA Program to insert data into Student DATA BASE and retrieve info based on particular queries(For example update, delete, search etc…).
12. A program to design the Login page and validating the USER_ID and PASSWORD using JSP and DataBase.

Any 10 experiments to be conducted

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply appropriate collection class/interface to solve the given problem

CO2	Demonstrate the concepts of String operations in Java
CO3	Apply the concepts of Swings to build Java applications
CO4	Develop web based applications using Java servlets and JSP
CO5	Use JDBC to build database applications

Text Books	
1.	Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007.
2.	Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007.

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

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Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksare executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1			3	2	2	2		2				1
CO2		3	3	2	2	2		2				2
CO3		3	3	2	2	2		2				3
CO4		3	3	2	2	2		2				2
CO5		3	3	2	2	2		2				3

Semester: IV		
Database Management Systems		
Course Code:	**MVJ22IS43**	**CIE Marks:50**
Credits:	**4**	**SEE Marks: 50**
L:T:P:S:	**3:0:2:0**	**SEE Duration: 3 Hrs**
Hours:	**40L+26T**	
Course Learning Objectives: The students will be able to		
1	To Provide a strong foundation in database concepts, technology, and practice.	
2	To Practice SQL programming through a variety of database problems	
3	To Understand the relational database design principles	
4	To Demonstrate the use of concurrency and transactions in database.	
5	To Design and build database applications for real world problems	
6	To become familiar with database storage structures and access techniques	

UNIT-I	
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. **Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. **Conceptual Data Modelling using Entities and Relationships**: Entity types, Entity sets and structural constraints, Weak entity types, ER diagrams,Specialization and Generalization. Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10 RBT: L1, L2, L3	**8 Hrs**
UNIT-II	
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Relational Algebra**: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design**: Relational Database Design using ER- to-Relational mapping. **SQL**: SQL data definition and data types, Schema change statements in SQL, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL Textbook 1: Ch 5.1 to 5.3, Ch 8.1 to 8.5; Ch 9.1 to 9.2 Ch 6.1 to 6.5 Textbook 2: 3.5 RBT: L1, L2, L3	**8 Hrs**
UNIT-III	

SQL: Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL. **Normalization**: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Textbook 1: Ch 14.1 to 14.7, Ch 20.1 to 20.6 RBT: L1, L2, L3	**8 Hrs**
UNIT-IV	
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. Textbook 1: Ch 7.1 to 7.3, RBT: L1, L2, L3	**8 Hrs**
UNIT-V	
Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j Textbook 1:Chapter 21.1 to 21.5, Chapter 24.1 to 24.6 RBT: L1, L2, L3	**8 Hrs**

PRACTICAL COMPONENTS FOR IPCC

Exp 1:	Create a table called Employee C execute the following. Employee(EMPNO,ENAME,JOB, MANAGER_NO, SAL, COMMISSION) 1. Create a user and grant all permissions to the user. 2. Insert the any three records in the employee table contains attributes EMPNO,ENAME JOB, MANAGER_NO, SAL, COMMISSION and use rollback. Check the result.	2 hrs
Exp 2:	Create a table called Employee C execute the following. Employee(EMPNO,ENAME,JOB, MANAGER_NO, SAL, COMMISSION) 3. Add primary key constraint and not null constraint to the employee table. 4. Insert null values to the employee table and verify the result.	2 hrs
Exp 3:	Create a table called Employee that contain attributes EMPNO,ENAME,JOB, MGR,SAL C execute the following. 1. Add a column commission with domain to the Employeetable. 2. Insert any five records into the table.	2 hrs

	3. Update the column details of job 4. Rename the column of Employ table using alter command. 5. Delete the employee whose Empno is 105.	
Exp 4:	Queries using aggregate functions(COUNT,AVG,MIN,MAX,SUM),Group by,Orderby. Employee(E_id, E_name, Age, Salary) 1. Create Employee table containing all Records E_id, E_name, Age, Salary. 2. Count number of employee names from employeetable 3. Find the Maximum age from employee table. 4. Find the Minimum age from employeetable.	2 hrs
Exp 5:	Queries using aggregate functions(COUNT,AVG,MIN,MAX,SUM),Group by,Orderby. Employee(E_id, E_name, Age, Salary) 5. Find salaries of employee in Ascending Order. 6. Find grouped salaries of employees.	2 hrs
Exp 6:	Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old C new Salary. CUSTOMERS(ID,NAME,AGE,ADDRESS,SALARY)	2 hrs
Exp 7:	Implementations of Normal Forms	2 hrs
Exp 8:	Create cursor for Employee table C extract the values from the table. Declare the variables ,Open the cursor C extrct the values from the cursor. Close the cursor. Employee(E_id, E_name, Age, Salary)	2 hrs
Exp 9:	Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data should be skipped.	2 hrs
Exp 10:	Install an Open Source NoSQL Data base MangoDB C perform basic CRUD(Create, Read, Update C Delete) operations. Execute MangoDB basic Queries using CRUD operations.	2 hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the basic elements of a relational database management system
CO2	Design entity relationship for the given scenario.
CO3	Apply various Structured Query Language (SQL) statements for database manipulation
CO4	Analyse various normalization forms for the given application
CO5	Develop database applications for the given real world problem. And Understand the concepts related to NoSQL databases.

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

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

Mini Project:

- Project Based Learning

Continuous Internal Evaluation (CIE):

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

1. Two Tests each of 20 Marks
2. Two assignments each of 10 Marks/One Skill Development Activity of 20 marks
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to 30 marks.

CIE for the practical component of IPCC

On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments‟ write-ups are added and scaled down to 15 marks.

The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

SEE for IPCC

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

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

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

The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course(CIE+SEE)

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	POG	PO10	PO11	PO12
CO1	1											
CO2	1		2	2			1			2	2	
CO3	1							2	2	2	1	
CO4	1	2				2						2

DISCRETE MATHEMATICAL STRUCTURES		Semester	IV
Course Code	**BCS405A**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

1. To help students to understand discrete and continuous mathematical structures.
2. To impart basics of relations and functions.
3. To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations.
4. To have the knowledge of groups and their properties to understand the importance of algebraic properties relative to various number systems.

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

Module-1: Fundamentals of Logic

Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems. **(8 hours)**

(RBT Levels: L1, L2 and L3)

Module-2: Properties of the Integers

Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions.

Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition. **(8 Hours)**

(RBT Levels: L1, L2 and L3)

Module-3: Relations and Functions

Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions.

Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions. **(8 hours)**

(RBT Levels: L1, L2 and L3)

Module-4: The Principle of Inclusion and Exclusion

The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.

Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients. **(8 Hours)**

(RBT Levels: L1, L2 and L3)

Module-5: Introduction to Groups Theory

Definitions and Examples of Particular Groups Klein 4-group, Additive group of Integers modulo n, Multiplicative group of Integers modulo-p and permutation groups, Properties of groups, Subgroups, cyclic groups, Cosets, Lagrange's Theorem. **(8 Hours)**

(RBT Levels: L1, L2 and L3)

Course outcome (Course Skill Set)

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

1. Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements.
2. Demonstrate the application of discrete structures in different fields of computer science.
3. Apply the basic concepts of relations, functions and partially ordered sets for computer representations.
4. Solve problems involving recurrence relations and generating functions.
5. Illustrate the fundamental principles of Algebraic structures with the problems related to computer science & engineering.

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

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

Semester-End Examination:

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

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

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)

Text Books:

1. **Ralph P. Grimaldi, B V Ramana: "Discrete Mathematical Structures an Applied Introduction",** 5th Edition, Pearson Education, 2004.
2. **Ralph P. Grimaldi: "Discrete and Combinatorial Mathematics"**, 5th Edition, Pearson Education. 2004.

Reference Books:

1. **Basavaraj S Anami and Venakanna S Madalli: "Discrete Mathematics – A Concept-based approach"**, Universities Press, 2016
2. **Kenneth H. Rosen: "Discrete Mathematics and its Applications"**, 6th Edition, McGraw Hill, 2007.
3. **Jayant Ganguly: "A Treatise on Discrete Mathematical Structures",** Sanguine-Pearson, 2010.
4. **D.S. Malik and M.K. Sen: "Discrete Mathematical Structures Theory and Applications,** Latest Edition, Thomson, 2004.
5. **Thomas Koshy: "Discrete Mathematics with Applications"**, Elsevier, 2005, Reprint 2008.

Web links and Video Lectures (e-Resources):

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

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

- Quizzes
- Assignments
- Seminar

BIOLOGY FOR ENGINEERS		Semester	IV
Course Code	**BBOK407**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

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

Teaching-Learning Process (General Instructions)

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

1. Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical/hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' participation through audio-video based content creation for the syllabus (as assignments).
7. Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
8. Students' seminars (in solo or group) /oral presentations.

Module-1 (8 Hours)

INTRODUCTION TO BIOLOGY:

The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each),Properties and functions), vitamins and hormones.

Module-2(8 Hours)

BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):

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

Module-3(8 Hours)

HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE):

Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).

Module-4 (8 Hours)

NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):

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

Module-5(8 Hours)

TRENDS IN BIOENGINEERING (QUALITATIVE):

Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self-healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

Course outcome (Course Skill Set)

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

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

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Books

- Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

Web links and Video Lectures (e-Resources):

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

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

- Group Discussion of Case studies
- Model Making and seminar/poster presentations
- Design of novel device/equipment like Cellulose-based water filters, Filtration system

Semester: IV		
UNIVERSAL HUMAN VALUES		
Course Code:	MVJ22UHV48	CIE Marks: 50
Credits:	L: T:P: 1:0:0	SEE Marks: 50
Hours:	15 L	SEE Duration: 02 Hrs.

Course Learning Objectives: The students will be able to

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

UNIT-I	
Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness, and Prosperity – the Basic Human Aspirations, Happiness, and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations. Practical Sessions: (1) Sharing about Oneself (2) Exploring Human Consciousness (3) Exploring Natural Acceptance. Video link: 1. https://www.youtube.com/watch?v=85XCw8SU084 2. https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_ Kt6jqzA3p Z3yA7g_OAQz 3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	3 Hrs.
UNIT-II	
Harmony in the Human Being: Understanding Human being as the Co- existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Program to ensure self-regulation and Health. Practical Sessions: (4) Exploring the difference of Needs of Self and Body (5) Exploring Sources of Imagination in the Self (6) Exploring Harmony of Self with the Body	3 Hrs.

Video link: 1. https://www.youtube.com/watch?v=GpuZo495F24 2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	
UNIT-III	
Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order. Practical Sessions: (7) Exploring the Feeling of Trust (8) Exploring the Feeling of Respect (9) Exploring Systems to fulfill Human Goal Video link: 1. https://www.youtube.com/watch?v=F2KVW4WNnS 2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	3 Hrs.
UNIT-IV	
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. Practical Sessions: (10) Exploring the Four Orders of Nature (11) Exploring Co- existence in Existence. Video link: 3. https://www.youtube.com/watch?v=1HR-QB2mCF0 4. https://www.youtube.com/watch?v=lfN8q0xUSpw 5. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	3 Hrs.
UNIT-V	
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession Practical Sessions: (12) Exploring Ethical Human Conduct (13) Exploring Humanistic Models in Education (14) Exploring Steps of Transition towards Universal Human Order Video link: 1. https://www.youtube.com/watch?v=BikdYub6RY0 2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	3 Hrs.

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore themselves, get comfortable with each other and with the teacher

CO2	Enlist their desires and the desires are not vague.
CO3	Restate that the natural acceptance (intention) is always for living in harmony, only competence is lacking
CO4	Differentiate between the characteristics and activities of different orders. and study the mutual fulfillment among them
CO5	Present sustainable solutions to the problems in society and nature

Reference Books	
3.	AICTE SIP UHV-I Teaching Material, https://fdp-si.aicte india.org/ AICTE Sip UHV _download.php
4.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
3.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
4.	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Continuous Internal Evaluation (CIE):

CIE for 50 marks is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. The test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in tests, quizzes and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students must answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three subdivisions. Each unit will have an internal choice in which both questions cover the entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	2	2	3	2	1	2	1
CO2	-	1	-	-	-	2	2	3	2	1	2	1
CO3	-	1	-	-	-	2	2	3	2	1	2	1
CO4	-	1	-	-	-	2	2	3	2	1	2	1
CO5	-	1	-	-	-	2	2	3	2	1	2	1

V Semester

Course Title	Software Engineering and Project Management	Semester	V
Course code	MVJ22IS51	CIE	50
Total No.of Contact Hours	40	SEE	50
No.Of Contact Hours/week	3(L:T:P:S::3:0:0:0)	Total	100
Credits	3	Exam Duration	3 hours

Course Objective : ***This course will enable students to***

1. Outline software engineering principles and activities involved in building large software programs and identify ethical and professional issues faced by Software Engineers.
2. Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.
3. Infer the fundamentals of object-oriented concepts, differentiate system models, use UML diagrams, apply design patterns and explain the role of DevOps in Agile Implementation.
4. Discuss various types ofsoftware testing practices and software evolution processes. Recognize the importance of Project Management with its methods and methodologies and identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved.

MODULE 1	8 HRS

Introduction: The evolving role of software, Software, The changing nature of software, Software engineering, A Process Framework, Process Patterns, Process Assessment, Personal and Team Process Models, Process Technology, Product and Process.

Process Models: Prescriptive models, Waterfall model, Incremental process models, Evolutionary. process models, Specialized process models.

Requirements Engineering: Requirements Engineering Task, Initiating the Requirements Engineering process, Eliciting Requirements, Developing use cases, Building the analysis model, Negotiating Requirements, Validating Requirements, Software Requirement Document.

MODULE 2	8 HRS

Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling, abstraction, The Three models. Class Modelling: Object and Class Concept, Link and associations concepts, Generalization and Inheritance, A sample class model, Navigation of class models, Introduction to RUP and UML diagrams.

Building the Analysis Models: Requirement Analysis, Analysis Model Approaches, Data modelling Concepts, Object Oriented Analysis, Scenario-Based modelling, Flow-Oriented Modelling, class Based modelling, Creating a Behavioural Model.

MODULE 3	8 HRS

Software Testing: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging. Agile Methodology & DevOps: Before Agile – Waterfall, Agile Development. What is DevOps? DevOps Importance and Benefits, DevOps Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing, How to Choose Right DevOps Tools?, Challenges with DevOps Implementation

MODULE 4	8 HRS

Introduction to Project Management: Introduction, Project and Importance of Project Management,

Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.

MODULE 5	8 HRS

Activity Planning: Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, Identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks.
Software Economics: Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts.

Course Outcome: students will be able to

CO1	Understand the activities involved in software engineering and analyze the role of various process models
CO2	Explain the basics of object-oriented concepts and build a suitable class model using modelling. Techniques.
CO3	Describe various software testing methods and to understand the importance of agile methodology and DevOps.
CO4	Illustrate the role of project planning and quality management in software development
CO5	Understand the importance of activity planning and different planning models.

Textbooks :

1	Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw
2	Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.
3	Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018
4	Deepak Gaikwad, Viral Thakkar, DevOps Tools from Practitioner's Viewpoint, Wiley
5	Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.
6	Management and Entrepreneurship, N V R Naidu, T Krishna Rao 4th reprint Willey Publications.
7	Schaum's outline oftheory and problems ofsoftware engineering, David A. Gustafson, McGrawHill's

References:

1	Principles of Management, P C Tripathi, P N Reddy, 5th edition, Tata Mc Graw Hill, 2012
2	Dynamics of Entrepreneurial Development & Management, Vasant Desai, Himalaya publishing house, 2009

CIE Marks:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having

choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.
CO-PO Mapping :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**3**	**2**	**3**					**2**	**3**	**3**
CO2	**1**	**3**	**3**	**2**	**2**					**2**	**3**	**3**
CO3	**2**	**3**	**2**	**2**	**3**					**2**	**3**	**3**
CO4	**2**	**2**	**2**	**2**	**2**					**3**	**3**	**3**
CO5	**1**	**2**	**3**	**2**	**2**					**2**	**3**	**3**

3- HIGH 2- MODERATE 1- LOW

Course Title	Computer Networks	Semester	v
Course Code	MVJ22IS52	CIE	50
Total No. Of Contact Hours	40T+26P	SEE	50
No.of Contact Hours/week	5(L:T:P:S::3:0:2:0)	Total	100
Credits	4	Exam Duration	3

Course Objectives : This course will enable students to

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in network protocols.
3. Get details about Functions of Network layer, Router and delivery of data to host network.
4. Learn the function of mobile networking and switching. 5. Multimedia data transmission in network.

Module 1	8 hrs

Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division.

Module 2	8 hrs

Data Link Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ. Medium Access Sub Layer: Switching, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA, IEEE802 standard protocol

Module 3	8 hrs

The Network Layer: Network layer design issues, Logical Addressing: IPV4, IPV6; Address mapping, routing algorithms, Congestion control algorithms, Internetworking, the network layer in the internet (IPv4 and IPv6), Quality of Service.

Module 4	8 hrs

Transport Layer: Elements of Transport protocols: Addressing, Connection establishment, Connection release, Crash recovery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Module 5	8 hrs

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls; AI in network infrastructure, Self-Healing Networks.

LABORATORY EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, lookup and trace route. Capture ping and trace route PDUs using a network protocol analyzer and examine. Screen effectiveness studies.
2. Write a program for error detecting code using CRC-CCITT (16- bits).
3. Write a program to find the shortest path between vertices using the Bellman-ford algorithm.
4. Applications using TCP and UDP sockets like: a) Chat b) File Transfer
5. Simulation of DNS using UDP sockets.
6. Write a code for simulating ARP /RARP protocols.
7. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
8. Write a program for congestion control using leaky bucket algorithm.
9. Implement three nodes point – to- point networks with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped using NS 2 .

10. Simulate the transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion using NS 2.
11. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination using NS 2.
12. Simulate simple ESS and with transmitting nodes in wireless LAN by simulation and determine the performance with respect to transmission of packets using NS 2

Course Outcome : At the end of the course students will be able to

CO1	Analyze and compare different methods of bandwidth utilization to optimize data transfer efficiency.
CO2	Select the specific IEEE 802 standard protocols to be implemented in the network environment.
CO3	Apply theoretical knowledge of network layer design issues to real-world networking scenarios and troubleshoot network problems effectively.
CO4	Analyze metrics such as throughput, delay, and packet loss rate to see how the protocols behave in each scenario.
CO5	create a user-friendly website that meets modern standards in terms of navigation, design, and performance.

Textbooks :

1. Computer Networks:5th ed by Andrew. S. Tanenbaum PHI Publication.
2. Data Communications and Networks: 3 rd ed byBehrouz A. Forouzan. TataMcGraw Hill publication.

References :

1. William Stallings, Data and Computer Communication, Tenth Edition, Pearson Education, 2013.
2. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach Featuring the Internet, 3 rd Edition

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.
One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2						1	2
CO2	1	1	2	2	3						2	2
CO3	2	2	2	2	2						2	2
CO4	3	2	2	3	3						2	2
CO5	2	2	2	3	3						1	2

3-High 2-Moderate 1- low

Course Title	Theory of Computation	Semester	V
Course Code	MVJ22IS53	CIE	50
Total No. Of Contact Hours	40	SEE	50
No. Of Contact Hours/week	4(L:T:P:S::4:0:0:0)	Total	100
Credits	3	Exam Duration	3 hours

Course Objectives : This Course will enable the students to

1. Acquire knowledge of Automata Theory as the basis of all computer science languages design.
2. Understand the concept of Context Free Grammars and Languages.
3. Understand the concepts of Turing Machine and Chomskian Languages.
4. Acquire knowledge of Decidability.
5. Enrich the knowledge in various phases of compiler ant its use.

Module 1	**8 Hrs**
Finite Automata: Mathematical preliminaries and notations – Central concepts of automata theory – Finite automata -Deterministic Finite Automata - Nondeterministic Finite Automata – Equivalence of DFA and NFA –Finite Automata with Epsilon transitions - Application of FA	
Module 2	**8 Hrs**
Regular Expressions: Regular languages: Regular Expressions – Finite Automata and Regular Expressions –Applications of Regular Expressions - Regular Grammars. Problems on CFG, pushdown automata	
Module 3	
Regular Languages: Properties of regular languages: Pumping lemma for regular languages – Closure properties of regular languages –Equivalence and Minimization of Finite Automata. C Problems on Turing Machine, Halting Problem	
Module 4	**8Hrs**
Context Free Grammar: Context Free languages: Context Free Grammars – Parse Trees - Ambiguity in Grammars and languages– Applications of Context Free Grammars – Pushdown automata (PDA) – Languages of a PDA -Equivalence of PDA ‘s and CFG ‘s, Conversion of PDA -CFG and CFG - PDA Problems on Computational Complexity	
Module 5	**8Hrs**
Context Free Languages: Properties of Context Free Languages: Normal Forms (CNF, GNF) for Context Free Grammars - Pumping lemma for CFL ‘s - Closure properties of CFL Turing Machines: Turing Machines- Programming Techniques for Turing Machines – Multitape Turing Machines. Problems on lexical analysis	

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

CO1	Construct finite automata for given pattern and find its equivalent regular expressions.
CO2	Design and simplify context free grammar and find equivalent pushdown automata for given language
CO3	Design Turing Machines for any languages
CO4	Derive whether a problem is decidable or not
CO5	Understand the basic concepts of compiler Design

Textbooks:

1.Hopcroft J E, MotwaniR and Ullman J D, Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2012.

2.Rich Eiane—Automata Computability and Complexity: Theory and Applications, Second Edition, PHI, 2003.

References:

1. Padma Reddy.A, ―Finite Automata and Formal Languages: A Simple Approach.

2. Raghavan V, Principles of Compiler Design, Third Edition, Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2009

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	2	3							
CO2	2	2	2	2	3							
CO3	1	3	3	2	3							
CO4	2	3	2	2	3							
CO5	2	3	1	2	3							

3-High 2-Moderate 1- low

Course Title	Data Visualization Lab	Semester	V
Course Code	MVJ22ISL54	CIE	50
Total No. Of Contact Hours	26	SEE	50
No. Of Contact Hours/week	2(L:T:P:S::0:0:2:0)	Total	100
Credits	1	Exam Duration	3 hours

Course Objectives : This Course will enable the students to

1. Effective use of Business Intelligence (BI) technology (Tableau) to apply data visualization
2. Discern patterns and relationships in the data.
3. Build Dashboard applications.
4. Communicate the results clearly and concisely.
5. Work with different formats of data sets.

Sl no	LIST OF PROGRAMS
1	Understanding Data, what is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?
2	Getting started with Tableau Software using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps), Using the Show me panel.
3	Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.
4	Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view
5	Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.
6	Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data
7	Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colors.
8	Creating Dashboards & Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.
9	Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing, and Exporting.
10	Creating custom charts, cyclical data and circular area charts, Dual Axis charts

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

CO1	Understand How to import data into Tableau
CO2	Understand Tableau concepts of Dimensions and Measures.
CO3	Develop Programs and understand how to map Visual Layouts and Graphical Properties
CO4	Create a Dashboard that links multiple visualizations
CO5	Use graphical user interfaces to create Frames for providing solutions to real world problems.

Textbooks:

1.Microsoft Power BI cookbook, Brett Powell, 2nd edition

2.R Programming for Data Science by Roger D. Peng (References)

3. The Art of R Programming by Norman Matloff Cengage Learning India

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3							
CO2	2	2	3	2	3							
CO3	2	3	3	2	3							
CO4	2	3	3	2	3							
CO5	2	3	3	2	3							

Course Title	Computer Vision	semester	V
Course Code	MVJ22IS551	CIE	50
Total No. Of Contact Hours	40	SEE	50
No. Of Contact Hours/week	3 (L: T : P :S:: 3: 0: 0 : 0)	Total	100
Credits	3	Exam Duration	3 hours

Course Objectives : This Course will enable the students to

1. Understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization
2. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision
3. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Module 1

Overview of computer vision and its applications: Image Formation and Representation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation

Image Processing: Pixel transforms, color transforms, histogram processing, histogram equalization, filtering, convolution, Fourier transformation and its applications in sharpening, blurring and noise removal

Module 2

Feature detection: edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors, Morphological operations.

Segmentation: Active contours, split & merge, watershed, region splitting, region merging, graph-based segmentation, mean shift and model finding, Normalized cut

Module 3

Camera calibration: camera models; intrinsic and extrinsic parameters; radial lens distortion; direct parameter calibration; camera parameters from projection matrices; orthographic, weak perspective, affine, and perspective camera models.

Module 4

Motion representation: the motion field of rigid objects; motion parallax; optical flow, the image brightness ,constancy equation, affine flow; differential techniques; feature-based techniques; regularization and robust estimation

Motion tracking: statistical filtering; iterated estimation; observability and linear systems; the Kalman filter

Module 5

Object recognition and shape representation: alignment, appearance-based methods, invariants, image eigenspaces

Course Outcome

CO1	Learn fundamentals of computer vision and its applications
CO2	Understand the basic image processing operations to enhance, segment the images.
CO3	Understand the analyzing and extraction of relevant features of the concerned domain problem

CO4	Understand and apply the motion concepts and its relevance in real time applications
CO5	Apply the knowledge in solving high level vision problems like object recognition, image classification etc

Textbooks:

1	Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011
2	Introductory techniques for 3D computer vision, E. Trucco and A. Verri, Prentice Hall, 1998

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3							2
CO2	2	2	3	2	3							2
CO3	2	3	3	2	3							2
CO4	2	3	3	2	3							2
CO5	2	3	3	2	3							2

3-High 2- Moderate 1-Low

Course Title	Artificial Intelligence	**semester**	**V**
Course Code	**MVJ22IS552**	**CIE**	**50**
Total No. Of Contact Hours	**40**	**SEE**	**50**
No. Of Contact Hours/week	**3 (L: T : P :S:: 3: 0: 0 : 0)**	**Total**	**100**
Credits	**3**	**Exam Duration**	**3 hours**

Course Objectives : This Course will enable the students to

1.Understand fundamental concepts in Artificial Intelligence.
2.Understand and analyze the problem-solving techniques and knowledge representation.
3.Design intelligent components or programs to meet desired needs.
4.Implement, and evaluate computer-based intelligent systems.
5.Understand fundamental concepts in Artificial Intelligence.

Module 1	**8 hrs**

Introduction: AI problems, foundation of AI and history of AI, Intelligent agents: Agents and Environments, The concept of rationality, The nature of environments, Structure of agents, Problem solving agents, Problem formulation

Module 2	**8 hrs**

Knowledge Representation & Reasons: Knowledge – Based Agents, The Wumpus world. Propositional Logic: Reasoning patterns in propositional logic - Resolution, Forward & Backward Chaining. Inference in First order logic: Propositional vs. first order inference, Unification & lifting, Forward chaining, Backward chaining, Resolution

Module 3	**8 hrs**

Searching: Searching for solutions, uniformed search strategies – Breadth first search, depth first search, Depth limited search, Iterative deepening depth first search bi-direction search, Comparing uninformed search strategies. Search with partial information (Heuristic search), Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions.
Local search Algorithms: Hill climbing, Simulated annealing search, Local beam search, Genetic algorithms

Module 4	**8 hrs**

Constrain satisfaction problems: Backtracking search for CSPs local search for constraint satisfaction problems.
Game Playing: Games, Minimax algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, Cutting of search.

Module 5	**8 hrs**

Planning: Classical planning problem, Language of planning problems, Expressiveness and extension, planning with state – space search, Forward state spare search, Backward state space search, Heuristics for state space search, Partial order planning Graphs, Planning graphs
Learning: what is learning, Forms of learning, Inductive learning, Learning Decision Trees.

Course Outcome

CO1	Understand the various types and working units of an expert systems
CO2	Evaluate the logic behind the building of knowledge base and knowledge representation
CO3	Deploy Searching Techniques to design intelligent agents
CO4	Implement various Constraint Satisfaction Problem, Game Playing techniques to use in various intelligent system designs
CO5	Apply suitable learning methodology while designing systems based on their applications

Textbooks:

1	Stuart Russel, Peter Norvig, (2009), Artificial Intelligence – A Modern Approach,3rd Edition,

	Pearson Education.
2	E.Rich and K.Knight, (2008), Artificial Intelligence , 3rd Edition, Tata McGraw Hill
3	
References:	
1	Patterson, (2009), Artificial Intelligence and Expert Systems, 2nd Edition, PHI.
2	Ivan Bratka, (2000), PROLOG Programming for Artificial Intelligence. 3rdEdition – Pearson Education.

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	2							1
CO2	2	3	3	2	3							1
CO3	3	3	2	2	2							2
CO4	2	3	3	3	3							1
CO5	2	3	2	2	2							1

3-High 2- Moderate 1- Low

Course Title	Unix System Programming	semester	V
Course Code	MVJ22IS553	CIE	50
Total No. Of Contact Hours	40	SEE	50
No. Of Contact Hours/week	3(L:T:P:S::3:0:0:0)	Total	100
Credits	3	Exam Duration	3 hours

Course Objectives : This Course will enable the students to

1.Understand fundamental concepts in Unix Programming .
2.Understand the problem solving techniques and knowledge representation.
3.Design intelligent components or programs to meet desired needs.
4. Ability to understand and reason out the working of Unix Systems
5. Build an application/service over a Unix system.

Module 1

UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.
Introduction to UNIX - Introduction, History, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput, and bc.

Module 2

UNIX Files and APIs : File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs.

Module 3

UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.
Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection.

Module 4

Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client- Server Model

Module 5

Interprocess Communication : Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.

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

CO1	Learn fundamentals of Unix system and its applications
CO2	Understand the basic image processing operations to enhance, segment the images
CO3	Understand the analyzing and extraction of relevant features of the concerned domain problem

CO4	Understand and apply the motion concepts and its relevance in real time applications
CO5	Apply the knowledge in solving high level unix system problems.

Textbooks:

1	Charlie jacob, "Unix Programming System: An Introduction", Springer-Verlag
2	Hassan K Khalil, Unix Systems, Prentice - Hall International (US), 2006.

References:

1	**V R Ganapthi, "Interprocess Communication", Prentice-Hall, India, 1991, 2. Shankar Sastry, "Nonlinear System Analysis, Stability and Control", Springer, 1999**

CIE Assessment :

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3							
CO2	2	3	3	2	3							
CO3	2	2	3	2	3							
CO4	2	2	3	2	3							
CO5	2	2	2	2	3							

Course Title	Distributed Systems	semester	V
Course Code	MVJ22IS554	CIE	50
Total No. Of Contact Hours	40	SEE	50
No. Of Contact Hours/week	3(L:T:P:S::3:0:0:0)	Total	100
Credits	3	Exam Duration	3 hours

Course Objectives : This Course will enable the students to

Understand fundamental concepts in Distributed systems
Understand the problem-solving techniques and knowledge representation.
Design intelligent components or programs to meet desired needs.
Implement, and evaluate a computer-based distributed systems.
Understand fundamental concepts in Distributed systems.

Module 1 — **8 Hrs**

Distributed Systems: Characterization of Distributed Systems: Introduction, Examples of DS, Resource sharing and the Web, Challenges System Models: Architectural Models, Fundamental Models

Module 2 — **8 Hrs**

Files and APIs: For complete syllabus and results, class timetable and more pls download iStudy. It's a light weight, easy to use, no images, no pdfs platform to make students life easier.

Module 3 — **8 Hrs**

Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System

Module 4 — **8 Hrs**

Time and Global States: Introduction, Clocks, events and process status, synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections

Module 5 — **8 Hrs**

Inter-process Communication: Introduction, The API for the Internet Protocols, External Data Representation and Marshalling, Client-Server Communication, Group Communication, Case Study: IPC in UNIX.

Course Outcome: At the end of the course the students will be able to

CO1	Illustrate the mechanism of IPC between distributed objects
CO2	Describe the distributed file service architecture and the important characteristics of SUN NFS.
CO3	Discuss concurrency control algorithms applied in distributed transactions
CO4	Apply logical time and logical clocks to order events correctly in a distributed system
CO5	Design and implement communication systems between processes in various computing environments.

Textbooks:

1	George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5th Edition, Pearson Publications, 2009

References:

1	T Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2	AjayD. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3	Sunita Mahajan, Seema Shan, Distributed Computing, Oxford University Press,2015

CIE Assessment:

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SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3							3	3
CO2	2	2	3	3							2	3
CO3	2	2	2	3							3	2
CO4	3	2	3	2							2	3
CO5	2	3	3	2							3	2

3-High 2- Moderate 1-low

VI SEMESTER
(2022 SCHEME)

Course Title	Full Stack Development	Semester	VI
Course code	MVJ22IS61	CIE	50
Total No. of Contact Hours	3:0:1	SEE	50
No. of Contact Hours/week	40 L+26 P	Total	100
Credits	4	Exam. Duration	3

COURSE OBJECTIVES: **This course will enable students to**

1. Explain the use of learning full stack web development.
2. Make use of rapid application development in the design of responsive web pages.
3. Illustrate Models, Views and Templates with their connectivity in Django for full stack web development.
4. Demonstrate the use of state management and admin interfaces automation in Django.

Module 1	8hrs

The Modern Web: Rise of the web, Mobile web, The state of HTML, Applications vs web sites
Planning your Work: Identifying Requirements, Defining the work, Tracking the work, Continuous Improvements
User Experience: Information Architecture, Getting the user Experience, Polishing the user Experience, Implementing The user Experience.

MODULE-II	8hrs

Front End: HTML, From Server to browser, Styling, Components, Responsive design, Progressive Enhancement, search engine Optimization.
Javascript: Asynchronicity, Javascript in the browser, Offline First Development, Document object Model, Server side javascript, Javascript Modules, Structuring your javascript, javascript types, Functional Programming, Connecting components together , communication between components

MODULE-III	8hrs

Accessibility : working with Assistive Technologies, Dealing with interative UI, Testing for Accessibilty, Avoiding common mistakes
API: API responsibilities, Designing REST API, Securing Your API, Event Based APIs, Discovering APIs, Using APIs, API testing – postman

MODULE-IV	8hrs

Deployment: Twelve Factor Apps, Developer Machines, Production Environments, Moving code into Production, Infrastructure, Immutable infrastructure, Continuous Delivery and Continuous Deployment

MODULE-V	8hrs

Introduction to React JS: Introduction, understanding Components and Props, State and Lifecycle, React Hooks, handling Events, Working with Forms, Conditional Rendering, List and Keys, Styling in React JS .

LABORATORY EXPERIMENTS

Programs:

1. Write a program to create a simple webpage using HTML.
2. Write a program to create a website using HTML CSS and JavaScript
3. Write a program to build a Chat module using HTML CSS and JavaScript
4. Write a program to create a simple calculator Application using React JS
5. Write a program to create a voting application using React JS
6. Write a program to create and Build a Password Strength Check using JQuery
7. Write a program to create and Build a star rating system using JQuery
8. Create a Simple Login form using React JS
9. Using the CMS users must be able to design a web page using the drag and drop method
10. Create a project on Grocery delivery application
11. Connecting our TODO React js Project with Firebase

Course outcomes: Students will able to

CO1	Understand the basics of Web Application Development
CO2	Learn the Front End Developing Tools.
CO3	Develop the REST APIs for Real time Applications
CO4	Apply different Deployment strategies for Producing products
CO5	Create Applications using React JS

Textbooks:

1	The Full Stack Developer Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, Chris Northwood https://doi.org/10.1007/978-1-4842-4152-3
2	Learning React JavaScript Library From Scratch eBook : Sidelnikov, Greg.

CIE Assessment:

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Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	3						3	3
CO2	2	2	3	3	3						2	3
CO3	2	2	2	3	3						3	2
CO4	3	2	3	2	3						2	3
CO5	2	3	3	2	3						3	2

3- High 2- Moderate 1- Low

Course Title	Machine Learning	Semester	VI
Course code	MVJ22IS62	CIE	50
Total No. of Contact Hours :	3:0:0:0(L:T:P:S::3:0:0:0)	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

Course objectives: The course will enable the students to

1.Understand fundamentals of machine learning, including the types of learning, data pre-processing techniques, and design principles, to enable them to develop effective learning systems that can tackle real-world problems.

2. Implement and evaluate regression and classification models, including linear and polynomial regression, logistic regression, and decision trees, to solve real-world problems and make informed decisions.

3.Understand classification techniques, including decision trees, random forests, naive Bayes, K-NN, SVM, and evaluation metrics, to develop robust and accurate classification models that can handle complex data sets and real-world applications.

4. Understand the concepts and techniques of clustering and artificial neural networks, enabling them to apply clustering algorithms and design neural networks to solve real-world problems, including data clustering, classification, and prediction.

5. Understand the fundamentals of reinforcement learning and deep learning, enabling them to understand the concepts of learning from feedback and building deep neural networks to solve complex problems in artificial intelligence, such as decision-making and pattern recognition.

Module 1	8hrs

Introduction: Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning, Unsupervised learning, and Reinforcement learning.

Data Pre-processing: Need of Data Pre-processing, Data Pre-processing Methods: Data Cleaning, Data Integration, Data Transformation, Data Reduction; Feature Scaling (Normalization and Standardization), Splitting dataset into Training and Testing set.

Association Rules Learning: Need and Application of Association Rules Learning, Basic concepts of Association Rule Mining, Naïve algorithm, Apriori algorithm.

Module 2	8hrs

Regression: Linear Regression, Multiple Linear Regression and Polynomial Regression, Evaluation Regression Model's Performance (RMSE, Mean Absolute Error, Correlation,RSquare),Regularization Methods

Classification: Need and Applications of Classification, Logistic Regression, Decision tree.

Module 3	8hrs

Advanced Classification: Tree induction algorithm – split algorithm based on information theory,

split algorithm based on Gini index; Random Forest classification, Naïve Bayes algorithm; K-Nearest Neighbors (K-NN), Support Vector Machine (SVM), Evaluating Classification Model's Performance (Sensitivity, Specificity, Precision, Recall, etc.)

Module 4	**8hrs**

Clustering: Need and Applications of Clustering, Partitioned methods, Hierarchical methods, Density-based methods. Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptron, Backpropagation algorithm

Module 5	**8hrs**

Reinforcement Learning: Introduction, Learning Task, Q Learning. Deep Learning: Introduction to Deep Learning-Reasons to go Deep Learning.

Course outcomes: Students will able to	
CO1	Identify the issues in machine learning and Algorithms for solving it.
CO2	Explain theory of probability and statistics related to machine learning.
CO3	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor.
CO4	Describe protocols of resource constraint network.
CO5	Explain the concepts of deep learning.

Textbooks:	
1	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2	Alpaydin E., Introduction to Machine Learning, MIT Press (2014) 3rd Edition.
3	Vijayvargia Abhishek, Machine Learning with Python, BPB Publication (2018)

Reference Books:	
1	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2	Ethem Alpaydin,Introduction toMachine learning,2nd Edition,MIT Press.

CIE Assessment:

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SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	3						3	3
CO2	2	2	3	3	3						2	3
CO3	2	2	2	3	3						3	2
CO4	3	2	3	2	3						2	3
CO5	2	3	3	2	3						3	2

Course Title	Blockchain Technology	Semester	VI
Course code	MVJ22IS631	CIE	50+50
Total No. of Contact Hours	3:0: 0:0 (L:T:P:S)	SEE	50+50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Familiarise the functional/operational aspects of cryptocurrency ecosystem.
2. Understand emerging abstract models for Blockchain Technology.
3. Understand how blockchain systems (mainly Bitcoin and Ethereum) work and how to securely interact with them.
4. Identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain.
5. Design, build, and deploy smart contracts and distributed applications.

Module 1		8hrs

IN Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Module 2		8hrs

Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Module 3		8hrs

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

Module 4		8hrs

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

Module 5		8hrs

Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects- Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Course outcomes: Students will able to

CO1	Basic Cryptographic primitives used in Blockchain – Secure, Collison-resistant hash
CO2	functions, digital signature, public key cryptosystems, zero-knowledge proof systems.
CO3	Policies and applications of Blockchain in Distributed databases.
CO4	Explain the Nakamoto consensus, List and describe differences between proof-of-
CO5	work and proof-of-stake consensus.

Textbooks:

1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2	Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.

Reference Books:

1	Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
2	DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
3	Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	-	-	-	-	-	-	-	3
CO2	3	3	1	-	-	-	-	-	-	-	-	3
CO3	3	3	1	2	-	-	-	-	-	1	-	3
CO4	3	3	3	3	-	-	-	2	2	2	-	3
CO5	3	3	3	3	-	-	2	2	3	2	-	3

Course Title	Internet of Things	Semester	VI
Course code	MVJ22IS632	CIE	50
Total No. of Contact Hours : L:T:P:S	3:0:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

Course Objective : This course will enable the students to

1.Assess the genesis and impact of IoT applications, architectures in real world
2.Illustrate diverse methods of deploying smart objects and connect them to network.
3.Compare different Application protocols for IoT.

Module 1	8hrs

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Module 2	8hrs

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies, IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT, Profiles and Compliances.

Module 3	8hrs

Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods, Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security

Module 4	8hrs

Common Challenges in OT Security**, How IT and OT Security Practices and Systems Vary, Formal** Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment, IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints.

Module 5	8hrs

RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

Course outcomes: Students will able to

CO1	Describe the characteristics and key technologies for IoT system
CO2	Interfacing Sensor and Actuator with Arduino development board.
CO3	Implementing IoT device by interfacing communication module and cloud
CO4	Describe protocols of resource constraint network.

CO5	Elaborate the need for Data Analytics and Security in IoT.
Textbooks:	
1	"IoTFundamentals: Networking Technologies, Protocols, and Use Cases for the Internet ofThings", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743
2	"Internet of Things", Srinivasa K G,CENGAGE Leaning India,2017

CIE Assessment:

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SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	3	0	0	0	0	0	0	1	1
CO2	2	3	0	3	0	0	0	0	0	0	1	1
CO3	2	3	0	3	0	0	0	0	0	0	1	1
CO4	3	3	0	3	0	0	0	0	0	0	1	1
CO5	3	3	0	3	0	0	0	0	0	0	1	1

Course Title	Compiler Design	Semester	VI
Course code	MVJ22IS633	CIE	50
Total No. of Contact Hours :	3:0:0:0(L:T:P:S)	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Learn the various parsing techniques and different levels of translation.
2. Learn how to obtain specific object code from source language.
3. Learn how to optimize the code and schedule for optimal performance.

Module 1	8hrs

FRONT END OF COMPILERS: The Structure of Compiler – Lexical Analysis: Role of Lexical Analyzer, Specification and Recognition of Tokens, Syntax Analysis: Top Down Parsing, Bottom up Parsing, LR Parsers: SLR, CLR, and LALR.

Module 2	8hrs

INTERMEDIATE CODE GENERATION: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Syntax Directed Translation Schemes, Intermediate Languages: Syntax Tree, Three Address Code, Postfix Code, Declarations, Translation of Expressions, Type Checking, Back Patching.

Module 3	8hrs

RUNTIME AND OBJECT CODE GENERATION: Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of Code Generator - Register Allocation and Assignment – Instruction Selection by Tree Rewriting – Optimal Code Generation for Expressions – Dynamic Programming Code Generation.

Module 4	8hrs

CODE OPTIMIZATION: Basic Blocks and Flow Graphs – Optimization of Basic Blocks – Principal Sources of Optimizations – Data Flow Analysis – Constant Propagation – Partial Redundancy Elimination – Peephole Optimizations.

Module 5	8hrs

SCHEDULING AND OPTIMIZING FOR PARALLELISM: Code Scheduling Constraints – Basic Block Scheduling – Global Code Scheduling - Basic Concepts in Parallelization – Parallelizing Matrix Multiplication – Iteration Spaces – Affine Array Indexes.

Course outcomes: Students will able to

CO1	Design compiler phases from language specification.
CO2	Design code generators for the specified machine.
CO3	Analyze Object Code Generation techniques.
CO4	Apply the various optimization techniques.
CO5	Understand the Optimizing for Parallelism
Textbooks:	
1	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, ―Compilers: Principles, Techniques and Tools‖, Second Edition, Pearson Education, 2009.
2	Randy Allen, Ken Kennedy, ―Optimizing Compilers for Modern Architectures: A Dependence based Approach‖, Morgan Kaufmann Publishers, 2002.
3	Keith D Cooper and Linda Torczon, ―Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004
4	V. Raghavan, ―Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.
5	Allen I. Holub, ―Compiler Design in C‖, Prentice-Hall Software Series, 1993.
6	Steven S. Muchnick, ―Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
7	Keith D Cooper and Linda Torczon, ―Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	2	-	-	-	-	-	-	-	2
CO2	3	3	2	3	1	-	-	-	-	-	-	2
CO3	3	3	2	3	1	-	-	-	-	-	-	2
CO4	3	3	2	3	2	-	-	-	-	-	-	2
CO5	3	3	2	3	2	-	-	-	-	-	-	2

Course Title	Cloud Computing	Semester	VI
Course code	MVJ22IS634	CIE	50
Total No. of Contact Hours :	3:0:0:0(L:T:P:S)	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. To explain the fundamentals of cloud computing
2. To illustrate the cloud application programming and aneka platform
3. To Contrast different cloud platforms used in industry

Module 1	**8hrs**

Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services

Module 2	**8hrs**

Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud.

Module 3	**8hrs**

Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization
Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems

Module 4	**8hrs**

Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds,
Exercises and problems.

Module 5	**8hrs**

Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

Course outcomes: Students will able to

CO1	Compare the strengths and limitations of cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing
CO3	Apply suitable virtualization concept (can be attained through assignments and CIE)

CO4	Choose the appropriate cloud player
CO5	Address the core issues of cloud computing such as security, privacy and interoperability (can
Textbooks:	
1	Cloud Computing Theory and Practice, Dan C Marinescu ,Elsevier(MK) 2013.
2	Computing Principles and Paradigms, Rajkumar Buyya , James Broberg, Andrzej Goscinski Willey 2014.
3	Cloud Computing Implementation, Management and Security, John W Rittinghouse, James F Ransome CRC Press 2013

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	2	2	-	-	-	-	-
CO2	3	3	-	-	3	-	2	-	-	-	-	-
CO3	3	3	3	-	3	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	2	-	-	-	2	-
CO5	3	3	-	3	-	2	-	2	-	2	2	2

Course Title	Introduction To Data Structures	Semester	VI
Course code	MVJ22IS641	CIE	50
Total No. of Contact Hours :	3:0:0:0(L:T:P:S)	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Discuss the fundamental concepts and principles of data structures.
2. Understand the importance of data structures in computer programming and problem solving.
3. A compressive overview of various data structures such as arrays, linked lists, stacks, queues, trees and graphs.
4. Prepare the students for advanced courses in algorithms, data analysis.

Module 1	8hrs

Introduction : Data Structures definition , classification of data structures , Arrays – Definition, Declaration , Types of arrays, Structures , Pointers.

Module 2	8hrs

Stacks- definition, implementation of stacks using arrays, operations of stacks.

Queues- Introduction, Types of queues, Linear queue using arrays, operations on linear queue, circular queue. Limitation of linear queue, Linear Queue vs circular queue.

Module 3	8hrs

Linked List -Linked-list and its types- singly linked lists- doubly-linked lists- circular linked lists, Applications of Linear Data Structures.

Module 4	8hrs

Non Linear Data Structures: Trees – Introduction , Terminologies, Representation of trees , Types of Trees, Application of trees , Binary Tree – Representation, Traversal techniques, Binary Search trees – Tree Construction, Expression trees. Application of Binary search tree.

Module 5	8hrs

Graphs: Introduction , terminologies, Representation of graphs , Connected graph , graph traversal techniques, Application of graphs in data structures **.**
Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extensible Hashing.

Course outcomes: Students will able to

CO1	Evaluate the performance and efficiency of different operations on arrays, stacks, queues, and circular queues.
CO2	Understand the different types of linked list.
CO3	Implement basic operations on trees.
CO4	Demonstrate the representation and traversal techniques of graphs and their applications.

CO5	Use the concepts of Hashing in storing data.

Textbooks:	
1	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2011
2	Fundamentals of Data structures , Ellis Horowitz, sartaj sahni,
3	Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures & Algorithms, Pearson Education, New Delhi, 2006

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**3**	**3**	**3**							**2**
CO2	**3**	**2**	**2**	**3**	**3**							**2**
CO3	**3**	**2**	**2**	**3**	**3**							**2**
CO4	**3**	**2**	**3**	**3**	**3**							**2**
CO5	**3**	**2**	**3**	**3**	**3**							**2**

Course Title	Fundamentals of Operating Systems	Semester	VI
Course code	MVJ22IS642	CIE	50
Total No. of Contact Hours : L:T:P:S	3:0:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. understanding the fundamental concepts of operating systems.
2. Analyse the exchanging data between different process.
3. Discuss the deadlock mechanism in operating systems.
4. Recognize the importance of process and memory management.
5. Outline the features of files and file management systems.

Module 1	8hrs

The Basics: An overview: Introduction to operating systems, components of an operating systems, Evolution of operating system, architecture of operating system, Functions of operating system.

Module 2	8hrs

Operating system services, user and operating system interface, system calls and services, operating system structure, **Process:** Introduction, Process management, OS view of processes. Process states. **Interrupts:** Interrupts in operating systems, Interprocess communication, types of interprocess communications.

Module 3	8hrs

Deadlocks: what is Deadlock, Deadlock Characteristics, resource management, conditions of deadlock – Handling Deadlocks, deadlock avoidance, Deadlock Detection, Deadlock Recovery.

Module 4	8hrs

Process scheduling: Concept of Process Scheduling, operation on Processes scheduling, Scheduling criteria.

Memory Management: Memory organization in operating system, Memory Hierarchy, Memory Management Strategies. Contiguous Memory Allocation, Non-contiguous Memory Allocation.

Module 5	8hrs

File and Database Systems: File concept, Access methods, Data Hierarchy, Directory Structure, File Protection, File System Structure. File access control.

Course outcomes: Students will able to

CO1	Demonstrate need for OS and different types of OS
CO2	Understand the process and interprocess communication
CO3	Apply suitable methods to handle and avoid deadlock
CO4	Analyze and solve problems related to process management, memory management
CO5	create, modify, and delete files and directories within an operating system.

Textbooks:

1	"Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, 10th ed.
2	"Modern Operating Systems" by Andrew S. Tanenbaum and Herbert Bos,5th ed.

3	"Operating Systems: Internals and Design Principles" by William Stallings,7th ed

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**3**	**2**	**3**							
CO2	**2**	**3**	**3**	**3**	**3**							
CO3	**2**	**3**	**3**	**2**	**3**							
CO4	**2**	**3**	**2**	**3**	**3**							
CO5	**2**	**3**	**2**	**2**	**2**							

Course Title	Mobile Application Development	Semester	VI
Course code	MVJ22IS643	CIE	50
Total No. of Contact Hours :	3:0:0:0(L:T:P:S)	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1.Understand system requirements for mobile applications.

2.Generate suitable design using specific mobile development frameworks.

3.Implement the design using specific mobile development frameworks.

4.Deploy the mobile applications in marketplace for distribution.

Module 1	8hrs

Introduction: Introduction to mobile application - Market values for mobile applications System requirements for mobile application,Mobile application development architecture.

Module 2	8hrs

Designing Applications using Android: Developing user interfaces -Layout -Input Controls and Events- Menus - Dialogs, Notifications and Toasts

Module 3	8hrs

Multimedia & Services: Lifecycle of a Service - Managing ServicesGPS API Playing audio, video.

Module 4	8hrs

Technology I Android: Introduction Establishing the development environment, Android architecture Activities and views Interacting with UI Persisting data using SQLite Packaging and deployment.

Module 5	8hrs

Technology II IOS: Introduction to Objective C IOS features UI implementation Touch frameworks Data persistence using Core Data and SQLite.

CO1	Demonstrate knowledge on basics of mobile application.
CO2	Understand the framework of mobile application and design simple interfaces
CO3	Create an application using multimedia components.
CO4	Develop and deploy application with server side connectivity.
CO5	Understand basic concepts of IOS

Textbooks:	
1	James Dovey and Ash Furrow ,"Beginning objective C",Apress,20212
2	Android in Practice",Dream Tech,2012 Charlie Collins,Michael Galpin and Matthias Kappler.

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	-	-	-	-	-	-	-	3
CO2	3	3	1	-	-	-	-	-	-	-	-	3
CO3	3	3	1	2	-	-	-	-	-	1	-	3
CO4	3	3	3	3	-	-	-	2	2	2	-	3
CO5	3	3	3	3	-	-	2	2	3	2	-	3

Course Title	Introduction to AI	SEMESTER	VI
Course code	MVJ22IS644	CIE	50
Total No. of Contact Hours : L:T:P:S	3:0:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Identify the problems where AI is required and the different methods available
2. Compare and contrast different AI techniques available.
3. Define and explain learning algorithms

Module 1	8hrs
What is artificial intelligence?, Problems, Problem Spaces and search	

Module 2	8hrs
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules.	

Module 3	8hrs
Symbolic Reasoning under Uncertainty, Statistical reasoning	

Module 4	8hrs
Heuristic search techniques: Generate and test, Hill Climbing, Best First Search, ProblemReduction, Constraint Satisfaction, Means-ends Analysis.	

Module 5	8hrs
Learning, Expert Systems.	

Course outcomes: Students will able to

CO1	Identify the AI based problems.
CO2	Apply techniques to solve problems
CO3	Define learning and explain various learning techniques.
CO4	Implement projects using different AI learning techniques.
CO5	Discuss Expert system.

Textbooks:

1	E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.
2	Stuart Russel, Peter Norvig, "Artificial Intelligence: A Modern Approach" , 2nd Edition, Pearson Education, 2003.
3	Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50

marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	
CO1	2	2	3	3	2							**2**	
CO2	2	3	3	3	2							**2**	
CO3	3	2	2	2	3							**2**	
CO4	3	2	2	3	3							**2**	
CO5	3	3	3	3	3							**2**	

SEMESTER -6TH MACHINE LEARNING LAB			
Course code	MVJ22ISL66	**CIE**	**50**
Total No. of Contact Hours : L:T:P:S	**0:0:2:0**	**SEE**	**50**
No. of Contact Hours/week	**20**	**Total**	**100**
Credits	**1**	**Exam. Duration**	**3**

COURSE OBJECTIVES: ***This course will enable students to***

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

LIST OF PROGRAMS

1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
3	Develop a program to demonstrate the prediction of values of a given dataset using Linear regression.
4	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
6	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
8	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

9	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using k- Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
10	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
11	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

Course outcomes: Students will able to	
CO1	Preprocess raw data for machine learning algorithms. to implement andevaluate linear regression models.
CO2	Implement and evaluate logistic regression models.
CO3	Implement and evaluate KNN models for both classification and regression tasks. To implement and evaluate SVM models with different kernels
CO4	Perform dimensionality reduction using PCA and understand its impact on the dataset. to implement and evaluate K-Means clustering and determine the optimal number of clusters.
CO5	To implement and evaluate ensemble methods and understand their advantages over individual models

Textbooks:	
1	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.

CIE Assessment:

Continuous Internal Evaluation (CIE):
Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

SEE Assessment:

SEE for 50 marks are executed by means of an examination.

CO-PO MAPPING

COPO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	1	-	-	-	-	-	-	2	-	1
CO2	2	1	1	-	-	-	-	-	-	2	-	1

CO3	2	1	1	-	-	-	-	-	-	2	-	1	
CO4	2	1	1	-	-	-	-	-	-	2	-	1	
CO5	2	1	1	-	-	-	-	-	-	2	-	1	

VII SEMESTER
(2022 SCHEME)

Course Title	Big Data Analytics	Semester	VII
Course code	MVJ22IS71	CIE	50+50
Total No. of Contact Hours	3:0:1	SEE	50+50
No. of Contact Hours/week	40 L+26 P	Total	100
Credits	4	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hadoop Eco System.
6. Explain different approaches for text analysis and big data.

Module 1	8hrs

Introduction To Big Data : Types of Digital Data, Introduction to Big Data, Analysing Data with Unix tools, The Big Data Foundation, Big Data Computing Platforms (or Computing Platforms That Handle the Big Data Analytics Tsunami), Big Data Computation, More on Big Data Storage, Big Data Computational Limitations, Big Data Emerging Technologies.

Module 2	8hrs

Basics of Hadoop: Hadoop Architecture, The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance. Analysing Data with Hadoop, Hadoop Streaming, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

Module 3	8hrs

Map Reduce: Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.
Hadoop Ecosystem And Yarn: Hadoop ecosystem components - SPARK, FLUME, Hadoop 2.0 New Features- NameNode High Availability, HDFS Federation, MRv2, YARN.

Module 4	8hrs

Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.
Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.
Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

Module 5	8hrs

Understanding Text Analytics and big Data: Exploring Unstructured data, Understanding Text Analytics, Analysis and extraction techniques, Putting the results together with structured data, putting big data to use, Text analytics tools for Big Data.
Customized approaches for Analysis of Big Data: Different approaches to big data Analysis, custom and semi-custom applications for big data analysis.

LABORATORY EXPERIMENTS

1. Installation of Hadoop and basic commands execution on Hadoop.
2. Implementation of wordcount program using MapReduce.
3. Implementation of max avg of student marks using MapReduce programs.
4. Implement MapReduce program to find the max temperature.
5. Implementation of matrix multiplication using map reduce program.
6. Implement MapReduce program to find the max. Fuel consumed by the vehicles in the city.
7. Implement MapReduce program to find the average of city MPG just for electric cars for the given data sets
8. Implement the MapReduce program to find Even and odd numbers.
9. Implement the MapReduce program to find the list of prime numbers in the given data sets.
10. Implement MapReduce program to find the total and Average salary of the employees.

Course outcomes: Students will able to

CO1	Describe big data and use cases from selected business domains
CO2	Install, configure, and run Hadoop and HDFS
CO3	Perform map-reduce analytics using Hadoop
CO4	Use Hadoop related tools such as HBase, Pig, and Hive for big data Analytics
CO5	Understand different Applications of big data approaches

Textbooks:

1	Big Data Analytics" , Seema Acharya, Subhasini Chellappan, Wiley 2015
2	Understanding Big data: Analytics for Enterprise Class Hadoop and Streaming Data,Chris Eaton, Dirk deroos et al., 1 st edition, Tata McGraw Hill, 2015, ISBN 13: 978-9339221270
3	Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
4	Big data for dummies, Judith Hurwitz, Alan Nugent,Fern Halper, Marcia Kaufman, Wiley Publications, 1st edition, 2013, ISBN: 978-1-118-50422-2
5	Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Michael Minelli ,Michele Chambers , Ambiga Dhiraj

CIE Assessment:
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Laboratory- 50 Marks
Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**1**	**2**	**2**	**-**							1
CO2	**2**	**2**	**2**	**2**	**-**							1
CO3	**2**	**2**	**2**	**2**	**3**							1
CO4	**2**	**2**	**2**	**2**	**3**							1
CO5	**2**	**2**	**2**	**2**	**3**							1

Course Title	Parallel Computing	Semester	VII
Course code	MVJ22IS72	CIE	50+50
Total No. of Contact Hours	3:0:1	SEE	50+50
No. of Contact Hours/week	40 L+26 P	Total	100
Credits	4	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Understand fundamental concepts in Parallel Computing.
2. Understand Distributed-Memory Programming with MPI.
3. Understand parallel programming model, analyse synchronization in real computing problems.
4. Apply open MP on Shared memory programming.

Module 1	8hrs

Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing. Parallel Programming Platforms: Trends in microprocessor architectures - limitations of memory system performance – parallel computing platforms – communication costs in parallel machines – routing mechanisms for interconnection networks.

Module 2	8hrs

Principles of Parallel Algorithm Design: Preliminaries – decomposition techniques – characteristics of tasks and interactions – mapping techniques for load balancing – methods for containing interaction overheads – parallel algorithm models. Basic Communication Operations: One-to-all broadcast and all-to-one reduction – all-to-all broadcast reduction – all-reduce and prefix-sum operations – scatter and gather – all to-all personalized communication – circular shift – improving the speed of some communication Operation.

Module 3	8hrs

Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.

Module 4	8hrs

System Model Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation And Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation. Case study: Java RMI.

Module 5	8hrs

Peer-to-peer Systems – Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays. Overlay case studies: Pastry, Tapestry. Distributed File Systems –Introduction – File service architecture – Andrew File system.

LABORATORY EXPERIMENTS

1.Familiarization with HPC programming paradigms: Single program multiple data (SPMD) & MPMD

2. To interface Speeding up C/Fortran/Python programs: Vectorization; Compiler options.

3. Programming in Message Passing Interface (MPI): Point-to-point and collective communications; Parallel I/O; MPI for Python and C/Fortran.

4. Programming in OpenMP.

5. Programming GPUs using OpenACC.

6. Programming GPUs using CuPy and CUDA

7. Reduction clause in OpenMP

8. Scheduling loops in OpenMP-odd even transposition sort

9. Synchronization in OpenMp – Producer – Consumer problem

10. OpenMP program for fork join model

Course outcomes: Students will able to

CO1	Acquire the skills to implement software effectively and efficiently on parallel hardware platforms
CO2	Discuss trends in Distributed Systems
CO3	Apply network virtualization.
CO4	Apply remote method invocation and objects.
CO5	Differentiate the file systems.

Textbooks:

1	P. S. Pacheco, An Introduction to Parallel Programming, Elsevier (2011)
2	M. Quinn, Parallel Programming in C and OpenMP, McCraw Hill Education (India) (2003)
3	A. Grama, A. Gupta, G. Karypis, and V. Kumar, Introduction to Parallel Computing, Pearson (2007)
4	G. Zaccone. Python Parallel Programming Cookbook, Packt Publ. (2015)
5	R. Farber, Parallel Programming with OpenACC, Morgan Kaufmann

CIE Assessment:

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Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**3**	**3**							
CO2	**3**	**2**	**3**	**3**	**3**							
CO3	**2**	**3**	**2**	**3**	**3**							
CO4	**3**	**2**	**3**	**3**	**3**							
CO5	**2**	**3**	**3**	**3**	**3**							

Course Title	Information and Network Security	Semester	VII
Course code	MVJ22IS73	CIE	50+50
Total No. of Contact Hours	3:0:0	SEE	50+50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Identify the major types of threats to information security and the associated attacks, Services and Mechanisms.
2. Design and develop cryptographic algorithms using public key cryptography.
3. Generate the own key for developing cryptography algorithms.
4. Understand various Transport-level Security and Wireless Network Security
5. Generate and distribute a PGP key pair and use the PGP package to send an encrypted e- mail message.

Module 1	8hrs

Computer Security Concepts: Introduction, The need for security, Security approaches, Principles of security, The OSI Security Architecture, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security. **Cryptography:** Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4 45, Cipher Block Modes of Operation, Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Algorithms (Knapsack, RSA, Diffie-Hellman, Elliptic Curve Cryptography), Digital Signatures.

Module 2	8hrs

Network Security Applications: Symmetric Key Distribution Using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption**,** Public key infrastructure, Federated Identity Management. **Transport Level Security:** Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell (SSH). **Wireless Network Security:** Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security.

Module 3	8hrs

Electronic Mail Security: Pretty Good Privacy**,** S/MIME 241, DomainKeys Identified Mail. IP **Security**: IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites, Intrusion Detection, Password Management, Firewalls – Types, Location and Configurations, Basics of SNMP, Legal and Ethical Aspects - Intellectual Property, Privacy, Ethical Issue

Module 4	8hrs

Hash Functions: Introduction, The Birthday Problem, Non-Cryptographic Hashes, Tiger Hash, HMAC, Uses. **Advanced Cryptanalysis:** Linear and differential Cryptanalysis, Side Channel Attack on RSA, Lattice Reduction and Knapsack, Hellman's time memory trade off. **Access Control:** Authentication, Authorization, Simple Authentication Protocols

Module 5	8hrs

Malware: Introduction, Types **Insecurity in software:** Software Reverse Engineering, Software Tamper Resistance, Digital Rights Management, Software Development. **Operating System and Security:** Operating System Security Functions, Trusted Operating Systems	
Course outcomes: Students will able to	
CO1	Identify common security threats and vulnerabilities in networks and information systems.
CO2	learn about encryption techniques, access control mechanisms, and security protocols.
CO3	Evaluate and propose solutions to legal and ethical challenges in the context of technology and information systems.
CO4	Apply mathematical and statistical methods to cryptanalysis and develop strategies for breaking encrypted messages.
CO5	Develop skills in malware analysis, reverse engineering, and incident response to effectively combat malware threats.
Textbooks:	
1	Principles of Information Security - Michael E. Whitman and Herbert J. Mattord, 2nd Edition, Thompson, 2005.
2	Network Security Essentials Applications and Standards - William Stallings, Person Education, 2000
3	Cryptography and Network Security - Behrouz A. Forouzan, Tata McGraw-Hill, 2007

CIE Assessment:

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SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**3**	**3**							**2**
CO2	**2**	**3**	**2**	**2**	**3**							**2**
CO3	**3**	**3**	**3**	**2**	**2**							**3**
CO4	**2**	**3**	**3**	**2**	**3**							**2**
CO5	**3**	**3**	**2**	**2**	**3**							**3**

Course Title	Deep Learning	Semester	VII
Course code	MVJ22IS741	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Learn feed forward deep networks.
2. Understand convolutional networks and sequence modelling.
3. Study probabilistic models and auto encoders.
4. Expose the students to various deep generative models.
5. Study the various applications of deep learning.

Module 1	8hrs

DEEP NETWORKS: Machine Learning Basics: Learning Algorithms – Supervised and Unsupervised learning – Feed forward Deep networks – regularization – Optimization for training Deep models.

Module 2	8hrs

CONVOLUTIONAL NETWORKS AND SEQUENCE MODELLING : Convolutional Networks – Convolution operation – Motivation Pooling – Basic Convolution function – Algorithms – Recurrent and recursive nets : Recurrent neural networks – Bidirectional RNN – Recursive Neural networks – Auto regressive networks – Long term dependencies – Temporal dependencies – Approximate search.

Module 3	8hrs

PROBABILISTIC MODELS AND AUTO ENCODERS : Structured Probabilistic models : Challenges of unstructured modelling – using graphs to describe model structure – Learning about dependencies – inference – Deep learning approach – Monte carlo models Linear Factor models and Auto encoders

Module 4	8hrs

DEEP GENERATIVE MODELS : Restricted Boltzmann Machines – Deep Belief networks – Deep Boltzmann machine – Convolutional Boltzmann machine

Module 5	8hrs

APPLICATIONS: Speech, Audio and Music processing – Language modelling and Natural language processing – information retrieval – object recognition and computer vision – Multi modal and multi task learning

Course outcomes: Students will able to

CO1	Use feed forward deep networks
CO2	Apply convolutional networks and sequence modelling for problem solving
CO3	Use probabilistic models and auto encoders.
CO4	Use deep generative models for problem solving
CO5	Apply the deep learning techniques

Textbooks:

1	Yoshua Bengio and Ian J.Goodfellow and Aaron Courville, "Deep Learning", MIT Press, 2015
2	Li Deng, Dong Yu, "Deep Learning: Methods and Applications", now publishers, 2014

CIE Assessment:

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SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3							2
CO2	2	3	2	2	3							2
CO3	3	3	3	2	2							3
CO4	2	3	3	2	3							2
CO5	3	3	2	2	3							3

Course Title	Natural Language Processing	Semester	VII
Course code	MVJ22IS742	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Learn the fundamentals of natural language processing
2. Understand the use of CFG and PCFG in NLP
3. Understand the role of semantics of sentences and pragmatics
4. Gain knowledge in automated Natural Language Generation and Machine Translation.

Module 1	8hrs

INTRODUCTION: Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM –Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance values of real symmetric matrices: Jacobi and Givens method.

Module 2	8hrs

WORD LEVEL AND SYNTACTIC ANALYSIS: N grams Models of Syntax - Counting Words Unsmoothed N grams-Smoothing-Back off Deleted Interpolation – Entropy – English Word Classes - Tag sets for English-Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging -Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Module 3	8hrs

CONTEXT FREE GRAMMARS: Context-Free Grammars, Grammar rules for English, Tree banks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

Module 4	8hrs

Representing Meaning - Meaning Structure of Language, First Order Predicate Calculus-Representing Linguistically Relevant Concepts –SyntaxDriven Semantic Analysis - Semantic Attachments –Syntax Driven Analyzer- Robust Analysis – Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation -Information Retrieval.

Module 5	8hrs

LANGUAGE GENERATION AND DISCOURSEANALYSIS: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Co reference Resolution – Resources: Porter Stemmer, Lemmatize, Penn ,Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, and British National Corpus (BNC).

Course outcomes: Students will able to	
CO1	Tag a given text with basic Language features.
CO2	Design an innovative application using NLP components
CO3	Implement a rule-based system to tackle morphology/syntax of a language
CO4	Design a tag set to be used for statistical processing for real-time applications
CO5	Compare the use of different statistical approaches for different types of NLP applications
Textbooks:	
1	Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014
2	C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MITPress. Cambridge, MA:1999

CIE Assessment:

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SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**3**	**3**	**2**							
CO2	**3**	**2**	**3**	**3**	**2**							
CO3	**3**	**3**	**3**	**3**	**3**							
CO4	**2**	**2**	**3**	**3**	**3**							
CO5	**3**	**3**	**3**	**3**	**3**							

Course Title	Embedded Systems	Semester	VII
Course code	MVJ22IS743	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Comprehend the underlying features and building blocks of embedded system development.
2. Outline the advanced architecture components of 8051 microcontroller.
3. Build the assembly language routines using 8051 microcontroller.
4. Analyze various models of embedded system development
5. Evaluate the RTOS concepts of embedded system applications
6. Design embedded systems prototypes for real-time applications.

Module 1	**8hrs**

Introduction to Embedded Systems: Definition, Purpose, Embedded systems Vs. General computing systems, Classifications, Applications, Innovative bonding of lifestyle with embedded technologies, Building Blocks of Embedded Systems: Core components including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (on board and external types), Embedded firmware, Other system components

Module 2	**8hrs**

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

Module 3	**8hrs**

Introduction to the ARM Instruction Set : Data Processing Instructions , Programme Instructions, Software Interrupt Instructions, Program Status Register Instructions, Co-processor Instructions, Loading Constants ,ARM programming using Assembly language: Writing Assembly code, Profiling and cycle counting, instruction scheduling.

Module 4	**8hrs**

Exception, Interrupt Handling : Exception handling,Interrupts, Interrupt handling Schemes.
Memory Management Unit : The Memory Hierarchy and Cache Memory, Cache Architecture, Cache Policy, Moving from MPU to an MMU,How Virtual Memory Works, Details of ARM MMU.

Module 5	**8hrs**

Real Time Operating System (RTOS) based Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread pre-emption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS.

Course outcomes: Students will able to

CO1	Comprehend the underlying features and building blocks of embedded system development

CO2	Describe the architectural features and instructions of ARM microcontroller
CO3	Develop Assembly Programs in ARM for Embedded applications
CO4	Describe the fundamentals of Exception, Interrupt Handling and Memory Management Unit of ARM Controller
CO5	Demonstrate the need of real time operating system for embedded system applications.
Textbooks:	
1	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developer's guide, Elsevier, Morgan Kaufman publishers, 2008.
2	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**3**	**3**	**3**							
CO2	**3**	**-**	**3**	**3**	**3**							
CO3	**3**	**-**	**3**	**3**	**3**							
CO4	**2**	**2**	**3**	**3**	**3**							
CO5	**3**	**3**	**3**	**3**	**3**							

Course Title	Distributed File Systems	Semester	VII
Course code	MVJ22IS744	CIE	50+50
Total No. of Contact Hours	3:0:0	SEE	50+50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
2. To understand Distributed on multiple file servers or multiple locations. It allows programs to access or store isolated files as they do with the local ones, allowing programmers to access files from any network or computer.
3. Illustrates DFS is executed as a part of the operating system.
4. Analyse DFS, a namespace is created, and this process is transparent for the clients.

Module 1	**8hrs**
Distributed file System: What is distributed file system, File Service architecture, Need of Distributed File system, Distributed file system requirement, – Case Study 1: Sun Network File System, Case Study 2: The Andrew File System. Name Services, Domain Name System, Directory Services.	
Module 2	**8hrs**
Name Services and Domain Name System: Name servers and Navigation, Domain Name systems, Main Features, Directory service protocol, Name Hierarchy, Case study Global Name service, The X.500 directory service, X.500 Infrastructure.	
Module 3	**8hrs**
Distributed File system: Motivation, Naming and Transparency, Remote File Access, Stateful vs State less service, why did we choose these systems, GFS, GFS2- Google colossus system, Hyper scale: Facebook Tectonic system	
Module 4	**8hrs**
Desirable Features of a Good Distributed File System, Goal of Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles, Trends in Distributed File system,	
Module 5	**8hrs**
Hadoop Distributed File System: The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop File System interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop Archives, Apache Storm, Spark, Oozie	

Course outcomes: Students will able to

CO1	Demonstrate Proficiency in understanding of Distributed file system
CO2	Analyze the Name services and Domain Name system.
CO3	Illustrate DFS its Motivation, GFS
CO4	Interpret File Accessing Models, Caching Schemes, Replication Models, sufficient Knowledge

	on File access.
CO5	Discussion about Hadoop Distributed File System, Hadoop File System interfaces
Textbooks:	
1	Distributed File Systems: Concepts and Examples" by Juraj Hromkovic
2	Distributed File Systems" by Sun Microsystems
3	Modern Distributed File Systems: Design and Implementation" by Ricardo Morin
Video links: http://acl.digimat.in/nptel/courses/video/106104189/lec4.pdf	

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**3**	**3**							**2**
CO2	**3**	**3**	**2**	**3**	**2**							**2**
CO3	**3**	**3**	**2**	**2**	**2**							**2**
CO4	**2**	**2**	**2**	**2**	**2**							**2**
CO5	**2**	**2**	**2**	**3**	**3**							**2**

Course Title	Introduction To DBMS	Semester	VII
Course code	MVJ22IS7551	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

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

Module 1	**8hrs**
Introduction to Databases: Introduction; An example; characteristics of the database approach; actors on the scene; workers behind the scene; advantages of using the DBMS approach; A brief history of database Applications; when Not to use a DBMS.	
Module 2	**8hrs**
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.	
Module 3	**8hrs**
SQL: Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL	
Module 4	**8hrs**
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce- Codd Normal Form,	
Module 5	**8hrs**
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.	

Course outcomes: Students will able to	
CO1	Identify, analyse and define database objects, enforce integrity constraints on a database using RDBMS.
CO2	Use Structured Query Language (SQL) for database manipulation.
CO3	Design and build simple database systems.
CO4	Apply the concepts of Normalization and design database which possess no anomalies.
CO5	Develop application to interact with databases
Textbooks:	
1	Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition,

	2017, Pearson
2	Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill
3	Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, McGrawHill, 2013.

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**1**	**3**	**3**	**2**	**2**				**1**			**2**
CO2	**3**	**3**	**3**	**2**	**2**				**1**			**2**
CO3	**3**	**3**	**3**	**2**	**2**				**1**			**2**
CO4	**2**	**3**	**3**	**2**	**2**				**1**			**2**
CO5	**2**	**3**	**3**	**3**	**3**				**2**			**2**

Open Elective II
Semester 7th
INTRODUCTION TO ALGORITHMS

Course code	**MVJ22IS7552**	**CIE**	**50+50**
Total No. of Contact Hours	**3:0:0**	**SEE**	**50+50**
No. of Contact Hours/week	**40**	**Total**	**100**
Credits	**3**	**Exam. Duration**	**3**

COURSE OBJECTIVES: ***This course will enable students to***

1. Learn the basics Algorithms
2. Learn to write algorithms and its performance.
3. Learn the different functions of algorithms.
4. Understand the concept of recurrence algorithms
5. Understand probabilistic analysis.

Module 1	**8hrs**
The Role of Algorithms in Computing: Algorithms, kinds of problems are solved by algorithms, Algorithms as a technology, Efficiency, Data structures, Technique, Hard problems	
Module 2	**8hrs**
Getting Started Insertion sort, Analyzing algorithms, Analysis of insertion sort, Worst-case and average-case analysis, Designing algorithms	
Module 3	**8hrs**
Growth of Functions Growth of Functions, Asymptotic notation, Comparison of functions, Standard notations and common functions, Functional iteration	
Module 4	**8hrs**
Recurrences The substitution method, The recursion-tree method, The master method, Proof of the master theorem, The proof for exact powers	
Module 5	**8hrs**
Probabilistic Analysis and Randomized Algorithms The hiring problem, Indicator random variables, Randomized algorithms, Probabilistic analysis and further uses of indicator random variables	

Course outcomes: Students will able to

CO1	Explain the basic algorithm and its characteristics
CO2	Understanding of sorting algorithm
CO3	Analysis of algorithm and performance
CO4	Illustrate Recurrence algorithms
CO5	Interpret Probabilistic Analysis and randomized algorithms

Textbooks:

1	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
2	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
3	Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).
4	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
5	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.

CIE Assessment:

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SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	-	-	--	-	3	1	3	1	1
CO2	3	2	3	3	2	-	2	2	2	3	2	3
CO3	3	2	3	3	2	2	2	3	3	3	2	3
CO4	3	3	3	3	2	2	3	3	3	3	2	3
CO5	3	2	2	2	2	2	3	3	3	3	2	3

COurse Title	Software Engineering	Semester	VII
Course code	MVJ22IS7553	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: This Course will enable the students to

1. Understand principles, concepts, methods, and techniques of the software engineering approach to producing quality software (particularly for large, complex systems).
2. Impart skills in the design and implementation of efficient software systems across disciplines.
3. Familiarize engineering practices and standards used in developing software products and components.
4. Gather knowledge on various software testing, maintenance methods.

Module 1	8hrs
FUNDAMENTALS OF SOFTWARE ENGINEERING AND REQUIREMENTS ENGINEERING Software Engineering Fundamentals; Software processes: Software life-cycle models; Software requirements and specifications: Requirements elicitation; Requirements analysis modeling techniques; Functional and non-functional requirements.	
Module 2	**8hrs**
Fundamental design concepts and principles; Design characteristics; System Models - Context, Behavioral, Data and, Object models.	
Module 3	**8hrs**
SOFTWARE VALIDATION AND MAINTENANCE Software validation: Validation planning; Testing fundamentals, including test plan creation and test case generation; Black-box and white-box testing techniques; Unit, integration, validation, and system testing; Object-oriented testing; Inspections	
Module 4	**8hrs**
COMPONENT BASED SOFTWARE ENGINEERING Engineering of Component-Based Systems; The CBSE Process; Domain Engineering; Component Based Development; Classifying and Retrieving Components; Economics of CBSE	
Module 5	**8hrs**
SOFTWARE QUALITY PROCESS IMPROVEMENT Overview of Quality management and Process Improvement; Overview of SEI -CMM, ISO 9000, CMMI, PCMM, TQM and Six Sigma; overview of CASE tools. Software tools and environments: Programming environments; Project management tools;	

Course outcomes: Students will able to	
CO1	Comprehend software development life cycle and Prepare SRS document for a project
CO2	Apply software design and development techniques
CO3	Identify verification and validation methods in a software engineering project
CO4	Apply on Component based software development process.
CO5	Involve in continuous learning to solve issues of process and software product using the advanced CASE tools and techniques

Textbooks:	
1	Ian Sommerville, "Software Engineering", 9th Edition, Addison- Wesley, 2011
2	R. S. Pressman, Software Engineering, a practitioner's approach, McGraw Hill,7th Edition, 2010
3	Rajib Mall, “Fundamentals of Software Engineering”, PHI Publication, 3rd edition, 2009
4	Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.

CIE Assessment:

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SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**2**	**2**	**-**			**1**	**2**		
CO2	**2**	**2**	**2**	**2**	**2**	**1**			**1**	**2**		
CO3	**2**	**2**	**2**	**2**	**2**	**1**			**1**	**2**		
CO4	**1**	**2**	**2**	**2**	**2**	**1**			**1**	**2**		
CO5	**1**	**2**	**2**	**1**	**2**	**1**			**2**	**2**		

Course Title	Cloud Computing	Semester	VII
Course code	MVJ22IS7554	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: This Course will enable the students to

1.Understands cloud computing models and infrastructure for larger networks

2. Identify policies, mechanisms and scheduling for resource management, virtualization, and optimization of networks.

3. Compare multiple approaches to cloud system design and solve real world problems.

4. Illustrate storage concept and self-organizing capability for different cloud systems.

5. Understands cloud security and risk

Module 1	**8hrs**
Defining a Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies, Eras of Computing, Parallel vs. Distributed Computing, Elements of Parallel Computing.	
Module 2	**8hrs**
Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples, Xen, VMware, Microsoft Hyper-V, Cloud Reference Model and Architecture, Infrastructure as a Service, Platform as a Service, Software as a Service, Types of Clouds, Economics of the Cloud, Open Challenges in Clouds	
Module 3	**8hrs**
Data-intensive computing Characterizing data-intensive computations, Challenges ahead, Historical perspective, Technologies for data-intensive computing – Storage systems, Programming platforms – Map Reduce. Public Cloud Infrastructures: Amazon Web Services - Compute, Storage, and Communication Services; Google App Engine – Architecture, Application Life-Cycle, Cost Model; and Microsoft Azure	
Module 4	**8hrs**
ECG Data Analysis on Cloud, Protein Structure Prediction, Satellite Image Processing; Business and Consumer Applications – CRM, Social Networks, Media Applications, and Multiplayer Online Gaming. Advanced Topics in Cloud Computing, Energy efficiency in clouds, Energy-efficient and green cloud computing architecture, Market-based management of clouds, Market-oriented cloud computing, A reference model for MOCC,3 Technologies and initiatives supporting MOCC, Observations	
Module 5	**8hrs**
Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor.	

Course outcomes: Students will able to	
CO1	Explore the basic concepts of cloud computing, cloud infrastructure, cloud models, cloud services, distributed computing, and other related concepts.
CO2	Understand Virtualization and working of some of industrially popular Virtualization technologies.
CO3	Apply Map Reduce programming model to solve some data-intensive computing applications over public or private cloud platforms.
CO4	Analyzing the security risks in cloud from different perspectives and study some of the available solutions.
CO5	Explain Operating system security, Virtual machine Security and Security of virtualization.
Textbooks:	
1	Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi, 2013, McGraw Hill, New Delhi, India, ISBN-13: 978-1-25-902995-0. (Module 1, Module 2, Module 3, Module 4, Module 5)
2	Cloud Computing Theory and Practice, Dan C Marinescu, 1st Edition, 2013, Elsevier (MK), ISBN: 9780124046276. (Module 5)
3	Distributed Computing and Cloud Computing, from parallel processing to internet of things, Kai Hwang, GeofferyC. Fox, Jack J Dongarra, 1st Edition, 2012, Elsevier (MK), ISBN: 978-0-12-385880-1.

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CO2	3	3	3	2	3	-	-	-	-	2	3	3
CO3	3	3	2	2	3	-	-	-	-	2	3	3

CO4	3	3	2	2	3	-	-	-	-	2	3	3
CO5	2	2	-	2	2	-	-	-	-	-	-	-