Semester: III		
Transforms and Statistical Methods (Theory)		
Course Code	**MVJ21MA31A**	**CIE Marks: 50**
Credits	**L:T:P:: 3:2:0**	**SEE Marks: 50**
Hours	**30L+20T**	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Comprehend and use of analytical and numerical methods in different engineering fields.	
2	Apprehend and apply Fourier Series.	
3	Realize and use of Fourier transforms.	
4	Realize and use of Z-Transforms.	
5	Use of statistical methods in curve fitting applications.	

UNIT-I	
Laplace Transform: Definition and Laplace transforms of elementary functions. Laplace transforms of Periodic functions and unit-step function and problems. **Inverse Laplace Transform:** Definition and problems, Convolution theorem to find the inverse Laplace transforms and problems. **Applications**: Solution of linear differential equations using Laplace transforms. Self study topic: Derivations of Laplace transforms of elementary functions, Unit impulse function-problems. **Web Link and Video Lectures:** https://nptel.ac.in/courses/111106139	**10 Hrs**
UNIT-II	
Fourier series: Recapitulation of Series, Continuous and Discontinuous functions, Periodic functions, Dirichlet's condition, Fourier series of periodic functions of period 2π and arbitrary period $2l$, Half-range Fourier sine and cosine series, Practical Harmonic Analysis and Problems. **Web Link and Video Lectures:** https://nptel.ac.in/courses/111106111/	**10 Hrs**
UNIT-III	
Fourier transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, Inverse Fourier transforms, Inverse Fourier sine and cosine transforms, Convolution theorem. **Web Link and Video Lectures:** https://nptel.ac.in/courses/111105123	**10 Hrs**
UNIT-IV	

Z-Transforms: Difference equations, basic definition, Z-transform -definition, Properties of Z-transforms, Standard Z-transforms, damping rule, Shifting rule, Initial value and final value theorems - problems, Inverse Z-transform. **Applications**: Application of Z- transforms to solve difference equations. Self study topic: Proof of Initial value and final value theorems. **Web Link and Video Lectures:** https://nptel.ac.in/courses/108104100	**10 Hrs**
UNIT-V	
Curve Fitting: Curve fitting by the method of least squares. Fitting of the curves of the form $y = ax + b$, $y = ax^2 + bx + c$, $y = ae^{bx}$. Statistical Methods: Introduction, Correlation and coefficient of correlation, Regression, lines of regression and problems. Self study topic: Fitting of the curves of the form $\boldsymbol{y = ax^b}$. **Web Link and Video Lectures:** https://nptel.ac.in/courses/111105042	**10 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Use Laplace transform and inverse transforms techniques in solving differential equations.
CO2	Communications, Know the use of periodic signals and Fourier series to analyze circuits and system.
CO3	Demonstrate Fourier Transform as a tool for solving Integral equations.
CO4	Apply Z Transform to solve Difference Equation.Use Method of Least Square for appropriate Curves.
CO5	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data.

Reference Books	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition,2014.
3.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
4.	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: III		
OBJECT ORIENTED PROGRAMMING (Theory)		
Course Code: MVJ21CS/CG/AI32		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Identify the need for Java - an object-oriented language. Set up Java JDK environment to create, debug and run simple Java programs.	
2	Illustrate the use of classes and distinguish the usage of different types of Inheritance and constructors in real world.	
3	Demonstrate the use of exceptions and to create multi-threaded programs.	

4	Illustrate the use of Collections with elements in Java program.
5	Develop Java Application using JDBC connectivity.

UNIT-I	
Prerequisites : Basic Knowledge about C or C++ **Introduction to Object Oriented Concepts and Java:**Java's Magic: the Byte code; Java Development Kit (JDK); The Java Buzz words, Object Oriented Programming - Two Paradigms, Abstraction, The Three OOP Principles and its advantages, Simple Java programs. Data types, variables and arrays, Operators, Control Statements. **Video link / Additional online information (related to module if any):** • Differences between JVM vs JRE vs JDK in Java: https://www.youtube.com/watch?v=5Bp6GLU6HKE	**8 Hrs**
UNIT-II	
Classes, Inheritance, Packages and Interfaces: Classes fundamentals; Declaring objects; Assigning object reference variables; Introducing Methods, Constructors, this keyword, Finalize Method. Inheritance: Inheritance basics, using super, creating multi-level hierarchy ,when constructors are called, method overriding, using abstract classes. Packages, Access Protection, Importing Packages, Interfaces. **Video link / Additional online information (related to module if any):** Types of Inheritance: https://www.youtube.com/watch?v=ZP27c7i5zpg	**8 Hrs**
UNIT-III	
Exception Handling and Multi-Threaded Programming : Exception Handling fundamentals, Exception Types, Uncaught Exceptions, Using try catch, Multiple catch clauses, Nested try statements, throw, throws, finally, Java's built-in exceptions, Programming Examples. **Multi-Threaded Programming**: The java thread model, Main thread, Creating Thread, Creating multiple threads, Using isAlive() and join(),Thread priorities, Synchronization; InterThread Communication - Bounded buffer problem. **Video link / Additional online information (related to module if any):** Multithreading: https://www.youtube.com/watch?v=O_Ojfq-OIpM	**8 Hrs**
UNIT-IV	
The collections and Framework: Collections Overview, Recent Changes to	**8 Hrs**

Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections. **Java Lambda expressions:** Java Lambda expressions, Using Java Lambda expressions, Lambda expression vs method in java, Lambda expression in the array list. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=Q_9vV3H-dt4	
UNIT-V	
JDBC: 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. **Video link / Additional online information (related to module if any):** **Java JDBC :**https://www.youtube.com/watch?v=hEWBIJxrLBQ	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate the Object Oriented Programming concepts and basic characteristics of Java.
CO2	Demonstrate the principles of classes, inheritance, packages and interfaces.
CO3	Experiment with exception handling Mechanisms and Create multi-threaded programs.
CO4	Interpret the need for advanced Java concepts like collections in developing modular and efficient programs.
CO5	Develop an application with Database using JDBC connectivity.

Reference Books	
3.	Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806
4.	Herbert Schildt, Java The Complete Reference, 7 /9th Edition, Tata McGraw Hill, 2007.
3.	Jim Keogh: J2EE-The Complete Reference, McGraw Hill, 2007.
4.	Effective Java, Third Edition, Joshua Bloch, Addison-Wesley Professional,2017

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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												
CO/PO	**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**
C05	**3**	**3**	**3**	**3**	**-**	**-**	**2**	**2**	**3**	**2**	**-**	**3**

High-3, Medium-2, Low-1

Semester: III		
OPERATING SYSTEMS (Theory)		
Course Code: MVJ21CS/CG/AI33		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Introduce concepts and terminology used in OS.	
2	Explain threading and multithreaded systems.	
3	Illustrate process synchronization and concept of Deadlock.	
4	Introduce Memory and Virtual memory management, File system and storage techniques.	

UNIT-I	
Introduction: What operating systems do; Computer System organization; Computer System architecture; Operating System operations; 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; System boot. **Process Management**: Process concept; Process scheduling; Operations on processes;Inter process communication.	**8 Hrs**
UNIT-II	
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. **Process Synchronization**: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.	**8 Hrs**
UNIT-III	
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock	**8 Hrs**

detection and recovery from deadlock. **Memory Management**: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation	
UNIT-IV	
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **File System, Implementation of File System**: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; **Implementing File system**: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.	**8 Hrs**
UNIT-V	
Mass Storage Structure-Disk Structure - Disk Attachment-Disk Scheduling-Disk Management- Swap-Space Management. **Protection**: Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Studies: Windows, Unix, Linux, Android.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate the fundamental concepts of operating systems.
CO2	Compare and illustrate various process scheduling algorithms.
CO3	Ability to recognize and resolve Deadlock problems ,Memory Management techniques.
CO4	Apply appropriate memory and file management schemes.
CO5	Appreciate the need of access control and protection in Operating System and illustrate various disk scheduling algorithms.

Reference Books	
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts 7th edition,Wiley-India, 2006
2.	D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013.
3.	Tanenbaum, A., "Modern Operating Systems", Prentice-Hall of India. 2004
4.	P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition,2013

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: III		
DATA STRUCTURES & APPLICATIONS & LAB (Theory and Practice)		
Course Code: MVJ21CS/CG/AI34		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	Identify the importance of data structures & memory allocation.	
2	Perform operations on stacks and queues and its applications	
3	Apply the operations of linked list, Trees & Graphs in various applications	
4	Apply searching and sorting operations in real time applications.	

UNIT-I	
Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays. **Abstract Data Type, Array Operations:** Traversing, inserting, deleting, searching,	**8 Hrs**

and sorting**,** **Array ADT** :Multidimensional Arrays, Polynomials and Sparse Matrices. **Strings:** Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples.	
UNIT-II	
Stacks: Definition, Stack Operations, Stack ADT, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. **Recursion -** GCD, Tower of Hanoi. **Queues:** Definition, Array Representation, Queue Operations, Queue ADT, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues. Programming Examples.	**8 Hrs**
UNIT-III	
Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials. Programming Examples	**8 Hrs**
UNIT-IV	
Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, AVL Trees, Splay Trees, B-Tree, Programming Examples	**8 Hrs**
UNIT-V	
Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search, Topological Sort. **Sorting and Searching:** Quick sort, Insertion Sort, Radix sort, Merge Sort, Address Calculation Sort.	**8 Hrs**
LABORATORY EXPERIMENTS	
1.A courier company has number of items to be delivered to its intended customers through its salesman. The salesman visits the following cities to deliver the respective items. Write a C program,	

S.No	Cities	Number of items
1	Agra	25
2	Chennai	50
3	Kolkata	59
4	Mumbai	72
5	Delhi	12

*To display name of cities where salesman has delivered maximum and minimum number of items

*To search the number of items to be delivered of a user supplied city.

2. Implement Knuth-Morris- Pratt pattern matching algorithm using C program.

3. Design, Develop and Implement a menu driven Program in C with the listed operations for the data structure which follows Last In First Out (LIFO) order. (Use Array Implementation of specified DS with maximum size MAX).

a. Push an Element

b. Pop an Element

c. Demonstrate how it can be used to check Palindrome

d. Demonstrate Overflow and Underflow situations

e. Display the status

f. Exit

Support the program with appropriate functions for each of the above operations

4.Design, Develop and Implement 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. Design, Develop and Implement a menu driven Program in C for the following operations on Ring Buffer of Integers (Use Array Implementation)

a. Insert an Element on to Ring Buffer

b. Delete an Element from Ring Buffer

c. Demonstrate Overflow and Underflow situations on Ring Buffer

d. Display the status of Ring Buffer

e. Exit

Support the program with appropriate functions for each of the above operations

6. Design, Develop and Implement 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

e. Exit

7. Design, Develop and Implement 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

8. Design, Develop and Implement a menu driven C Program 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 recursively in inorder, preorder & postorder

Search the BST for a given element (KEY) and report the appropriate message

9. Design, Develop and Implement a Program in C for the following operations on Graph(G) ofCities
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

10. Develop a C program to sort a given set of n integer elements using Quick Sort method. Run the program for varied values of n and show the results of each iteration.

11. Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2- digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K →L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

Any 10 experiments to be conducted

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze and Compare various linear data structures.
CO2	Code, debug and demonstrate the working nature of different types of data structures and their applications
CO3	Implement, analyse and evaluate the searching and sorting algorithms.
CO4	Choose the appropriate data structure for solving real world problems.

Reference Books	
1.	A M Tenenbaum, Data Structures using C, PHI, 1989
2.	Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.
3.	Choose the appropriate data structure for solving real world problems.

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 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.

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 marks are 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

Semester:III		
ANALOG AND DIGITAL ELECTRONICS & LAB (Theory and Practice)		
Course Code: MVJ21CS/CG/AI35		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	Analyze the working of oscillators and use of regulators.	
2	Make use of simplifying techniques in the design of combinational circuits.	
3	Illustrate combinational and sequential digital circuits.	
4	Demonstrate the use of flipflops and design registers and counters.	
5	Design and test Analog-to-Digital and Digital-to-Analog conversion techniques.	

UNIT-I	
Prerequisites : Basic analog Circuits **Metal Oxide Semiconductor Field Effect transistor(MOSFET):** Structure and I-V characteristics, MOSFET as a switch, MOSFET as an amplifier, CMOS and its applications. **Oscillators:** Basic working and applications of RC Phase shift oscillator, Wien Bridge oscillator, LC oscillator, Colpitt oscillator, Crystal Oscillator. **Linear Power Supplies:** Constituents of a Linear Power Supply, Designing Mains Transformer, Linear IC voltage regulators, Regulated Power Supply Parameters.	**8 Hrs**
UNIT-II	
Prerequisites: Digital Electronic Fundamentals **Karnaugh maps**: Minimum forms of switching functions, two and three variable Karnaugh maps, four variable karnaugh maps, Quine-McClusky Method: determination of prime implicants, The prime implicant chart, petricks method, simplification of incompletely specified functions, simplification using map-entered variables	**8 Hrs**
UNIT-III	
Combinational Circuits: Multiplexer, Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU-Design and popular MSI	**8 Hrs**

chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices.	
UNIT-IV	
Flip-Flops and Registers: **Flip Flops:** S-R,J-K,D and T flip flops,Edge-triggered JK FLIP-FLOPs **Registers:** Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers. **Counters:** Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus, Decade Counters, Applications of Counters.	**8 Hrs**
UNIT-V	
D/A Conversion and A/D Conversion: **Digital to analog converters**: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit. **Analog to digital converters:** quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D Converter ICs	**8 Hrs**
LABORATORY EXPERIMENTS	
1. Study of transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value. **2.** Design and test IC 723 voltage regulator **3.** Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC. **4.** Design and implement a faster way3 to add binary numbers using carry look ahead adders. **5**. a) Realization and implementation of 2-bit comparator using logic gates. b) Implementation of 4-bit magnitude comparator using IC 7485. **6**. To design and construct basic flip-flops R-S ,J-K,J-K Master slave flip-flops using gates and verify their truth table **7**. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops **8**. Design and implementation of 3-bit synchronous up/down counter **9.** Design and implement a ring counter and Johnson counter using 4-bit shift register and demonstrate its working. **10**. Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working. **11**. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on 7-segment display (using IC-7447). **12.** Design 4 bit r-2r ladder DAC using opamp.	

Any 12 experiments to be conducted

Course Outcomes: After completing the course, the students will be able to	
CO1	Design and analyze analog circuits using transistors,power supply, MOSFETS, regulator IC and opamp
CO2	Simplify digital circuits using Karnaugh Map , POS and Quine-McClusky Methods
CO3	Explain construction and working of data processing circuits
CO4	Understanding the various types of latches and flip flops and building the registers and counters using flip flops.
CO5	Explain the basic principles of A/D and D/A conversion circuits and develop the same.

Reference Books	
1.	Anil K Maini, Varsha Agarwal, Electronic Devices and Circuits, Wiley, 2012.
2.	Charles H Roth and Larry L Kinney, Fundamentals of Logic design, Cengage Learning,2019.
3.	Donald P Leach, Albert Paul Malvino & Goutam Saha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015.
4.	M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008.

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 marks are 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**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO5	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

High-3, Medium-2, Low-1

Semester: III		
Additional Mathematics-I (Common to all branches)		
Course Code:	**MVJ21MATDIP1**	**CIE Marks:50**
Credits:	**L:T:P:S: 4:0:0:0**	**SEE Marks: 50**
Hours:	**40L**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To familiarize the important and introductory concepts of Differential calculus	
2	Aims to provide essential concepts integral calculus	
3	To gain knowledge of vector differentiation	
4	To learn basic study of probability	
5	Ordinary differential equations of first order and analyze the engineering problems.	

UNIT-I	
Differential calculus: Recapitulation of successive differentiation -nth derivative -Leibnitz theorem (without proof) and Problems, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation, Taylor's and Maclaurin's series expansions- Illustrative examples. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8 Hrs**
UNIT-II	
Integral Calculus: Statement of reduction formulae for the integrals of $\sin^n(x)$, $\cos^n(x)$, $\sin^n(x)\cos^n(n)$ and evaluation of these integrals with standard limits-	**8 Hrs**

problems. Double and triple integrals-Simple examples. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	
UNIT-III	
Vector Differentiation: Scalar and Vector point functions, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields. **Vector identities** - $div(\phi \vec{A}), curl(\phi \vec{A}), curl(grad(\phi)), div(curl \vec{A})$. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8Hrs**
UNIT-IV	
VI **Probability: Basic terminology, Sample space and events. Axioms of probability. Conditional probability – illustrative examples. Bayes theorem-examples.** **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8Hrs**
UNIT-V	
Ordinary Differential Equations of First Order: Introduction – Formation of differential equation, solutions of first order and first degree differential equations: variable separable form, homogeneous, exact, linear differential equations. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge of calculus to solve problems related to polar curves and its applications
CO2	Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and volumes.
CO3	Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors and also exhibit the inter dependence of line, surface and volume integrals.
CO4	Understand the basic Concepts of Probability
CO5	Recognize and solve first-order ordinary differential equations occurring in different branches of engineering.

Reference Books	
1.	B.S. Grewal, Higher Engineering Mathematics**,** Khanna Publishers, 43rd Edition**,** 2013**,** .
2.	G. B. Gururajachar, Calculus and Linear Algebra, Academic Excellent Series Publicatior 2018-19
3.	Chandrashekar K. S, Engineering Mathematics-I, Sudha Publications, 2010.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: IV		
Complex Variables and Numerical Methods (Theory)		
Course Code	**MVJ21MA41A**	**CIE Marks: 50**
Credits	**L:T:P:: 2:2:0**	**SEE Marks: 50**
Hours	**20L+20T**	**SEE Duration: 3 Hrs.**

Course Learning Objectives: The students will be able to	
1	Understand the concepts of Complex variables and transformation for solving Engineering Problems.
2	Understand the concepts of complex integration, Poles and Residuals in the stability analysis of engineering problems.
3	Apply the concept to find extremal of functionals.
4	Solve initial value problems using appropriate numerical methods.
5	Students learn to obtain solutions of ordinary and partial differential equations numerically.

UNIT-I	
Complex variables - I: Functions of complex variables, Analytic function, Cauchy-Riemann Equations in Cartesian and polar coordinates, Consequences of Cauchy-Riemann Equations, Construction of analytic functions (Using Milne-Thomson method). **Transformations:** Bilinear Transformation, Conformal transformation, Discussion of the transformations $w = z^2$, $w = e^z$ and $w = z + \frac{a}{z}, (z \neq 0)$. **Self Study topic :** Harmonic function and its properties **Web Link and Video Lectures:** https://nptel.ac.in/courses/111103070	8 Hrs
UNIT-II	
Complex variables-II: Complex integration - Cauchy theorem, Cauchy's Integral Theorem-Problems, Taylor & Laurent series- Problems, Singularities, Types of Singularities, Poles, Residues-definitions, Cauchy residue theorem - Problems. **Self Study topic:** Consequences of Cauchy's theorem, Cauchy residue theorem. **Web Link and Video Lectures:** https://nptel.ac.in/courses/111103070	8 Hrs
UNIT-III	
Numerical methods-I: Numerical solution of Ordinary Differential Equations of first order and first degree, Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's and Adam-Bashforth Predictor and Corrector method. **Web Link and Video Lectures:** https://nptel.ac.in/courses/127106019	8 Hrs
UNIT-IV	
Numerical methods-II: Numerical solution of Ordinary Differential Equations of	8 Hrs

second order: Runge-Kutta method of fourth order, Milne's Predictor and Corrector method. **Calculus of variations:** Variation of function and Functional, variational problems, Euler's equation, Geodesics. **Applications** : Hanging Chain problem. **Self Study topic :** Adam-Bashforth Predictor and Corrector method. **Web Link and Video Lectures:** https://nptel.ac.in/courses/127106019 https://nptel.ac.in/courses/111107103	
UNIT-V	
Numerical methods-III: Numerical solution of Partial Differential Equations: Introduction, Finite difference approximations to derivatives, Explicit methods-Numerical Solution of Laplace Equation, Numerical solution of one-dimensional heat equation by Bender - Schmidt's method and by Crank-Nicholson Method, Implicit method-Numerical solution of one-dimensional wave equation. **Self Study topic:** Classification of Partial differential equations, Parabolic, Elliptic and Hyperbolic equations. **Web Link and Video Lectures:** https://nptel.ac.in/courses/111107063	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	State and prove Cauchy - Riemann equation with its consequences and demonstrate Con-formal Transformation.
CO2	Illustrate Complex Integration using Cauchy's Integral theorem, Cauchy's Integral formula and Cauchy's Residue theorem.
CO3	Identify appropriate numerical methods to solve ODE.
CO4	Determine the extremals of functionals and solve the simple problems of the calculus of variations.
CO5	Choose appropriate numerical methods to solve Partial Differential Equations.

Reference Books	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition,2014.
3.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
4.	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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												
CO/PO	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	3	3	0	3	0	0	0	0	0	0	1	0
CO3	3	2	0	2	0	0	0	0	0	0	0	0
CO4	3	3	0	3	0	0	0	0	0	0	0	1
CO5	3	3	0	3	0	0	0	0	0	0	1	0

High-3, Medium-2, Low-1

Semester: IV		
MICRO CONTROLLER AND EMBEDDED SYSTEMS (Theory)		
Course Code: MVJ21CS/CG/AI42		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Explain the fundamentals of ARM based system, basic hardware components, selection methods and attributes of an ARM Controller.	
2	Program ARM controller using the various instructions.	
3	Explain the fundamentals of Exception, Interrupt Handling and Memory Management Unit of ARM Controller.	
4	Identify the Embedded System Design applications.	
5	Explain the real time operating system for the embedded system design.	

UNIT-I	
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	**8 Hrs**
UNIT-II	
Introduction to the ARM Instruction Set : Data Processing Instructions , Programme Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants **ARM programming using Assembly language:** Writing Assembly code, Profiling and cycle counting, instruction scheduling	**8 Hrs**
UNIT-III	
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	**8 Hrs**
UNIT-IV	
Embedded System Components: Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major	**8 Hrs**

applications areas of embedded systems, purpose of embedded systems Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (on board and external types), Embedded firmware, Other system components.	
UNIT-V	
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	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the architectural features and instructions of ARM microcontroller
CO2	Develop Assembly Programs in ARM for Embedded applications.
CO3	Describe the fundamentals of Exception, Interrupt Handling and Memory Management Unit of ARM Controller
CO4	Interface external devices and I/O with ARM microcontroller.
CO5	Demonstrate the need of real time operating system for embedded system applications

Reference Books	
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.
3.	Raghunandan.G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication, 2019
4.	The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd., 1st edition, 2005.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: IV		
COMPUTER ORGANIZATION AND ARCHITECTURE (Theory)		
Course Code: MVJ21CS/CG/AI43		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Learn the basic structure and operations of a computer.	
2	Learn the arithmetic and logic unit.	
3	Learn the different ways of communication with I/O devices & memories, memory hierarchies, cache memories and virtual memories.	
4	Understand & implement arithmetic process.	
5	Understand the processor and pipelining concepts.	
6	Understand parallelism and multi-core processors.	

UNIT-I	
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance –Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses,	**8 Hrs**

Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions. **Arithmetic:** Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division. **Video link :** https://nptel.ac.in/courses/106105163/	
UNIT-II	
Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB **Videolink:**https://www.youtube.com/watch?v=RkAE4zE4uSE&list=PL13FD5F00C21BBC0B&index=11	**8 Hrs**
UNIT-III	
Memory: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Types of cache ,Cache miss management Mapping Functions, Replacement Algorithms, Performance Considerations,(ARM Cache and Pentium cache). **Video link :** https://nptel.ac.in/courses/106105163/	**8 Hrs**
UNIT-IV	
Processor : A Basic MIPS implementation – Building a Data path – Control Implementation Scheme –Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards –Exceptions. **Video link:** https://nptel.ac.in/courses/106106166/	**8 Hrs**
UNIT-V	
Parallelism: Parallel processing challenges –Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors. Video link: https://nptel.ac.in/courses/106102114/	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the basic organization of a computer system.
CO2	Demonstrate functioning of different sub systems, such as processor, Input/output, and memory.

CO3	Design and analyses simple arithmetic and logical units.
CO4	Illustrate hardwired control and micro programmed control, pipelining, embedded and other Computing systems.
CO5	Design and analyses of simple Parallelism and Multithread.

Reference Books	
1.	Carl Hamacher, Zvonko Vranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, and 6).
2.	David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.(Listed topics only from Chapters 4and 6).
3.	John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
4.	John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach‖, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: IV		
PYTHON PROGRAMMING **(Theory and Practice)**		
Course Code: MVJ21CS/CG/AI44		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**

Course Learning Objectives: The students will be able to	
1	Familiarize the students with the fundamentals and programming basics of Python Language

UNIT-I	
Introduction to Python: Features of python, Applications of python, Syntax, Comments, Indentations, Number types, Variables and Data Types, Operators, conditional statement, Loops in Python. **Python List:** Create Python List, Access Python List, Slicing a Python List, slicing and dicing, Reassigning a Python List (Mutable), Reassigning the whole Python list, Deleting list and elements, Multidimensional Lists, List Operations, Built-in List Functions.	**8 Hrs**
UNIT-II	
Python Tuple: Create a Python Tuple, Tuples Packing, Tuples Unpacking, Creating a tuple with a single item, Access Python Tuple, Slicing a Tuple, Deleting a Python Tuple, Reassigning Tuples, Tuple Functions Tuple Operations. **Python Dictionary:** Create a Dictionary, Dictionaries with mixed keys, Access a Python Dictionary, Delete Python Dictionary, In-Built Functions on a Python Dictionary, In-Built Methods on a Python Dictionary, Dictionary Operations.	**8 Hrs**
UNIT-III	
Python Function: User-Defined Functions in Python, Python Built-in Functions, Python Lambda Expressions, Recursion Function, Range function. **Python Method:** Introduction to Method, __init__(), Self Parameter, Functions vs Method, Magic Methods	**8 Hrs**
UNIT-IV	
Python Class: Introduction to Python Class, Defining a Python Class, Accessing Python Class Members Python Object Attributes Belonging to Python Class, Delete Python Class, Attribute, Inheritance, Multiple inheritance.	**8 Hrs**
UNIT-V	
File Handling In Python: Read and Write File, Open File, Close File, File Methods, Data Base connections.	**8 Hrs**

LABORATORY EXPERIMENTS

1. Write a Python program to encrypt the text using Caesar Cipher technique. Display the encrypted text. Prompt the user for input and the shift pattern.
2. Devise a Python program to implement the Rock-Paper-Scissor game.
3. Write a Python program to perform Jump Search for a given key and report success or failure. Prompt the user to enter the key and a list of numbers.
4. The celebrity problem is the problem of finding the celebrity among n people. A celebrity is someone who does not know anyone (including themselves) but is known by everyone. Write a Python program to solve the celebrity problem.
5. Write a Python program to construct a linked list. Prompt the user for input. Remove any duplicate numbers from the linked list.

6. Perform the following file operations using Python

a) Traverse a path and display all the files and subdirectories in each level till the deepest level for a given path. Also, display the total number of files and subdirectories.

b) Read a file content and copy only the contents at odd lines into a new file.

7. Create a menu drive Python program with a dictionary for words and their meanings. Write functions to add a new entry (word: meaning), search for a particular word and retrieve meaning, given meaning find words with the same meaning, remove an entry, display all words sorted alphabetically.

8. Using Regular Expressions, develop a Python program to

a) Identify a word with a sequence of one upper case letter followed by lower case letters.

b) Find all the patterns of "1(0+)1" in a given string.

c) Match a word containing 'z' followed by one or more o's.

Prompt the user for input.

9. Devise a Python program to implement the Hangman Game.

10. Write a Python program to print all the Disarium numbers between 1 and 100

Any 10 experiments to be conducted

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand data types (like character strings, integers, and real numbers)and the Operations that can be Applied to each data type.
CO2	Write programs that get input, perform calculations, and provide output (using Conditional logic, loops, Functions).
CO3	Write well designed and well documented programs that are easily maintainable
CO4	Analyze String Formatting Options.
CO5	Enjoy the art and science of computer files using python.

Reference Books	
5.	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser Data Structures and Algorithms in PythonJohn Wiley & Sons, Incorporated.
6.	Frank Kane (2017)Hands-On Data Science and Python Machine Learning 1st Edition, Kindle Edition
3.	Mark Smart,(2018), Introduction to Data Science with Python: Basics of Numpy and Pandas.
4.	VK Jain,Data Science & Analytics, Khanna Book Publishing ;edition (2018)

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 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.

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 marks are 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.

Semester:IV		
DESIGN AND ANALYSIS OF ALGORITHMS & LAB (Theory and Practice)		
Course Code: MVJ21CS/CG/AI45		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**

Course Learning Objectives: The students will be able to	
1	Identify the importance of different asymptotic notation.
2	Determine the complexity of recursive and non-recursive algorithms.
3	Compare the efficiency of various design techniques like greedy method, backtracking etc.
4	Apply appropriate method to solve a given problem.

UNIT-I	
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), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples . Important Problem Types. Fundamental Data Structures.	**8 Hrs**
UNIT-II	
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, Recurrence equation for divide and conquer, Finding the maximum and minimum , Merge sort, Quick sort , Strassen's matrix multiplication , Advantages and Disadvantages of divide and conquer.	**8 Hrs**
UNIT-III	
Decrease and Conquer approach: Topological Sort, Decrease-by-a-Constant-Factor Algorithms: Josephus Problem.	**8 Hrs**

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.	
UNIT-IV	
Dynamic Programming: General method with Examples, Multistage Graphs. Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem, Bellman-Ford Algorithm , Travelling Sales Person problem , Reliability design.	**8 Hrs**
UNIT-V	
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: Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.	**8 Hrs**
LABORATORY EXPERIMENTS	
1.Create a Java class called Student with the following details as variables within it. (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create nStudent objects and print the USN, Name, Branch, and Phoneof these objects with suitable headings. 2.Write a Java program to read two integers a andb. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero. 3.Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number. 4.Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case. 5.Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case. 6. Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.	

7. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program in Java.

8. Find Minimum Cost Spanning Tree of a given connected undirected graph using

Kruskal's algorithm. Use Union-Find algorithms in your program.

9.Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.

10. Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm. (b) Implement Travelling Sales Person problem using Dynamic programming.

11. Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

12. Design and implement in Java to find a subset of a given set S = {Sl, S2,.....,Sn}

of n positive integers whose SUM is equal to a given positive integer d.

For example, if S ={1, 2, 5, 6, 8} and d= 9, there are two solutions {1,2,6}and

{1,8}. Display a suitable message, if the given problem instance doesn't have a solution.

Any 10 experiments to be conducted

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

Reference Books	
1.	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
2.	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
3.	Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).
4.	Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.

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 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.

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 marks are 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.

Semester: IV		
Additional Mathematics-II (Common to all branches)		
Course Code:	**MVJ21MATDIP2**	**CIE Marks:50**
Credits:	**L:T:P:S: 4:0:0:0**	**SEE Marks: 50**
Hours:	**40L**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To familiarize the important concepts of linear algebra.	
2	Aims to provide essential concepts differential calculus, beta and gamma functions.	
3	Introductory concepts of three-dimensional geometry along with methods to solve them.	
4	Linear differential equations	
5	Formation of partial differential equations.	

UNIT-I	
Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and eigen vectors of a square matrix. Diagonalization of a square matrix of order two. **Self study**: Application of Cayley-Hamilton theorem (without proof) to	**8 Hrs**

compute the inverse of a matrix-Examples. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	
UNIT-II	
Differential calculus: Indeterminate forms: L-Hospital rule (without proof), Total derivatives, and Composite functions. Maxima and minima for a function of two variables. **Beta and Gamma functions:** Beta and Gamma functions, Relation between Beta and Gamma function-simple problems. **Self study**: Curve tracing. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8Hrs**
UNIT-III	
Analytical solid geometry : Introduction –Directional cosine and Directional ratio of a line, Equation of line in space- different forms, Angle between two line, shortest distance between two line, plane and equation of plane in different forms and problems. **Self study**: Volume tetrahedron. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8Hrs**
UNIT-IV	
Differential Equations of higher order: Linear differential equations of second and higher order equations with constant coefficients. Inverse Differential operator, Operators methods for finding particular integrals , and Euler –Cauchy equation. **Self study**: Method of variation of parameters **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8 Hrs**
UNIT-V	
Partial differential equation: Introduction- Classification of partial differential equations, formation of partial differential equations. Method of elimination of arbitrary constants and functions. Solutions of non-homogeneous partial differential equations by direct integration. Solution of Lagrange's linear PDE. **Self study:** One dimensional heat and wave equations and solutions by the method of separable of variable **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Make use of matrix theory for solving system of linear equations and compute eigenvalues and eigen vectors required for matrix diagonalization process.

CO2	Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.
CO3	Understand the Three-Dimensional geometry basic, Equation of line in space-different forms, Angle between two line and studying the shortest distance .
CO4	Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
CO5	Construct a variety of partial differential equations and solution by exact methods.

Reference Books	
1.	B.S. Grewal, Higher Engineering Mathematics**,** Khanna Publishers, 43rd Edition**,** 2013**,** .
2.	G. B. Gururajachar, Calculus and Linear Algebra, Academic Excellent Series Publicatior 2018-19
3.	Chandrashekar K. S, Engineering Mathematics-I, Sudha Publications, 2010.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1

CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Semester: V		
SOFTWARE ENGINEERING MANAGEMENT (Theory)		
Course Code:	**MVJ21SPM51**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:	**40**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able 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 method4s.

UNIT-I	
INTRODUCTION TO SOFTWARE ENGINEERING: The Evolving nature of software engineering, Changing nature of software engineering, Software engineering Layers, The Software Processes, Software Myths. **PROCESS MODELS:** A Generic Process Model, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Spiral Model, the Unified Process, Personal and Team Process Models, the Capability Maturity Model Integration (CMMI). **Laboratory Sessions/ Experimental learning:** To write the SRS for the given real time application using report writing tools. **Applications:** In Software development process. 1. **Video link / Additional online information:** https://nptel.ac.in/courses/106105182/	**Hrs 8**
UNIT-II	
REQUIREMENTS ENGINEERING: Functional and Non-Functional Requirements, The Software requirements Document, Requirements Specification, requirements Engineering, Requirements Elicitation and Analysis, Requirement Validation, Requirement Management, System Modeling: Context Models, Interaction Models, Structural Models, Behavioral Model, Model-Driven Engineering. **DESIGN CONCEPTS:** The Design Process, Design Concepts, The Design Models, Architectural Design: Software Architecture, Architectural Genres, Architectural Styles. **Applications:** In Software development process. **Video link / Additional online information:** 1. https://www.coursera.org/lecture/client-needs-and-software-requirements/3-2-4-use-cases-bZNCr	**Hrs 8**
UNIT-III	
DESIGN AND IMPLEMENTATION: The Object Oriented Design with UML, Design Patterns, Implementation Issues, Open Source Development. User	**Hrs 8**

Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation. **SOFTWARE TESTING STRATEGIES:** A Strategic approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Validation Testing, System Testing, The Art of Debugging, White-Box Testing, Black Box Testing. **Laboratory Sessions/ Experimental learning:** Using Selenium IDE write a test suite containing minimum 4 test cases. **Applications:** In Software development process. • **Video link / Additional online information:** https://www.youtube.com/watch?v=T3q6QcCQZQg	
UNIT-IV	
PRODUCT METRICS: A Frame Work for Product Metrics, Metrics for the Requirements Model, Metrics for Design Model, Metrics for Source Code, Metrics for Testing. **PROCESS AND PROJECT METRICES:** Metrics in the Process and Project Domains, Software Measurements, Metrics for Software Quality, Risk Management: Risk verses Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinements, Risk Mitigation Monitoring and Management (RMMM), The RMMM Plan. **Laboratory Sessions/ Experimental learning:** Create a project using MS projects for any real time scenario. **Applications:** In Software development process. • **Video link / Additional online information:** https://youtu.be/tIZ1dg4pxCE	**Hrs 8**
UNIT-V	
QUALITY MANAGEMENT: Quality Concepts, Software Quality, Software Quality Dilemma, Achieving Software Quality, Review Techniques, Reviews: A Formal spectrum, Informal Reviews, Formal Technical Reviews, **SOFTWARE QUALITY ASSURANCE:** Background Issues, Elements of Software Quality Assurance, Tasks, Goals and Metrics, Software Reliability, the ISO 9000 Quality Standards. **Laboratory Sessions/ Experimental learning:** Estimation of test coverage metrics using manual test metrics. **Applications:** In Software development process.	**Hrs 8**

1. **Video link / Additional online information:** https://nptel.ac.in/courses/110105039/	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand various Process Models.
CO2	Investigate various requirements engineering and apply design concepts.
CO3	Identify numerous Software Testing Strategies.
CO4	Evaluate Process and Project Metrices.
CO5	Illustrate Quality Management and Software Quality Assurance Concepts

Text Books	
1.	Roger S. Pressman (2011), Software Engineering, A Practitioner's approach, 7 th edition, McGraw Hill International Edition, New Delhi
2.	Sommerville (2001), Software Engineering, 9 th edition, Pearson education, India

Reference Books:	
1.	K. K. Agarval, Yogesh Singh (2007), Software Engineering, 3rd edition, New Age International Publishers, India.
2.	Lames F. Peters, Witold Pedrycz(2000), Software Engineering an Engineering approach, John Wiely & Sons, New Delhi, India
3	Shely Cashman Rosenblatt (2006), Systems Analysis and Design, 6th edition, Thomson Publications, India

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: V		
THEORY OF COMPUTATION (Theory)		
Course Code: MVJ21CS52		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To have a knowledge of regular languages and context free languages.	
2	To have an understanding of finite state and pushdown automata.	
3	To make a study of the programming capabilities of Turing machines.	

UNIT-I	
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 **Video link / Additional online information (related to module if any):** https://nptel.ac.in/courses/106/105/106105196/	**8 Hrs**
UNIT-II	
Regular Expressions: Regular languages: Regular Expressions – Finite Automata and Regular Expressions –Applications of Regular Expressions - Regular Grammars. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=OA8EY3HKZoc	**8 Hrs**
UNIT-III	

Regular Languages: Properties of regular languages: Pumping lemma for regular languages – Closure properties of regular languages –Equivalence and Minimization of Finite Automata. C **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=ganHwe4DU7A	**8 Hrs**
UNIT-IV	
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 **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=FjGrU7vczyg https://www.youtube.com/watch?v=b3OPl5wS4AQ	**8 Hrs**
UNIT-V	
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. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=IhyEGNn-7Uo	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Design Finite automata for different Problems
CO2	Understand about Regular Expressions
CO3	Apply pumping lemma to Regular languages and Context Free languages
CO4	Design Push down automata and write CFG for different problems
CO5	Analyze the properties of Context free languages and Turing Machine

Reference Books	
1.	J.E.Hopcroft, R.Motwani and J.D Ullman,” Introduction to Automata Theory, Languages and Computations”, 3rd Edition, Pearson Education, 2011
2.	J.Martin, “Introduction to Languages and the Theory of Computation”, 3rd Edition, TMH, 2007.
3.	H.R.Lewis and C.H.Papadimitriou, “Elements of the theory of Computation”, 2nd Edition, Pearson Education/PHI, 2003

4.	Micheal Sipser, ―Theory and Computatio, 7th Edition, Thomson Course Technology, 2008

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

Semester: V		
DATABASE MANAGEMENT SYSTEMS AND LAB (Theory and Practice)		
Course Code:	**MVJ21CS53**	**CIE Marks:50+50**
Credits:	**4**	**SEE Marks: 50 +50**
Hours:	**40L+26P**	**SEE Duration: 03+03 Hours**
Course (Theory) Learning Objectives: The students will be able 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.
Course (Practice) Learning Objectives: The students will be able to	
1	Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
2	Strong practice in SQL programming through a variety of database problems.
3	Develop database applications using front-end tools and back-end DBMS.

UNIT-I	
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. **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. **Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples. **Laboratory Sessions/ Experimental learning:** Draw ER diagram for database applications (logical database design). **Applications:** Library Management system, Banking, Universities and colleges, credit card transactions, social media sites, Telecommunications, Finance, Military, online shopping, Human Resource Management, Manufacturing, Airline Reservation systems. **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106106093/ • https://nptel.ac.in/courses/106105175/ • https://www.youtube.com/watch?v=WSNqcYqByFk	**Hrs 8**
UNIT-II	
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.	**Hrs 8**

Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. **SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL. **Laboratory Sessions/ Experimental learning:** programs to perform set operations, arithmetic operations, joins, selection, projection, create tables for real world db applications and insert values to it. **Applications:** RDBMS, enterprise level software solution(except light weight web applications) **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106106093/ https://nptel.ac.in/courses/106105175/	
UNIT-III	
SQL: Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Embedded SQL**.** **Laboratory Sessions/ Experimental learning:** Mini-projects to develop connections between front end and backend(database) using JDBC. Write SQL queries for the given schema. **Applications:** Java Programming, In Server to reduce network traffic and to provide security(Stored procedure) **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=64szTfLNu3o https://www.digimat.in/nptel/courses/video/106105175/L11.html	**Hrs 8**
UNIT-IV	
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. Dependency theory - functional dependencies,	**Hrs 8**

Armstrong's axioms for FD's, closure of a set of FD's, minimal covers. **Laboratory Sessions/ Experimental learning:** Draw schema diagram which satisfy all forms of normalization for all db real world application **Applications:** to optimize database design **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106106093/ • https://nptel.ac.in/courses/106105175/ https://www.youtube.com/watch?v=YD8dhOmuVnY	

UNIT-V

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering. **File Organizations and Indexes:** Introduction, Hashing techniques, Indexing, Structures for Files. **Laboratory Sessions/ Experimental learning:** Develop banking and other financial applications. **Applications:** systems that manage sales order entry, airline reservations, payroll, employee records, manufacturing, and shipping. Operating system(deadlock) **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106106093/ • https://nptel.ac.in/courses/106105175/ https://www.youtube.com/watch?v=5ammL5KU4mo	**Hrs 8**

LABORATORY EXPERIMENTS

SL. NO.	EXPERIMENT	HRS
1	**The following relations keep track of airline flight information**: **FLIGHTS** (no: integer, from: string, to: string, distance: integer, departs: time, arrives: time, price: real) **AIRCRAFT** (aid: integer, aname: string, cruisingrange: integer)	3

	CERTIFIED (eid: integer, aid: integer) **EMPLOYEES** (eid: integer, ename: string, salary: integer) Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly. Write each of the following queries in SQL. i. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80, 000. ii. For each pilot who is certified for more than three aircrafts, find the eid and the maximum cruisingrange of the aircraft for which she or he is certified. iii. Find the names of pilots whose salary is less than the price of the cheapest route from Bengaluru to Frankfurt. iv. For all aircraft with cruising range over 1000 Kms, .find the name of the aircraft and the average salary of all pilots certified for this aircraft. v. Find the names of pilots certified for some Boeing aircraft. vi. Find the aids of all aircraft that can be used on routes from Bengaluru to New Delhi.	
2	**Consider the Schema for a banking enterprise:** **BRANCH**(branch-name:string,branch-city:string,assets:real) **ACCOUNT**(accno:int, branch-name:string, balance:real) **DEPOSITOR**(customer-name:string, accno:int) **CUSTOMER**(customer-name:string, customer-Street:string, customer-city:string) **LOAN**(loan-number:int, branch-name:string, amount:real) **BORROWER**(customer-name:string, loan-number:int) i. Create the above tables by properly specifying the primary keys and the foreign keys ii. Enter at least five tuples for each relation iii. Find all the customers who have at least two accounts at the Main branch. iv. Find all the customers who have an account at all the branches	**3**

	located in a specific city. Demonstrate how you delete all account tuples at every branch located in a specific city.	
3	**Consider the schema for College Database:** **STUDENT**(USN,SName, Address, Phone, Gender) **SEMSEC**(SSID, Sem, Sec) CLASS(USN, SSID) **SUBJECT**(Subcode, Title, Sem, Credits) IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) Write SQL queries to 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1MJ15CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA< 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.	**3**
4	**Consider the schema for Company Database:** **EMPLOYEE**(SSN, Name, Address, Sex, Salary, SuperSSN, DNo) **DEPARTMENT**(DNo, DName, MgrSSN, MgrStartDate) **DLOCATION**(DNo,DLoc) **PROJECT**(PNo, PName, PLocation, DNo) **WORKS_ON**(SSN, PNo, Hours) Write SQL queries to 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. 2. Show the resulting salaries if every employee working on the 'IoT'	**3**

	project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.	
	STUDY EXPERIMENT For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process. Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable front-end tool. **Indicative areas include; health care, education, industry, transport, supply chain etc.**	**2**

Course (Theory) Outcomes: After completing the course, the students will be 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.
Course (Practice) Outcomes: After completing the course, the students will be able to	
CO1	Demonstrate the creation of relational tables using DDL/DML
CO2	Design and demonstrate the execution of simple queries retrieve information
CO3	Demonstrate the execution of complex queries
CO4	Design and implement a front end using modern tools
CO5	Implement, analyze and evaluate the project developed for an application.

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
Reference Books:	
1	Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, McGraw Hill, 2013.
2	Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.
3	Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008.

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 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.

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 marks are 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.

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/PSO Mapping (Theory)														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	1	3	3	2	3	-	-	-	1	-	-	2	2	-
CO2	3	3	3	2	2	-	-	-	1	-	-	2	1	-
CO3	3	3	3	2	2	-	-	-	1	-	-	2	2	2
CO4	2	3	3	2	2	-	-	-	1	-	-	2	2	3
CO5	2	3	3	3	3	-	-	-	2	-	-	2	-	1

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

High-3, Medium-2, Low-1

Semester: V		
WEB PROGRAMMING AND LAB (Theory and Practice)		
Course Code:	**MVJ21CS54**	**CIE Marks:50+50**
Credits:	**4**	**SEE Marks: 50 +50**
Hours:	**40T+26P**	**SEE Duration: 03+03 Hours**
Course (Theory) Learning Objectives: The students will be able to		
1	Understand different kind of Internet Technologies.	
2	Learn java-specific web services architecture.	
3	Understand the SQL and JDBC.	
4	Learn the AJAX and JSON.	
Course (Practice) Learning Objectives: The students will be able to get practical experience in design, develop, implement, analyze and evaluation of		
1	Web pages and Style sheet creation.	
2	Client side programming and Java script	
3	PHP and Database creation.	

UNIT-I

Website Basics, HTML5, CSS 3, Web 2.0: Web Essentials: Clients, Servers and Communication, The Internet, Basic Internet protocols, World wide web, HTTP Request Message , HTTP Response Message, Web Clients, Web Servers, HTML5 : Tables, Lists, Image, HTML5 control elements , Semantic elements , Drag and Drop, Audio, Video controls, CSS3: Inline, embedded and external style sheets, Rule cascading, Inheritance, Backgrounds, Border Images, Colours, Shadows, Text, Transformations. **Laboratory Sessions/ Experimental learning:** Create a simple website with following effects on Text and images 1. Add Background image/s 2. Colors effect. 3. Shadows and transformation. **Real Time Applications:** Animation website **Video link / Additional online information (related to module if any):** • https://youtu.be/FPtLsZ62pdA • https://nptel.ac.in/courses/106/106/106106222/ • https://youtu.be/vCo6p7zrbt4 https://nptel.ac.in/courses/106/106/106106223	**Hrs 8**
UNIT-II	
Client side Programming: An Introduction to java Script, JavaScript DOM Model, Date and Object, Regular Expression, Exception Handling, Validation, Built-in Objects, Event Handling, DHTML with JavaScript, JSON introduction, Syntax, Function Files, Http Request, SQL. **Laboratory Sessions/ Experimental learning:** • SQL and DOM model creation in website as created in module 1. **Real Time Applications:** Students results / Application form in online **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106/105/106105084/ • https://youtu.be/uUhOEj4z8Fo (NPTEL) • https://youtu.be/3uxp7mqUIfk (NPTEL) https://youtu.be/tfPfwDrfSP8 (NPTEL)	**Hrs 8**
UNIT-III	
Server Side Programming: Java Servlet Architecture, Servlet Life Cycle, Form GET and POST actions, Session handling, Installing and Configuring Apache Tomcat Web Server,	**Hrs 8**

Database Connectivity: JDBC perspectives, JDBC Program Example, JSP: Understanding Java server page, JSP Standard Tag Library (JSTL), Creating HTML form using JSP Code. **Laboratory Sessions/ Experimental learning:** Write a servlet program to display a message "Welcome to Java World" and deploy the process using GET and POST actions. **Real Time Applications:** Online ordering using any E-Commerce site. Video link / Additional online information (related to module if any): • https://nptel.ac.in/courses/106/105/106105224/ • https://youtu.be/J6qfWtQ54Ig • https://nptel.ac.in/courses/106/105/106105084/	
UNIT-IV	
PHP and XML: Introduction to PHP, PHP using PHP, Variables, Program Control, Built-in Functions, Form Validation, Basic command with PHP examples, Connection to server, creating Database, Selecting Database, Listing Database, listing table names Creating a table, Inserting data, deleting data and tables, altering tables. XML: Document type definition, XML Schema DOM and presenting XML, XML Parser and Validations, XSL and XSLT Transformation. **Laboratory Sessions/ Experimental learning:** Design, Develop and Implement a student/Employee table and perform the following operations using PHP. 1. Insert a row 2. Delete a row 3. Alter the table. **Video link:** • https://youtu.be/XlryaovT_3k • http://www.digimat.in/nptel/courses/video/106106127/L49.html http://www.nptelvideos.in/2012/11/internet-technologies.html	**Hrs 8**
UNIT-V	
AJAX and Web Services: AJAX: Ajax client server architecture, Xml HTTP request object, Call back methods. Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, Web Services: Introduction, Java web services Basics, Creating, Publishing, Testing and Describing a web services, Database driven web service from an	**Hrs 8**

application, SOAP.

Laboratory Sessions/ Experimental learning:

- jQuery process and AJAX services.

Video link/Lecturer/Tutorials:

- https://www.w3schools.com/xml/ajax_intro.asp (Practical examples)
- https://youtu.be/jMdHE4qInU4

https://youtu.be/FBDHe5T7quI

LABORATORY EXPERIMENTS

SL. NO.	EXPERIMENT	Hrs
1	Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information (Department of CSE) for the web pages.	3
2	Design HTML form for keeping student record and validate it using Java script.	3
3	Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access.	3
4	Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.	3
5	Assume four users user1, user2, user3 and user4 having the passwords pv pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the followin 1.Create a Cookie and add these four user id’s and passwords to this Cook 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.	3
6	Write a JSP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database.	3

7	Validate the form using PHP regular expression. PHP stores a form data in to database	**3**
8	Write a PHP program to display a digital clock which displays the current time of the server.	**3**
9	Creating simple application to access data base using JDBC Formatting HTML with CSS.	**3**
10	Write a Program for manipulating Databases and SQL with real time application	**3**

Course (Theory) Outcomes: After completing the course, the students will be able to	
CO1	Learn web essentials, HTML5 and CSS3.
CO2	Understand about Client-side programming, DHTML and JSON
CO3	Comprehend server-side programming and JSP.
CO4	Learn PHP, functions, and XML.
CO5	Analyze the concepts of AJAX and web services.
Course (Practice) Outcomes: After completing the course, the students will be able to	
CO1	Construct Web pages using HTML/XML and style sheets.
CO2	Build dynamic web pages with validation using Java Script objects and by applying diffe event handling mechanisms.
CO3	Develop dynamic web pages using server side scripting.
CO4	Use PHP programming to develop web applications
CO5	Use JDBC and SQL to develop web applications

Text Books	
1	Jean-Paul Tremblay & Paul G. Sor Deitel and Deitel and Nieto,Internet and World Wide Web,How to Program, Prentice Hall, 5th Edition, 2011.
2	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development",1stEdition, Pearson Education India. (ISBN:978-9332575271)
3	Robert W. Sebesta, Programming the World-Wide Web, 8thEdition, University of Colorado, Colorado Springs. ©2015 |Pearson
Reference Books:	
1	Stephen Wynkoop and John Burke ―Running a Perfect Website‖, QUE, 2nd Edition,1999.
2	Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley publications, 2009.

3	Jeffrey C and Jackson, ―Web Technologies A Computer Science Perspective‖, Pearson Education, 2011.
4	UttamK.Roy, ―Web Technologies‖, Oxford University Press, 2011
5	Gopalan N.P. and Akilandeswari J., ―Web Technology, Prentice Hall of India, 2011.

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 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.

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 marks are 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.

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

CO4	3	2	3	-	2	-	-	-	-	2	3	2	1	-
CO5	3	2	3	-	3	-	-	-	-	2	3	2	3	2

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

High-3, Medium-2, Low-1

Semester: V		
MOBILE COMPUTING		
Course Code:	**MVJ21CS551**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:	**40T**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand the concept of mobile computing terminology and basics	
2	Understand the wireless protocols.	
3	Realize various routing mechanisms.	

UNIT-I	
Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. **Global System for Mobile Communication(GSM):** Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, New Data Services, GPRS Architecture, GPRS Network Nodes. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=bur9hq_abog (NPTEL VIDEO)	**Hrs 8**

UNIT-II	
Medium Access Control (MAC) : Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), Wireless LAN/(IEEE 802.11) architecture, key IEEE802.11 a/b/c/d/e/g/i/n/T/ac/ standards. **Wireless Application Protocol (WAP)**: The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=sx0UPzztC5o (NPTEL VIDEO)	**Hrs 8**
UNIT-III	
Mobile Network Layer : IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization using Soft computing techniques – ANT Bee colony, Support Vector Machine, Particle Swarm Optimization and Genetic Algorithm. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=0QLRULNfbFg	**Hrs 8**
UNIT-IV	
Mobile Transport Layer : Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP. **Third Generation (3G) Mobile Services**: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W- CDMA) and CDMA 2000, Quality of services in 3G. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=KCcdF4IVrQk • https://www.youtube.com/watch?v=ymnQ5rpcYA&list=PLbMVogVj5nJSi8FUsvglRxLtN1TN9y4nx	**Hrs 8**
UNIT-V	
Mobile Ad hoc Networks (MANETs) : Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service Discovery ,case study using NS2 –traffic analysis using CBR and VBR.	**Hrs 8**

Text Books:	
1	Jochen Schiller, ―Mobile Communications‖, PHI, Second Edition, 2009.
2	Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols. **Video link:** • https://nptel.ac.in/courses/106/105/106105160/ • https://www.digimat.in/nptel/courses/video/106105160/L01.html	

Course Outcomes: After completing the course, the students will be able to	
CO1	Able to interpret GSM architecture and its services.
CO2	Analyze the various wireless application protocols and its different concepts for various mobile applications.
CO3	Learn the representation of mobile network layer protocols and its functionalities.
CO4	Understand, analyze & develop any existing or new models of mobile environments for 3G networks.
CO5	Understand, evaluate and create the platforms, protocols and related concepts along with along with mobile in mobile environment.

Reference Books:	
1	Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.
2	Martin Sauter, "From GSM to LTE-Advanced: An Introduction to Mobile Networks and Mobile Broadband," Second Edition, Wiley.
3	William.C.Y.Lee,―Mobile Cellular Telecommunications-Analog and Digital Systems‖, Second Edition,TataMcGraw Hill Edition ,2006.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: V		
VISUALIZATION TECHNIQUES		
Course Code:	**MVJ21CS552**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	learn the value of visualization, specific techniques in information visualization and scientific visualization, and how understand how to best leverage visualization methods	

UNIT-I	
Introduction –Visualization Stages –Computational Support –Issues –Different	**Hrs 8**

Types of Tasks –Data representation –Limitation: Display Space, Rendering Time, Navigation Link.	
UNIT-II	
Human Factors –Foundation for a Science of Data Visualization –Environment-Optics – Optimal Display –Overview about Lightness, Brightness, Contrast, Constancy, Color –Visual Attention that Pops Out –Types of Data –Data Complexity –The Encoding of Values – Encoding of Relation –Relation and Connection –Alternative Canvass.	**Hrs 8**
UNIT-III	
Human Vision –Space Limitation –Time Limitations –Design –Exploration of Complex Information Space –Figure Caption in Visual Interface –Visual Objects and Data Objects – Space Perception and Data in Space –Images, Narrative and Gestures for Explanation	**Hrs 8**
UNIT-IV	
Norman‟s Action Cycle –Interacting with Visualization –Interaction for Information Visualization –Interaction for Navigation –Interaction with Models –Interacting with Visualization –Interactive 3D Illustrations with Images and Text –Personal View –Attitude – user perspective –Convergence –Sketching –Evaluation.	**Hrs 8**
UNIT-V	
Design –Virtual Reality: Interactive Medical Application –Tactile Maps for visually challenged People –Animation Design for Simulation –Integrating Spatial and Nonspatial Data –Innovating the Interaction –Small Interactive Calendars – Selecting One from Many– Web Browsing Through a Key Hole –Communication Analysis –Archival Galaxies	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamentals of data visualization
CO2	Acquire knowledge about the issues in data representation
CO3	Visualize the complex engineering design.
CO4	Design real time interactive information visualization system
CO5	Apply the visualization techniques in practical applications

Text/Reference Books:	
1	Robert Spence, “Information Visualization:An Introduction”, Third Edition, Pearson Education, 2014.

2	Colin Ware, "Information Visualization Perception for Design", ThirdEdition, Morgan Kaufmann, 2012.
3	Robert Spence, "Information Visualization Design for Interaction", Second Edition, Pearson Education, 2006
4	Benjamin B. Bederson, Ben shneiderman, "The Craft of Information Visualization", Morgan Kaufmann, 2003.
5	Thomas Strothotte, "Computational Visualization: Graphics, Abstraction and Interactivity", Springer, 1998.
6	Matthew O.Ward, George Grinstein, Daniel Keim, "Interactive Data Visualization: Foundation, Techniques and Applications", Second Edition, A.K.Peters/CRC Press,2015.
7	JoergOsarek, "Virtual Reality Analytics", Gordon"s Arcade, 2016.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: V		
ARTIFICIAL INTELLIGENCE		
Course Code:	**MVJ21CS553**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:	**40T**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To provide strong foundation for data science and application area related to information technology and understand the underlying core concepts and emerging technologies in data science. Describe the basic principles, techniques, and applications of Artificial Intelligence	
2	Analyze and explain different AI learning methods.	
3	Compare and contrast different AI techniques available.	

UNIT-I	
INTRODUCTION: What Is AI? The Foundations of Artificial Intelligence ,The History of Artificial Intelligence, The State of the Art . Intelligent Agents : Agents and Environments ,Good Behavior: The Concept of Rationality ,The Nature of Environments, The Structure of Agents. Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules. **Experimental Learning:** Implementation of Relational and Inheritable Knowledge **Video Links** https://www.youtube.com/watch?v=3MW3ICnkQ9k	**Hrs 8**
UNIT-II	
FIRST-ORDER LOGIC- Syntax and Semantics of First-Order Logic – Using First-Order Logic – Knowledge Engineering in First-Order Logic – Forward Chaining – Backward Chaining. **Experimental Learning:** Implementing programs in PROLOG to solve problems of Predicate Logic **Video Links:** • https://www.youtube.com/watch?v=pzUBrJLIESU	**Hrs 8**

• https://www.youtube.com/watch?v=2juspgYR7as • https://www.youtube.com/watch?v=h9jLWM2lFr0 • https://www.youtube.com/watch?v=-v1K9AnkAeM	
UNIT-III	
Heuristic search techniques: Generate and test, Hill Climbing, Best First Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis. **Weak Slot- and- Filler Structures:** Semantic Nets ,Frames. **Strong slot-and Filler Structures-** Conceptual Dependency, Scripts. **Experimental Learning** : Program to implement Best first Search, A*, AO* algorithm **Video Links:** • https://www.youtube.com/watch?v=ieZr_TpRwnQ • https://www.youtube.com/watch?v=lCrHYT_EhDs	**Hrs 8**
UNIT-IV	
Game Playing : Overview, Minimax Search Procedure, Adding alpha beta cut off, Additional Refinements, Iterative Deepening, References on Specific games. **Learning:** What is learning?, Forms of learning, Rote learning, learning by taking advice, Learning in problem solving, Induction leaning, Explanation based learning, Discovery, Analogy, Formal learning Theory, Neural Net Learning and Genetic Learning. **Experimental Learning** : Real time problem solving using Game Playing **Video Links**: • https://www.youtube.com/watch?v=_i-lZcbWkps • https://www.youtube.com/watch?v=l-hh51ncgDI	**Hrs 8**
UNIT-V	
Natural Language Processing: Syntactic Processing, Semantic Analysis, Discourse and Pragmatic processing, Statistical Natural language processing and Spell checking. **Genetic Algorithms**: A peek into the biological world, Genetic Algorithms (GAs), Significance of genetic operators, termination parameters, niching and speciation, evolving neural-network, theoretical grounding, Ant Algorithms. **Experimental Learning** :	**Hrs 8**

Program to implement spell checking problem **Video Links**: • https://www.youtube.com/watch?v=zG8AJhVy5NY • https://www.youtube.com/watch?v=Z_8MpZeMdD4	

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify AI based problems and understand Intelligent agents
CO2	Apply predicate logic and heuristic techniques to solve AI problems.
CO3	Understand the different representation of knowledge.
CO4	Understand the concepts of learning and Natural Language Processing.
CO5	Understand Genetic Algorithms and solve AI problems using PROLOG.

Text Books	
1	Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition.
2	E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.

Reference Books:	
1	Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.
2	G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Fourth Edition, Pearson Education, 2002.
3	N.P. Padhy "Artificial Intelligence and Intelligent Systems" , Oxford University Press-2015

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: V		
COMPILER DESIGN		
Course Code:	**MVJ21CS554**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able 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.	

UNIT-I	
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. **Video Links :** • https://www.youtube.com/watch?v=yxnbvS2t_QA	**Hrs 8**
UNIT-II	
INTERMEDIATE CODE GENERATION: Syntax Directed Definitions,	**Hrs 8**

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. • **Video Links:** https://www.youtube.com/watch?v=EpAzj7zXrbk	
UNIT-III	
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. • **Video Links:** https://www.youtube.com/watch?v=lRvaRhPsqOo	**Hrs 8**
UNIT-IV	
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. • **Video Links**: https://nptel.ac.in/courses/106/108/106108113/	**Hrs 8**
UNIT-V	
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. **Video Links**: • https://www.youtube.com/watch?v=-yMWgtTeQgY	**Hrs 8**

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

Text Books	
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.

Reference Books:	
1	Keith D Cooper and Linda Torczon, ―Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004
2	V. Raghavan, ―Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.
3	Allen I. Holub, ―Compiler Design in C‖, Prentice-Hall Software Series, 1993.
4	Steven S. Muchnick, ―Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: V		
ENVIRONMENTAL STUDIES		
Course Code: MVJ21CV56		**CIE Marks: 50**
Credits: L:T:P: 1:0:0		**SEE Marks: 50**
Hours: 15 L		**SEE Duration: 2 Hrs.**

Course Learning Objectives: The students will be able to

1	Relate interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences including geo-systems, biology, chemistry, economics, political science and international processes
2	Study drinking water quality standards and to illustrate qualitative analysis of water.
3	Critically evaluate the science and policy ramifications of diverse energy portfolios on air and water quality, climate, weapons proliferation and societal stability.

UNIT-I	
Introduction to environmental studies, Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. **Ecosystems (Structure and Function):** Forest, Desert, Rivers, Ocean **Biodiversity:** Types, Hot spots; Threats and Conservation of biodiversity, Deforestation**.** Video link: https://nptel.ac.in/courses/127/106/127106004/	**3 Hrs**
UNIT-II	
Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, Tidal and Wind. **Natural Resource Management (Concept and case-study):** Disaster Management, Sustainable Mining and Carbon Trading. Video link: https://nptel.ac.in/courses/121/106/121106014/	**3 Hrs**
UNIT-III	
Environmental Pollution: Surface and Ground Water Pollution, Noise pollution, Soil Pollution and Air Pollution. **Waste Management & Public Health Aspects:** Bio-medical Waste, Solid waste,	**3 Hrs**

Hazardous waste and E-waste. Video link: • https://nptel.ac.in/courses/122/106/122106030/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/105/105105160/	
UNIT-IV	
Global Environmental Concerns (Concept, policies, and case-studies): Global Warming, Climate Change, Acid Rain, Ozone Depletion and Fluoride problem in drinking water. Video link: • https://nptel.ac.in/courses/122/106/122106030/ • https://nptel.ac.in/courses/120108004/ • https://onlinecourses.nptel.ac.in/noc19_ge23/preview	**3 Hrs**
UNIT-V	
Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems. Video link: • https://nptel.ac.in/courses/105/102/105102015/ • https://nptel.ac.in/courses/120/108/120108004/	**3 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and Abiotic components.
CO4	Apply their ecological knowledge to illustrate and graph a problem
CO5	Describe the realities that managers face when dealing with complex issues.

Reference Books	
1.	Principals of Environmental Science and Engineering, Raman Siva kumar, Cengage

	learning, Singapur, 2nd Edition, 2005.
2.	Environmental Science – working with the Earth G.Tyler Miller Jr. Thomson Brooks /Cole, 11th Edition, 2006
3.	Textbook of Environmental and Ecology, Pratiba Singh, Anoop Singh & Piyush Malaviya , ACME Learning Pvt. Ltd. New Delhi, 1st Edition.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

Semester End Examination (SEE):

SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 100 marks covering the entire syllabus 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	3	3	3	1	–	2	2	1	1	–	2	1
CO2	3	3	2	1	–	1	2	–	1	1	2	1
CO3	3	3	2	1	–	2	2	–	1	1	2	1
CO4	3	3	2	2	–	2	2	–	1	1	2	1

High-3, Medium-2, Low-1

Semester: V		
UNIVERSAL HUMAN VALUES		
Course Code: MVJ21UHVI58		**CIE Marks: 50**
Credits: L:T:P: 2:0:0		**SEE Marks: 50**
Hours: 30 L		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Appreciate the essential complementarily 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 behaviour and mutually enriching interaction with Nature.	

Prerequisites: Universal Human Values I	
UNIT-I	
Review on Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Self-exploration as the Process for Value Education, Happiness and Prosperity – Current Scenario, **Value Education:** Understanding Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, , Method to Fulfill the Basic Human Aspirations, **Practical Sessions:** Sharing about Oneself (Tutorial 1), Exploring Human Consciousness (Tutorial 2), Exploring Natural Acceptance (Tutorial 3) **Video link:** • https://www.youtube.com/watch?v=85XCw8SU084 • https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**Hrs 8**
UNIT-II	

Review on Understanding Human being as the Co-existence of the Self and the Body, The Body as an Instrument of the Self, Harmony of the Self with the Body. Harmony in the Human Being: Distinguishing between the Needs of the Self and the Body, Understanding Harmony in the Self, Programme to ensure self-regulation and Health. **Practical Sessions:** Exploring the difference of Needs of Self and Body (Tutorial 4), Exploring Sources of Imagination in the Self (Tutorial 5), Exploring Harmony of Self with the Body (Tutorial 6). **Video link:** • https://www.youtube.com/watch?v=GpuZo495F24 • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**Hrs 8**
UNIT-III	
Review on Harmony in the Family – the Basic Unit of Human Interaction, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society. **Harmony in the Family and Society:** Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Vision for the Universal Human Order, **Practical Sessions:** Exploring the Feeling of Trust (Tutorial 7), Exploring the Feeling of Respect (Tutorial 8), Exploring Systems to fulfil Human Goal (Tutorial 9). **Video link:** • https://www.youtube.com/watch?v=F2KVW4WNnS8 • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**Hrs 8**
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:** Exploring the Four Orders of Nature (Tutorial 10), Exploring Co-existence in Existence (Tutorial 11). **Video link:** • https://www.youtube.com/watch?v=1HR-QB2mCF0 • https://www.youtube.com/watch?v=lfN8q0xUSpw • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**Hrs 8**
UNIT-V	

Review on Natural Acceptance of Human Values,Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Holistic Technologies, Production Systems and Management Models-Typical Case Studies. **Implications of the Holistic Understanding – a Look at Professional Ethics:** Definitiveness of (Ethical) Human Conduct, Competence in Professional Ethics, Strategies for Transition towards Value-based Life and Profession **Practical Sessions:** Exploring Ethical Human Conduct (Tutorial 12), Exploring Humanistic Models in Education (Tutorial 13), Exploring Steps of Transition towards Universal Human Order (Tutorial 14). **Video link:** • https://www.youtube.com/watch?v=BikdYub6RY0 • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**Hrs 8**

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	
1.	AICTE SIP UHV-I Teaching Material, https://fdp-si.aicte india.org/ AicteSipUHV _download.php
2.	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. 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.

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 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.

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

High-3, Medium-2, Low-1

PROJECT MANAGEMENT and OOMD			
Course Code	**MVJ22CS61**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Outline software engineering principles and activities involved in building large software programs. Identify ethical and professional issues and explain why they are of concern to Software Engineers.

CLO 2. Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.

CLO 3. Infer the fundamentals of object oriented concepts, differentiate system models, use UML diagrams and apply design patterns.5

CLO 4. Explain the role of DevOps in Agile Implementation.

CLO 5. Discuss various types of software testing practices and software evolution processes. CLO 6. Recognize the importance Project Management with its methods and methodologies.

CLO 7. Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved

Teaching-Learning Process (General Instructions)

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

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

Module-1

Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling, abstraction, The Three models. Class Modelling: Object and Class Concept, Link and associations concepts, Generalization and Inheritance, A sample class model, Navigation of class models, Introduction to RUP**(Textbook: 5 Sec 2.4)** and UML diagrams

Textbook 3: Chapter 1,2,3

Building the Analysis Models: Requirement Analysis, Analysis Model Approaches, Data modeling Concepts, Object Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, class Based Modeling, Creating a Behavioral Model.

Textbook 1: Chapter 8: 8.1 to 8.8

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Process Overview: Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis.

Text Book-2:Chapter- 10,11,and 12

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

Module3

Use Cae on Banking System, Health Care , ATM , LMS,

Textbook 1: Chapter 13: 13.1 to 13.7

Agile Methodology & DevOps: Before Agile – Waterfall, Agile Development,

Self-Learning Section:

What is DevOps?, DevOps Importance and Benefits, DevOps Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing, How to Choose Right DevOps Tools?, Challenges with DevOps Implementation.

Textbook 4: Chapter 2: 2.1 to 2.9

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

Module-4

Introduction to Project Management:

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

Textbook 3: Chapter 1: 1.1 to 1.17

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

Module-5

Activity Planning:

Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, Identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks.

Apple's iPhone develeopment

NASA's Mars Rover Mission

Textbook 3: Chapter 6: 6.1 to

6.16

Software Quality:

Introduction, The place of software quality in project planning, Importance of software quality, software

quality models, ISO 9126, quality management systems, process capability models,

techniques toenhance software quality, quality plans.

Textbook 3: Chapter 13: (13.1 to 13.6 , 13.9, 13.11, 13.14),

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

Course Outcomes

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

CO 1. Understand the activities involved in software engineering and analyze the role of variousprocess models

CO 2. Explain the basics of object-oriented concepts and build a suitable class model using modellingtechniques

CO 3. Describe various software testing methods and to understand the importance of agile methodology and DevOps

CO 4. Illustrate the role of project planning and quality management in software developmentCO 5. Understand the importance of activity planning and different planning models

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

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

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semesterTwo assignments each of **10 Marks**
4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

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

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

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

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

CIE methods /question paper has to be designed to attain the different levels of Bloom'staxonomy 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 questionpapers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scoredshall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with amaximum 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

Suggested Learning Resources:

Textbooks

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. 12 Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007.
3. 13Michael 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.

Reference:

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

Weblinks and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://www.youtube.com/watch?v=WxkP5KR_Emk&list=PLrjkTql3j nm9b5nr- ggx7Pt1G4UAHeFlJ
3. http://elearning.vtu.ac.in/econtent/CSE.php
4. http://elearning.vtu.ac.in/econtent/courses/video/CSE/15CS42.html
5. https://nptel.ac.in/courses/128/106/128106012/ (DevOps)

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

Case study, Field visit

Semester: VI

MACHINE LEARNING AND LAB
(Theory and Practice)

Course Code:	**MVJ21CS62**	**CIE Marks:50+50**
Credits:	**4**	**SEE Marks: 50 +50**
Hours:		**SEE Duration: 03+03 Hours**

Course (Theory) Learning Objectives: The students will be able to	
1	Define machine learning and problems relevant to machine learning.
2	Differentiate supervised, unsupervised and reinforcement learning.
3	Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
4	Perform statistical analysis of machine learning techniques.
Course (Practice) Learning Objectives: The students will be able 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.

UNIT-I	
Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias. **Laboratory Sessions/ Experimental learning:** To understand purpose, give real time dataset(problem) and ask to students to solve in class room. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=rQ3oi9g8alY https://www.youtube.com/watch?v=h0e2HAPTGF4	**Hrs 8**
UNIT-II	
Decision Tree Learning Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. **Laboratory Sessions/ Experimental learning:** Ask students to design a Decision Tree using freely available dataset or problem in classroom. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=qDcl-FRnwSU • https://www.youtube.com/watch?v=FuJVLsZYkuE	**Hrs 8**
UNIT-III	
Bayesian Learning and Evaluating Hypotheses **Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm. **Evaluating Hypotheses**: Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis **Laboratory Sessions/ Experimental learning:** Ask the students to build Bayes Belief Networks for real time problem in class room. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=480a_2jRdK0	**Hrs 8**

- https://www.youtube.com/watch?v=E3l26bTdtxI

UNIT-IV

Artificial Neural Networks and Instance based Learning — **Hrs 8**

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptron, Backpropagation algorithm. Instanced Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression.

Laboratory Sessions/ Experimental learning:

Give real time problem and ask students to design an ANN using perceptrons.

Video link:

- https://www.youtube.com/watch?v=xbYgKoG4x2g&list=PL53BE265CE4A6C056.
- https://www.youtube.com/watch?v=BRMS3T11Cdw&list=PL3pGy4HtqwD2a57wl7Cl7tmfxfk7JWJ9Y

UNIT-V

Reinforcement Learning and Deep Learning : Reinforcement Learning: Introduction, Learning Task, Q Learning. — **Hrs 8**

Deep Learning: Introduction to Deep Learning-Reasons to go Deep Learning, Introduction to Convolution Networks ,Restricted Boltzmann Machines, Deep Belief Nets, Recurrent Nets.

Video link:

- https://www.youtube.com/watch?v=TIlDzLZPyhY&list=PLyqSpQzTE6M_FwzHFAyf4LSkz_IjMyjD9
- https://www.youtube.com/watch?v=iOh7QUZGyiU&list=PLqYmG7hTraZDNJre23vqCGIVpfZ_K2RZs

LABORATORY EXPERIMENTS

SL. NO.	EXPERIMENT	HRS
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.	3
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
3	Develop a program to demonstrate the prediction of values of a given dataset using **Linear regression**.	3

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.	**3**
5	Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.	**3**
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.	**3**
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.	**3**
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.	**3**
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.	**3**
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.	**3**
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.	**3**

Course (Theory) Outcomes: After completing the course, the students will be 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, Q, Learning.
CO4	Identify the difference between Machine Learning and Deep Learning and using

	scenario
CO5	Explain the concepts of Q learning and deep learning
Course (Practice) Outcomes: After completing the course, the students will be able to	
CO1	Understand the implementation procedures for the machine learning algorithms.
CO2	Design Java/Python programs for various Learning algorithms.
CO3	Apply appropriate data sets to the Machine Learning algorithms.
CO4	Identify and apply Machine Learning algorithms to solve real world problems.
CO5	Perform statistical analysis of machine learning techniques.

Text Books	
1	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
Reference Books:	
1	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2	Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

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 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.

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 marks are 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.

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

High-3, Medium-2, Low-1

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 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.

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 marks are 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.

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

Semester: VI		
CRYPTOGRAPHY AND NETWORKSECURITY **(Theory and Practice)**		
Course Code: MVJ21CS63		**CIE Marks: 50+50**
Credits:4 L:T:S:3:0:2		**SEE Marks: 50 +50**
Hours: 40L+26P		**SEEDuration:03+03Hours**
Course Learning Objectives: The students will be able to		
1	Explain the objectives of information security	

2	Explain the importance and application of each of confidentiality, integrity, authentication and availability
3	Understand various cryptographic algorithms.
4	Understand the basic categories of threats to computers and networks
5	Describe public-key cryptosystem.

UNIT-I	
Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security. **Cryptography Concepts and Techniques:** Introduction, plaintext and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks. Modular arithmetic- Euclid's algorithm, Polynomial Arithmetic –Prime numbers- Fermat's and Euler's theorem- Testing for primality -The Chinese remainder theorem	**8Hrs**
UNIT-II	
Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers,RC4. **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.	**8Hrs**
UNIT-III	
Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm(SHA-512), **Message authentication codes:** Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. **Key Management and Distribution:** Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys,Kerberos,X.509 Authentication Service, Public– Key Infrastructure	**8Hrs**
UNIT-IV	
Transport-level Security : Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell(SSH)	**8Hrs**

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE802.11 Wireless LAN, IEEE802.11i Wireless LAN Security	
UNIT-V	
E-Mail Security: Pretty Good Privacy, S/MIME **IP Security:** IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange **Case Studies on Cryptography and security:** Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Crosssite Scripting Vulnerability.	**8Hrs**

LABORATORYEXPERIMENTS

1. Write a program that contains a string(charpointer) with a value 'HelloWorld'. The program should XOR each character in this string with 0 and displays the result.
2. Write a program that contains a string (charpointer) with a value 'HelloWorld'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms: a) Ceaser Cipher b) Substitution Cipher c) Hill Cipher.
4. Write a Java program to implement the DES algorithm logic.
5. Write a C/JAVA program to implement the Blowfish algorithm logic.
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text "Helloworld" using Blowfish. Create your own key using Java key tool.
8. Write a Java program to implement RSA Algorithm with p=3,q=11.
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10. Calculate the message digest of a text using the MD5 algorithm in JAVA.
11. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
12. Using Java Cryptography, encrypt the text "Helloworld" using Blowfish. Create your own key using Java key tool.

Any 12 experiments to be conducted

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the major types of threats to information security and the associated attacks, Services and Mechanisms
CO2	Design and develop cryptographic algorithms using public key cryptography.
CO3	Generate the own key for developing cryptography algorithms.
CO4	Understand various Transport-level Security and Wireless Network Security
CO5	Generate and distribute a PGP key pair and use the PGP package to send an encrypted e-mail message.

ReferenceBooks	
1.	Cryptography and Network Security-Principles and Practice: William Stallings,Pearson Education,6th Edition
2.	Cryptography and Network Security: Atul Kahate, McGraw Hill, 3rd Edition
3.	Cryptography and Network Security: CK Shyamala, N Harini, Dr T R Padmanabhan, Wiley India,1st Edition.
4.	Cryptography and Network Security: Forouzan Mukhopadhyay,McGraw Hill,3rd Edition

Theoryfor 50Marks

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-50Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in everysession.The average of the marks over number of weeks isconsidered for 30 marks. At the end ofthe 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.

SemesterEndExamination(SEE): Total

marks: 50+50=100

SEEfor50marksareexecutedbymeansofanexamination.

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.

ExperimentConductionwithproperresultsisevaluatedfor40marksandVivaisfor10marks.Total SEE for laboratory is 50 marks.

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

High-3, Medium-2, Low-1

Semester: VI		
PYTHON PROGRAMMING (Theory)		
Course Code:	**MVJ21CS641**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Familiarize the students with the fundamentals and programming basics of Python Language	

UNIT-I	
Prerequisites: Knowledge of C Programming is required	**Hrs 8**

Introduction to Python: Features of python, Applications of python, Syntax, Comments, Indentations, Number types, Variables and Data Types, Operators, conditional statement, Loops in Python. **Python List:** Create Python List, Access Python List, Slicing a Python List, slicing and dicing, Reassigning a Python List (Mutable), Reassigning the whole Python list, Deleting list and elements, Multidimensional Lists, List Operations, Built-in List Functions.	
UNIT-II	
Python Tuple: Create a Python Tuple, Tuples Packing, Tuples Unpacking, creating a tuple with a single item, Access Python Tuple, slicing a Tuple, Deleting a Python Tuple, Reassigning Tuples, Tuple Functions Tuple Operations. **Python Dictionary:** Create a Dictionary, Dictionaries with mixed keys, access a Python Dictionary, Delete Python Dictionary, In-Built Functions on a Python Dictionary, In-Built Methods on a Python Dictionary, Dictionary Operations.	**Hrs 8**
UNIT-III	
Python Function: User-Defined Functions in Python, Python Built-in Functions, Python Lambda Expressions, Recursion Function, Range function. **Python Method:** Introduction to Method, __init__(), Self-Parameter, Functions vs Method, Magic Methods.	**Hrs 8**
UNIT-IV	
Python Class: Introduction to Python Class, defining a Python Class, Accessing Python Class Members Python Object Attributes Belonging to Python Class, Delete Python Class, Attribute, Inheritance, Multiple inheritance.	**Hrs 8**
UNIT-V	
File Handling In Python: Read and Write File, Open File, Close File, File Methods, Data Base connections.	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand data types (like character strings, integers, and real numbers)and the Operations that can be Applied to each data type.
CO2	Write programs that get input, perform calculations, and provide output (using Conditional logic, loops, Functions).
CO3	Write well designed and well documented programs that are easily maintainable
CO4	Analyze String Formatting Options.
CO5	Enjoy the art and science of computer files using python.

Text Books:	
1	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser Data Structures and Algorithms in Python John Wiley & Sons, Incorporated.
2	Frank Kane (2017)Hands-On Data Science and Python Machine Learning 1st Edition, Kindle Edition.

Reference Books	
1.	Mark Smart, (2018), Introduction to Data Science with Python: Basics of Numpy and Pandas.
2.	VK Jain,Data Science & Analytics, Khanna Book Publishing ;edition (2018)

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

CO4	3	3	2	2	-	-	-	-	-	-	-	1	2	-
CO5	3	3	3	2	-	-	-	-	-	-	-	1	1	2

High-3, Medium-2, Low-1

Semester: VI		
WEB TECHNOLOGIES (Theory)		
Course Code:	**MVJ21CS642**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand different Internet Technologies.	
2	Learn java-specific web services architecture	
3	Understand the SQL and JDBC	
4	Learn the AJAX and JSON	

UNIT-I	
Website Basics, HTML5, CSS 3, Web 2.0: Web Essentials: Clients, Servers and Communication ,The Internet, Basic Internet protocols, World wide web, HTTP Request Message , HTTP Response Message, Web Clients, Web Servers, HTML5 : Tables, Lists, Image, HTML5 control elements , Semantic elements , Drag and Drop, Audio, Video controls, CSS3: Inline, embedded and external style sheets, Rule cascading, Inheritance, Backgrounds, Border Images, Colours, Shadows, Text, Transformations **Laboratory Sessions/ Experimental learning:** **1.** Design HTML form for keeping student record. **2.** Write a HTML code to generate following output. Create an html page with following specifications a. Title should be about my college b. Put the image in the background c. Place your college name at the top of the page in large text followed by address in smaller size d. Add names of courses offered each in a different color, style and typeface e. Add scrolling text with a message of your choice	**Hrs 8**

Video link / Additional online information: • https://www.youtube.com/watch?v=QEtWL4lWlL4 • https://www.youtube.com/watch?v=h_RftxdJTzs	
UNIT-II	
Client side Programming: An Introduction to java Script, JavaScript DOM Model, Date and Object, Regular Expression, Exception Handling, Validation, Built-in Objects, Event Handling, DHTML with JavaScript, JSON introduction, Syntax, Function Files, Http Request, SQL. **Laboratory Sessions/ Experimental learning:** 1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient. 2. Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt. **Video link / Additional online information:** • https://www.youtube.com/watch?v=uDwSnnhl1Ng&list=PLsyeobzWxl7qtP8Lo9TReqUMkiOp446cV • https://www.youtube.com/watch?v=zPTY1hKq3SU&list=PLVlQHNRLflP-ByWEVjCZAj79kJdshKQwu	**Hrs 8**
UNIT-III	
Server Side Programming: Java Servlet Architecture, Servlet Life Cycle, Form GET and POST actions, Session handling, Installing and Configuring Apache Tomcat Web Server, Database Connectivity: JDBC perspectives, JDBC Program Example, JSP: Understanding Java server page, JSP Standard Tag Library (JSTL), Creating HTML form using JSP Code. **Laboratory Sessions/ Experimental learning:** 1. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. a. Create a Cookie and add these four user id's and passwords to this Cookie. b. Read the user id and passwords entered in the Login form and	**Hrs 8**

authenticate with the values available in the cookies. 2. Write a JSP which insert the details of the 3 or 4users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database. **Video link / Additional online information:** • https://www.youtube.com/watch?v=7TOmdDJc14s&list=PLsyeobzWxl7pUPF2xjjJiG4BKC9x_GY46 • https://www.youtube.com/watch?v=xve6QEgIR-0&list=PL0zysOflRCel5BSXoslpfDawe8FyyOSZb • https://www.youtube.com/watch?v=0pzR2FGTEhk	
UNIT-IV	
PHP: Introduction to PHP, PHP using PHP, Variables, Program Control, Built-in Functions, Form Validation, Basic command with PHP examples, Connection to server, creating Database, Selecting Database, Listing Database, listing table names Creating a table, Inserting data, deleting data and tables, altering tables. **Laboratory Sessions/ Experimental learning:** 1. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings. 2. Write a PHP program to display a digital clock which displays the current time of the server. 3. Write a PHP program to sort the student records which are stored in the database using selection sort. 4. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document. **Video link / Additional online information :** • https://www.youtube.com/watch?v=itRkLa2kq6w • https://www.youtube.com/watch?v=KJHYdkKtafU • https://www.youtube.com/watch?v=G_CFRAdbXfI&list=PL_RGaFnxSHWrjkpK2zD4TWKWMWVfeYK-b	**Hrs 8**
UNIT-V	

AJAX: Ajax client server architecture, Xml HTTP request object, Call back methods. Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, Web Services: Introduction, Java web services Basics, Creating, Publishing, Testing and Describing a web services, Database driven web service from an application. **Laboratory Sessions/ Experimental learning:** 1. Creating simple application to access data base using JDBC Formatting HTML with CSS. 2. Write a Program for manipulating Databases and SQL with real time application. 3. Write a Java applet to display the Application Program screen i.e. calculator and other. **Video link / Additional online information** • https://www.youtube.com/watch?v=qk9MWbyRlhE • https://www.youtube.com/watch?v=0pzR2FGTEhk • https://www.youtube.com/watch?v=HgvIox6ehkM	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Construct a basic website using HTML and Cascading Style Sheets.
CO2	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanism.
CO3	Develop server side programs using Servlets and JSP.
CO4	Construct simple web pages in PHP and to represent data in XML format.
CO5	Use AJAX and web services to develop interactive web applications.

Text Books:	
1	Deitel and Deitel and Nieto,Internet and World Wide Web, How to Program, Prentice Hall, 5th Edition, 2011.
2	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1stEdition, Pearson Education India. (ISBN:978-9332575271)

Reference Books	
1.	Stephen Wynkoop and John Burke ―Running a Perfect Website‖, QUE, 2nd Edition,1999
2.	Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.

3.	UttamK.Roy, ―Web Technologies‖, Oxford University Press, 2011.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: VI		
OPERATING SYSTEMS		
Course Code: MVJ21CS643		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		

1	Introduce concepts and terminology used in OS.
2	Explain threading and multithreaded systems.
3	Illustrate process synchronization and concept of Deadlock.
4	Introduce Memory and Virtual memory management, File system and storage techniques.

UNIT-I	
Introduction: What operating systems do; Computer System organization; Computer System architecture; Operating System operations; 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; System boot. **Process Management**: Process concept; Process scheduling; Operations on processes; Inter process communication.	**8 Hrs**
UNIT-II	
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. **Process Synchronization**: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.	**8 Hrs**
UNIT-III	
Deadlocks: Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Memory Management**: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation	**8 Hrs**
UNIT-IV	
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **File System, Implementation of File System**: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; **Implementing File system**: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.	**8 Hrs**
UNIT-V	
Mass Storage Structure-Disk Structure - Disk Attachment-Disk Scheduling-Disk	**8 Hrs**

Management- Swap-Space Management. **Protection**: Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Studies: Windows, Unix, Linux, Android.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate the fundamental concepts of operating systems.
CO2	Compare and illustrate various process scheduling algorithms.
CO3	Ability to recognize and resolve Deadlock problems ,Memory Management techniques.
CO4	Apply appropriate memory and file management schemes.
CO5	Appreciate the need of access control and protection in Operating System and illustrate various disk scheduling algorithms.

Reference Books	
3.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts 7th edition,Wiley-India, 2006
4.	D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013.
3.	Tanenbaum, A., "Modern Operating Systems", Prentice-Hall of India. 2004
4.	P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition,2013

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: VI		
MOBILE APPLICATION DEVELOPMENT		
Course Code:	**MVJ21CS644**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Demonstrate their understanding of the fundamentals of Android operating systems	
2	Demonstrate their skills of using Android software development tools	
3	Familiarize engineering practices and standards used in developing software products and components.	
4	Demonstrate their ability to develop software with reasonable complexity on mobile platform	

UNIT-I	
Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, best practices in Android programming, Android tools. Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes **Video link / Additional online information (related to module if any):** 2. https://www.youtube.com/watch?v=deq8mkt_cxQ	**Hrs 8**
UNIT-II	
Android User Interface: Measurements – Device and pixel density independent measuring units Layouts – Linear, Relative, Grid and Table	**Hrs 8**

Layouts User Interface (UI) Components – Editable and non editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities **Applications:** Design a Simple Calculator App **Video link / Additional online information (related to module if any):** 2. https://www.youtube.com/watch?v=PJ3RdfJ4Np8	
UNIT-III	
Intents and Broadcasts: Intent – Using intents to launch Activities, explicitly starting new Activity, Implicit Intents, passing data to Intents, getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toast. **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106/106/106106147/	**Hrs 8**
UNIT-IV	
Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update) **Video link / Additional online information (related to module if any):** • http://developer.android.com/develop/index.htm	**Hrs 8**
UNIT-V	
Advanced Topics: Alarms – Creating and using alarms Using Internet Resources – Connecting to internet resource, using download manager Location Based Services – Finding Current Location and showing location on the Map, updating location **Video link / Additional online information (related to module if any):**	**Hrs 8**

2. https://www.codeschool.com/learn/ios	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamentals of Android operating systems
CO2	Understand various layouts and designing UI.
CO3	Understand major Android components intents, broadcasting and notifications.
CO4	Understand basic concepts of SQLite database.
CO5	Understand how to utilize Location based services.

Text Books	
3.	Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012
4.	David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.
5.	Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.

Reference Books:	
1.	James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012
2.	Jeff McW herter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.

Continuous Internal Evaluation (CIE):
Theory for 50 Marks
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Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: VI		
NATURAL LANGUAGE PROCESSING		
Course Code:	**MVJ21CS645**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able 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.	

UNIT-I	
INTRODUCTION: Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM –Regular Expressions, Finite-State Automata – English Morphology, Transducers forlexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum EditDistance values of real symmetric matrices: Jacobi and Givens method. **Laboratory Session**: Word Analysis **Applications:** Text to Speech conversion **Video link** : https://nptel.ac.in/courses/106/105/106105158/	**Hrs 8**
UNIT-II	
WORD LEVEL AND SYNTACTIC ANALYSIS: Ngrams Models of Syntax - Counting Words - Unsmoothed Ngrams-Smoothing-Back off Deleted Interpolation –	**Hrs 8**

Entropy – EnglishWord Classes - Tag sets for English-Part of Speech Tagging- RuleBased Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging -Issues in PoS tagging – Hidden Markov and Maximum Entropy models. **Laboratory Session**: Morphological Analyzer for a given word **Applications**: Speech to text conversion **Video link** : https://nptel.ac.in/courses/106/105/106105158/	
UNIT-III	
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 **Laboratory Sessions**: Chunking for a given sentence **Applications**: Compiler • **Video link** : https://www.youtube.com/watch?v=6b40kKe2SFg	**Hrs 8**
UNIT-IV	
SEMANTICS AND PRAGMATICS: 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. **Laboratory Session**: Pragmatic Analysis of a given sentence **Applications**: Sentiment Analysis • **Videolink**:https://www.coursera.org/lecture/humanlanguage/pragmatics-E8VXH	**Hrs 8**
UNIT-V	

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). **Laboratory Session**: Sentiment analysis on movie database **Applications**: Sentiment analysis **Videolink**: https://www.coursera.org/lecture/text-mining-analytics/5-6-how-to-do-sentiment-analysis-with-sentiwordnet-5RwtX	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	To tag a given text with basic Language features.
CO2	To design an innovative application using NLP components
CO3	To implement a rule-based system to tackle morphology/syntax of a language
CO4	To design a tag set to be used for statistical processing for real-time applications
CO5	To compare the use of different statistical approaches for different types of NLP applications

Text Books	
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", MIT Press. Cambridge, MA:1999

Reference Books:	
1	Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.
2	Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S.Tiwary
3	Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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.

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CO3	3	3	3	-	-	-	-	-	-	-	-	-	1	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII		
INTERNET OF THINGS AND LAB (Theory and Practice)		
Course Code:	**MVJ21CS71**	**CIE Marks:50+50**
Credits:	**4**	**SEE Marks: 50 +50**
Hours:		**SEE Duration: 03+03 Hours**
Course (Theory) Learning Objectives: The students will be able to		
1	Learn the basic issues, policy and challenges in the Internet.	

2	Get an idea of some of the application areas where Internet of Things can be applied.
3	Understand the cloud and internet environment.
4	Understand the various modes of communications with Internet.
Course (Practice) Learning Objectives: The students will be able to	
1	Understand the concepts of Internet of Things.
2	Analyse basic protocols in wireless sensor network.
3	Design IoT applications in different domain and be able to analyze their performance
4	Implement basic IoT applications on embedded platform.

UNIT-I	
Prerequisites : Basic Knowledge about C or C++ **Introduction to IoT:** Definition – Foundations – Challenges and Issues - Identification - Security. Components in internet of things: Control Units – Sensors – Communication modules –Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks –Mobile Internet – Wired Communication-IoT Platform Overview-Raspberry pi-Arduino boards.* **Applications:** Sensors in IoT. **Video link / Additional online information (related to module if any):** • http://www.theinternetofthings.eu/what-is-the-internet-of-things. • https://www.engineersgarage.com/article_page/sensors-different-types-of-sensors/ • https://www.educba.com/applications-of-sensors/ *** Programming Assignments are Mandatory.**	**Hrs 8**
UNIT-II	
IoT Protocols: Protocol Standardization for IoT-M2M and WSN Protocols-SCADA and RFID Protocols-Issues with IoT Standardization-Protocols-IEEE 802.15.4-BACNet Protocol-Zigbee Architecture - Network layer – APS Layer – Security.* **Applications:** IoT Protocol Applications **Video link / Additional online information (related to module if any):** • https://inductiveautomation.com/resources/article/what-is-scada • https://iotbytes.wordpress.com/application-protocols-for-iot/ • https://data-flair.training/blogs/iot-protocols/ • https://www.avsystem.com/blog/iot-protocols-and-standards/ *** Programming Assignments are Mandatory.**	**Hrs 8**
UNIT-III	

Resource Management in the Internet of Things: Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object – Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behaviour of Objects.* **Applications:** RFID Applications **Video link / Additional online information (related to module if any):** RFID Applications: • https://www.digiteum.com/rfid-technology-internet-of-things • https://www.uio.no/studier/emner/matnat/ifi/INF5910CPS/h10/undervisningsmateriale/RFID-IoT.pdf *** Programming Assignments are Mandatory.**	**Hrs 8**
UNIT-IV	
Case Study and IoT Application Development: IoT applications in home- infrastructures security- Industries- IoT electronic equipment's. Use of Big Data and Visualization in IoT Industry 4.0 concepts - Sensors and sensor Node –Interfacing using Raspberry Pi/Arduino- Web Enabled Constrained Devices. **Laboratory Sessions/ Experimental learning:**Interfacing using Raspberry Pi/Arduino **Applications:** Elements in group **Video link / Additional online information (related to module if any):** • https://www.simform.com/home-automation-using-internet-of-things/ • https://iot5.net/iot-applications/smart-home-iot-applications/ • https://maker.pro/raspberry-pi/tutorial/how-to-connect-and-interface-raspberry-pi-with-arduino# • https://create.arduino.cc/projecthub/ruchir1674/how-to-interface-arduino-with-raspberrypi-504b06 *** Programming Assignments are Mandatory.**	**Hrs 8**
UNIT-V	

Web of Things:Web of Things versus Internet of Things-Architecture Standardization for WoT-Platform Middleware for WoT- WoT Portals and Business Intelligence-Cloud of Things: Grid/SOA and Cloud Computing-Cloud Standards –Cloud of Things Architecture-Open Source e-Health sensor platform. Video link / Additional online information (related to module if any): • https://www.water-io.com/iot-vs-wot • https://www.talend.com/resources/iot-cloud-architecture/ *** Programming Assignments are Mandatory.**	**Hrs 8**

LABORATORY EXPERIMENTS

SL. NO.	EXPERIMENT	HRS
1	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.	**3**
2	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.	**3**
3	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.	**3**
4	To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.	**3**
5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.	**3**
6	To interface Push button/Digital sensor (IR/LDR) with Arduino / Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.	**3**
7	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.	**3**
8	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	**3**
9	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.	**3**

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

CO1	Identify the components of IoT.
CO2	Analyze various protocols of IoT.
CO3	Design portable IoT using appropriate boards
CO4	Develop schemes for the applications of IOT in real time scenarios.
CO5	Design business Intelligence and Information Security for WoT
Course (Practice) Outcomes: After completing the course, the students will be able to	
CO1	To understand how sensors and embedded systems work
CO2	Design and implement an accessory with BLE connectivity using standard mobile application development tools
CO3	To understand how to communicate with other mobile devices using various communication platforms such as Bluetooth and Wi-Fi.
CO4	Develop and demonstrate applications e.g. smartphone-based, sensor station
CO5	To understand how to program on embedded and mobile platforms.

Text Books	
1	Honbo Zhou, ”The Internet of Things in the Cloud:A Middleware Perspective” -CRC Press-2012.
2	Dieter Uckelmann, Mark Harrison, “Architecting the Internet of Things”, Springer2011.
Reference Books:	
1	Arshdeep Bahga, Vijay Madisetti, “Internet of Things (A Hands-On-Approach)”, VPT, 2014.
2	Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
3	Luigi Atzori, Antonio Lera, Giacomo Morabito, “The Internet of Things: A Survey”, Journal on Networks, Elsevier Publications, October, 2010.

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 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.

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 marks are 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.

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

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

High-3, Medium-2, Low-1

Semester: VII		
QUANTUM COMPUTING		
Course Code:	**MVJ21CS721**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1		
2		
3		
4		
5		

UNIT-I	
	Hrs 8
UNIT-II	
	Hrs 8
UNIT-III	
	Hrs 8
UNIT-IV	
	Hrs 8
UNIT-V	
	Hrs 8

Course Outcomes: After completing the course, the students will be able to	
CO1	
CO2	
CO3	
CO4	
CO5	

Text Books	
1	
2	

Reference Books:	
1	

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: VII		
GREEN COMPUTING		
Course Code:	**MVJ21CS722**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
2	Skill in energy saving practices in their use of hardware.
3	Examine technology tools that can reduce paper waste and carbon footprint by user and to understand how to minimize equipment disposal requirements

UNIT-I	
FUNDAMENTALS: Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics. **Real Time Applications:** how they keep data safe while in transit **Video link / Additional online information:** • https://nptel.ac.in/courses/106/104/106104182/ • https://www.youtube.com/watch?v=350Rb2sOc3U	**Hrs 8**
UNIT-II	
GREEN ASSETS AND MODELING : Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models. **Real Time Applications:** climate-smart agriculture, land restoration, groundwater management, ecosystem-based adaptation **Video link / Additional online information:** • https://nptel.ac.in/courses/110/107/110107128/ • https://nptel.ac.in/courses/110/107/110107093/	**Hrs 8**
UNIT-III	
GRID FRAMEWORK : Virtualizing of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework. **Real Time Applications:** ChessBrain **Video link / Additional online information:** • https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee42/	**Hrs 8**

• https://onlinecourses.nptel.ac.in/noc19_ee64/preview	
UNIT-IV	
GREEN COMPLIANCE : Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future. **Real Time Applications:** Addressing Inconsistent Date Formats, Reducing False Positives in PEP Screening, Integrating Screening with Credit Card Approval Processes. **Video link / Additional online information:** • https://onlinecourses.nptel.ac.in/noc19_ee64/preview	**Hrs 8**
UNIT-V	
CASE STUDIES : The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector. **Real Time Applications:** The energy consumption in Torrent systems with malicious content, The use of thin client instead of desktop PC **Video link / Additional online information:** • https://nptel.ac.in/courses/106/105/106105195/ • https://nptel.ac.in/courses/106/104/106104182/	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
CO2	Enhance the skill in energy saving practices in their use of hardware.
CO3	Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.
CO4	Understand the ways to minimize equipment disposal requirements.
CO5	Carry out multiple real time case studies.

Text Books	
1	Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011
2	Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.

Reference Books	
1	Bhuvan Unhelkar, Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.
2	Woody Leonhard, Katherine Murray, Green Home computing for dummies, August 2012.
3	Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM rebook, 2011.
4	Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.
5	Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: VII		
ETHICAL HACKING		
Course Code:	**MVJ21CS723**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand numerous methods of real-world information intelligence	
2	Learn about vulnerability scanners	
3	Understand techniques used to sniff traffic across a network	
4	Familiarize with the methodologies that can be used to hack into a target.	
5	Appreciate the wide variety of attacks that can be performed against a wireless network	

UNIT-I	
INTRODUCTION TO HACKING : Terminologies, Categories of Penetration Test, Writing Reports, Structure of a Penetration Testing Report, Vulnerability Assessment Summary, Risk Assessment, Methodology, Linux Basics: File Structure, Cron Job, Users, Common Applications , BackTrack, Services. **Applications:** Network packet analysis, Password guessing and cracking **Video link / Additional online information (related to module if any):** • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_process.htm • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_hacker_types.htm	**Hrs 8**
UNIT-II	
INFORMATION GATHERING, TARGETENUMERATION AND PORT SCANNING TECHNIQUES Active, Passive and Sources of information gathering, Copying Websites Locally, NeoTrace, Cheops-ng, Intercepting a Response, WhatWeb, Netcraft, Basic Parameters, Xcode Exploit Scanner, Interacting with DNS Servers, Fierce, Zone Transfer with Host Command and Automation, DNS Cache Snooping- Attack Scenario, Automating Attacks, SNMP - Problem, Sniffing Passwords, Solar Winds Toolset, sweep, Brute Force and Dictionary- Tools , Attack, Enumeration,	**Hrs 8**

Intelligence Gathering Using Shodan, Target enumeration and Port Scanning Techniques. Applications: Session hijacking, Session spoofing Video link / Additional online information (related to module if any): •https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_enumeration.htm •https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sniffing.htm	
UNIT-III	
VULNERABILITY ASSESSMENT & NETWORKSNIFFING : Introduction to Vulnerability Assessment - Pros and Cons, NMap, Updation of database, Testing SCADA Environments with Nmap, Nessus, Sniffing: Types, Hubs versus Switches, Modes, MITM Attacks, ARP Protocol Basics- working, Attacks, DoS Attacks, Dsniff tool, Using ARP Spoof to Perform MITM Attacks, Sniffing the Traffic with Dsniff, Sniffing Pictures with Drifnet, Urlsnarf and Webspy, Sniffing with Wireshark, Ettercap- ARP Poisoning, Hijacking Session with MITM Attack, ARP Poisoning with Cain and Abel, Sniffing Session Cookies with Wireshark, Hijacking the Session, SSL Strip: Stripping HTTPS Traffic, Requirements, Automating Man in the Middle Attacks, DNS Spoofing, DHCP Spoofing Applications: Network traffic sniffing, Denial of Service attacks Video link / Additional online information (related to module if any): •https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sniffing.htm •https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_tcp_ip_hijacking.htm	**Hrs 8**
UNIT-IV	
Understanding Network Protocols: Attacking Network Remote Services, Common Target Protocols, tools for cracking network remote services, Attacking SMTP, Attacking SQL Servers, Client Side Exploitation Methods: E-Mails Leading to Malicious Attachments & Malicious Links, Compromising Client Side Update, Malware Loaded on USB Sticks **Post exploitation:** Acquiring Situation Awareness, Privilege Escalation, Maintaining Access, Data Mining, Identifying and Exploiting Further Targets, Windows Exploit Development Basics. **Applications:** Exploiting buffer overflow vulnerabilities **Video link / Additional online information (related to module if any):**	**Hrs 8**

• https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sql_injection.htm • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_exploitation.htm	
UNIT-V	
WIRELESS & WEB-HACKING **Wireless Hacking :** Requirements , Aircracking , Hidden SSIDs , Monitor Mode , Monitoring Tool- Beacon Frames on Wireshark ,Airodump-ng , Wireless Adapter in Monitor Mode , Determining the Target , Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng , Capturing Packets and Four-Way Handshake. **Web Hacking :** Attacking the Authentication , Brute Force and Dictionary Attacks , Types of Authentication , Crawling Restricted Links , Testing for the Vulnerability , Authentication Bypass with Insecure Cookie Handling , SQL injection, XSS – DOM based,BeEF,CSRF, Bypassing CSRF and BeEF with XSS, Vulnerability in FCKeditor, efront. **Applications:** Cross Site Scripting, Firewall **Video link / Additional online information (related to module if any):** • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_ddos_attacks.htm • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_wireless.htm	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the core concepts related to malware, hardware and software vulnerabilities and their causes
CO2	Understand ethics behind hacking and vulnerability disclosure
CO3	Appreciate the Cyber Laws and impact of hacking Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies
CO4	Learn & understand different network protocols and attack strategies
CO5	Understanding the usefulness of wireless & web hacking

Text Books	
1	Rafay Baloch ,―Ethical Hacking and Penetration Testing Guide‖, CRC Press, 2015.
2	Patrick Engebretson, ―The Basics of Hacking and Penetration Testing : Ethical Hacking and Penetration Testing Made Easy‖, Syngress Media, Second Revised Edition, 2013.

Reference Books:	
1	Michael T. Simpson, Kent Backman, James E. Corley, ―Hands On Ethical Hacking

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: VII		
CYBER SECURITY		
Course Code:	**MVJ21CS724**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand Ethical Hacking.
2	Understand Preventing, monitoring, and responding to data breaches and cyber-attacks.
3	Learn the key components of cyber security network architecture.
4	Analyse cyber security architecture principles

UNIT-I	
A web security forensic lesson, web languages, introduction to different web attacks, overview of n-tier web applications; Web servers: Apache, IIS, database servers, introduction and overview of cybercrime, nature and scope of cybercrime, types of cybercrime: social engineering, categories of cybercrime, property cybercrime. **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106/106/106106129/	**Hrs 8**
UNIT-II	
Public key cryptography, RSA, online shopping, payment gateways, unauthorized access to computers, computer intrusions, white collar crimes, viruses and malicious code, internet hacking and cracking, virus attacks, pornography, software piracy, intellectual property, mail bombs, exploitation, stalking and obscenity in internet, digital laws and legislation, law enforcement roles and responses. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=6qdmriq2tWA	**Hrs 8**
UNIT-III	
Web hacking basics HTTP and HTTPS URL, web under the cover overview of java security reading the HTML source, applet security, servlets security, symmetric and asymmetric encryptions, network security basics, firewalls and IDS. Investigation: Introduction to cybercrime investigation, investigation tools, e-discovery, digital evidence collection, evidence preservation, e-mail investigation, e-mail tracking, IP tracking, e-mail recovery, hands on case studies; Encryption and Decryption methods, search and seizure of computers, recovering deleted evidences, password cracking **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106/105/106105217/	**Hrs 8**
UNIT-IV	

Digital certificates, hashing, message digest, and digital signatures; Digital forensics: Introduction to digital forensics, forensic software and hardware, analysis and advanced tools, forensic technology and practices, forensic ballistics and photography, face, iris and fingerprint recognition, audio video analysis, windows system forensics, Linux system forensics, network forensics. **Video link / Additional online information (related to module if any):** • https://www.digimat.in/nptel/courses/video/106106178/L05.html	**Hrs 8**
UNIT-V	
Basics, secure JDBC, securing large applications, cyber graffiti; Laws and acts: Laws and ethics, digital evidence controls, evidence handling procedures, basics of Indian Evidence Act IPC and CrPC, electronic communication privacy act, legal policies. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=F7mH5vz1qEI	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.
CO2	Design, develop, test and evaluate secure software.
CO3	Develop policies and procedures to manage enterprise security risks.
CO4	Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.
CO5	Assess cyber-security risk management policies in order to adequately protect an organization

Text Books	
1	Mc Clure, Stuart, Saumil Shah, Shreeraj Shah, ―Web Hacking: Attacks and Defense‖, AddisonWesley Professional, Illustrated Edition, 2003.
2	Garms, Jess, Daniel Somerfield, ―Professional Java Security‖, WroxPress, Illustrated Edition, 2001.

Reference Books:	
1	Nelson Phillips, EnfingerSteuart, ―Computer Forensics and Investigations‖, Cengage Learning, New Delhi,2009.
2	Kevin Mandia, Chris Prosise, Matt Pepe, ―Incident Response and Computer Forensics ―, Tata McGraw Hill,2009
3	Robert M Slade, ―Software Forensics‖, Tata McGraw Hill, New Delhi, 1st Edition,2005.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: VII

DIGITAL IMAGE PROCESING		
Course Code:	**MVJ21CS725**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Focuses on development of algorithms and techniques to analyze and interpret the visible world around us.	
2	Understand the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc.	
3	Explore the applications ranging from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.	

UNIT-I	
DIGITAL IMAGE FORMATION AND LOW-LEVEL PROCESSING Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing **Video link / Additional online information:** • https://www.youtube.com/watch?v=CVV0TvNK6pk	**Hrs 8**
UNIT-II	
DEPTH ESTIMATION AND MULTI-CAMERA VIEWS Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. **Video link / Additional online information:** • http://www.cse.iitm.ac.in/~vplab/computer_vision.html	**Hrs 8**
UNIT-III	
FEATURE EXTRACTION Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. **Video link / Additional online information:** • https://nptel.ac.in/courses/106/106/106106046/	**Hrs 8**
UNIT-IV	
IMAGE SEGMENTATION	**Hrs 8**

Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection. **Video link / Additional online information:** • https://nptel.ac.in/courses/117/105/117105079/	
UNIT-V	
PATTERN ANALYSIS Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods. **Video link / Additional online information:** • https://www.youtube.com/watch?v=mfePdDh9t6Q	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the concepts of Digital Image Processing.
CO2	Analyse Homography and stereopsis.
CO3	Analyse Edges and Hough Transforms.
CO4	Demonstrate the ideas of image Segmentation.
CO5	Implement the concepts of Pattern Analysis.

Text Books	
1	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

Reference Books:	
1	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2	K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
3	R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.
4	Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: VII			
GAME DESIGN & DEVELOPMENT (Theory)			
Course Code:		**MVJ21CS731**	**CIE Marks:50**
Credits:		**3**	**SEE Marks: 50**
Hours:			**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to			
1	Understand the concepts of Game design and development.		
2	Learn the processes, mechanics and issues in Game Design.		

3	Be exposed to the Core architectures of Game Programming.
4	Know about Game programming platforms, frame works and engines. Learn to develop games

UNIT-I	
3D GRAPHICS FOR GAME PROGRAMMING	
3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation, Physics-based Simulation, Scene Graphs.	**Hrs 8**
UNIT-II	
GAME ENGINE DESIGN	
Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.	**Hrs 8**
UNIT-III	
GAME PROGRAMMING	
Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management	**Hrs 8**
UNIT-IV	
GAMING PLATFORMS AND FRAMEWORKS	
2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - Unity. DX Studio.	**Hrs 8**
UNIT-V	
GAME DEVELOPMENT	
Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi-Player games.	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Discuss the concepts of Game design and development.
CO2	Design the processes, and use mechanics for game development.
CO3	Explain the Core architectures of Game Programming.
CO4	Use Game programming platforms, frame works and engines.
CO5	Create interactive Games

Text/ Reference Books	
1	Mike Mc Shaffrfy and David Graham, “Game Coding Complete”, Fourth Edition, Cengage Learning, PTR, 2012.

2	Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.
3	David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" 2 nd Editions, Morgan Kaufmann, 2006.
4	Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 2 nd Edition Prentice Hall / New Riders, 2009.
5	Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", 3 rd Edition, Course Technology PTR, 2011.
6	Jesse Schell, The Art of Game Design: A book of lenses, 1 st Edition, CRC Press, 2008.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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CO-PO/PSO Mapping														
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CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	-	-	-	-	-	-	-	-	-	1	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII

CLOUD COMPUTING (Theory)		
Course Code:	**MVJ21CS732**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges;
2	Introduce the basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations;
3	Discuss the different CPU, memory and I/O virtualization techniques that serve in offering software, computation and storage services on the cloud; Software Defined Networks (SDN) and Software Defined Storage (SDS);
4	Introduce cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage;
5	Discuss the variety of programming models and develop working experience in several of them.

UNIT-I	
Introduction to Cloud Computing: Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud. Introduction to big data analytics, using MapReduce/Hadoop for analyzing unstructured data, Hadoop ecosystem of tools. **Applications:** Microsoft Azure, Amazon Web Services **Video link / Additional online information :** 3. https://www.youtube.com/watch?v=PW-V-72MJNY	**Hrs 8**
UNIT-II	
'Integration as a Service' Paradigm for the Cloud Era: An Introduction, The Onset of Knowledge Era, The Evolution of SaaS , The Challenges of SaaS Paradigm, Approaching the SaaS Integration Enigma, New Integration Scenarios,	**Hrs 8**

The Integration Methodologies, SaaS Integration Products and Platforms , SaaS Integration Services, Businesses-to-Business Integration (B2Bi) Services, A Framework of Sensor- Cloud Integration, SaaS Integration Appliances, Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain **Laboratory Sessions/ Experimental learning:** 1. Installation and Configuration of Hadoop. **Applications:** PAAS(Facebook, Google App Engine) **Video link / Additional online information :** 3. https://www.youtube.com/watch?v=ifZh5SJAujA	
UNIT-III	
Virtual Machines Provisioning and Migration Services: Introduction and Inspiration- Background and Related Work-Virtual Machines Provisioning and Manageability- Virtual Machine Migration Services- VM Provisioning and Migration in Action–Provisioning in the Cloud Context- The Anatomy of Cloud Infrastructures-Distributed Management of Virtual Infrastructures - Scheduling Techniques for Advance Reservation of Capacity- Capacity Management to meet SLA Commitments- RVWS Design and Cluster as a Service: The Logical Design **Laboratory Sessions/ Experimental learning:** Implementation of Para-Virtualization using VM Ware‘s Workstation/ Oracle‘s Virtual Box and Guest O.S **Applications:** Hardware Virtualization, Operating system Virtualization, Server Virtualization, Storage Virtualization **Video link / Additional online information :** • https://www.youtube.com/watch?v=7m3f-P-WWbg	**Hrs 8**
UNIT-IV	
Platform and Software as a Service: Technologies and Tools for Cloud Computing- Aneka Cloud Platform- Aneka Resource Provisioning Service- Hybrid Cloud Implementation - CometCloud Architecture- Autonomic Behavior of CometCloud- Overview of CometCloud-based Applications- Implementation and Evaluation- Workflow Management Systems and Clouds- Architecture of Workflow Management Systems - Utilizing Clouds for Workflow Execution-	**Hrs 8**

Case Study: Evolutionary Multi objective Optimizations- Visionary thoughts for Practitioners **Laboratory Sessions/ Experimental learning:** Create an application (Ex: Word Count) using Hadoop Map/Reduce. **Applications:** Schedule book **Video link / Additional online information :** • https://www.youtube.com/watch?v=3KJjKY8k9Lk	
UNIT-V	
MapReduce Programming Model and Implementations: MapReduce Programming Model- Major MapReduce Implementations for the Cloud- The Basic Principles of Cloud Computing-A Model for Federated Cloud Computing-Traditional Approaches to SLO Management- Types of SLA- Life Cycle of SLA-SLA Management in Cloud- Automated Policy-based Management- The Current State of Data Security in the Cloud-Data Privacy and Security Issues-Producer_Consumer Relationship-Cloud Service Life Cycle **Laboratory Sessions/ Experimental learning:** Create your resume in a neat format using google and zoho cloud Programs on PaaS **Applications:** Network Storage, Google Apps and Microsoft office online **Video link / Additional online information :** 3. https://www.youtube.com/watch?v=uj2Sb7b_Do0	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Recall the recent history of cloud computing, illustrating its motivation and evolution.
CO2	List some of the enabling technologies in cloud computing and discuss their significance
CO3	Articulate the economic benefits as well as issues/risks of the cloud paradigm for businesses as well as cloud providers
CO4	Define SLAs and SLOs and illustrate their importance in Cloud Computing.
CO5	List some of the common cloud providers and their associated cloud stacks and recall popular cloud use case scenarios.

Text Books	
1	Cloud Computing, Principles and Paradigms, Rajkumar Buyya, James Broberg, Wiley Publication

2	Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

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

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Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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/PSO Mapping														
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CO1	2	1	1	-	1	1	2	-	-	-	-	-	1	-
CO2	3	3	3	3	2	-	-	-	-	-	-	-	-	-
CO3	1	-	-	1	1	-	2	3	3	3	3	-	2	-
CO4	3	3	2	2	2	-	-	-	-	-	-	3	-	-
CO5	3	3	3	3	3	2	-	-	3	3	3	3	2	1

High-3, Medium-2, Low-1

Semester: VII
BLOCKCHAIN TECHNOLOGY

(Theory)		
Course Code:	**MVJ21CS733**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able 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.	

UNIT-I	
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. **Applications: Telecommunications, finance, universities** **Video link / Additional online information (related to module if any):** • https://coincentral.com/byzantine-generals-problem/ 4. https://www.tutorialspoint.com/distributed_dbms/distributed_dbms_databases.htm	**Hrs 8**
UNIT-II	
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. **Applications: Government, healthcare** **Video link / Additional online information (related to module if any):** 4. https://blockonomi.com/merkle-tree/	**Hrs 8**
UNIT-III	
Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. **Applications:** Decentralized Applications, Encrypted messaging applications **Video link / Additional online information (related to module if any):**	**Hrs 8**

• https://blockonomi.com/nakamoto-consensus/ • https://cointelegraph.com/explained/proof-of-work-explained	
UNIT-IV	
Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin. **Applications:** Peer - to - peer payment application. **Video link / Additional online information (related to module if any):** • https://blockgeeks.com/guides/smart-contracts/	**Hrs 8**
UNIT-V	
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. **Video link / Additional online information (related to module if any):** • https://www.water-io.com/iot-vs-wot 4. https://www.talend.com/resources/iot-cloud-architecture/	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Basic Cryptographic primitives used in Blockchain – Secure, Collison-resistant hash functions, digital signature, public key cryptosystems, zero-knowledge proof systems.
CO2	Policies and applications of Blockchain in Distributed databases.
CO3	Explain the Nakamoto consensus, List and describe differences between proof-of-work and proof-of-stake consensus.
CO4	Design, build, and deploy smart contracts and distributed applications.
CO5	Cryptocurrency governance, regulations and applications.

Text Books	
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

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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CO3	3	3	1	2	-	-	-	-	-	1	-	3	2	-
CO4	3	3	3	3	-	-	-	2	2	2	-	3	2	3
CO5	3	3	3	3	-	-	2	2	3	2	-	3	1	-

High-3, Medium-2, Low-1

Semester: VII		
BIG DATA ANALYTICS		
Course Code:	**MVJ21CS734**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	The scope and essentiality of Big Data and Business Analytics.
2	The technologies used to store, manage, and analyze big data in a Hadoop ecosystem.
3	The techniques and principles in big data analytics with scalability and streaming capability.
4	The hypothesis on the optimized business decisions in solving complex real-world problems.

UNIT-I	
INTRODUCTION TO BIG DATA: Characteristics of Data,Evolution of Big Data,Definition of Big Data,Challenges with Big Data,Traditional Business Intelligence (BI) versus Big Data. Big data analytics: Classification of Analytics, Importance and challenges facing big data, Terminologies Used in Big Data Environments, The Big Data Technology Landscape. **Video link** : https://www.digimat.in/nptel/courses/video/106104189/L01.html	**Hrs 8**
UNIT-II	
INTRODUCTION TO HADOOP: Introducing Hadoop,RDBMS versus Hadoop,Distributed Computing Challenges, History and overview of Hadoop, Use Case of Hadoop,Hadoop Distributors,Processing Data with Hadoop, Interacting with Hadoop Ecosystem **Video link** : https://www.digimat.in/nptel/courses/video/106104189/L04.html	**Hrs 8**
UNIT-III	
THE HADOOP DISTRIBUTED FILESYSTEM: Hadoop Distributed File System(HDFS):The Design of HDFS, HDFS Concepts, Basic Filesystem Operations, Hadoop Filesystems. The Java Interface- Reading Data from a Hadoop URL, Reading Data Using the Filesystem API, Writing Data. Data Flow- Anatomy of a File Read, Anatomy of a File Write, Limitations. • **Video link** : https://www.digimat.in/nptel/courses/video/106104189/L04.html	**Hrs 8**
UNIT-IV	
UNDERSTANDING MAP REDUCE FUNDAMENTALS: Map Reduce Framework: Exploring the features of Map Reduce, Working of Map Reduce, Exploring Map and Reduce Functions, Techniques to optimize Map Reduce jobs, Uses of Map Reduce. Controlling MapReduce Execution with InputFormat, Reading Data with custom RecordReader,-Reader, Writer, Combiner, Partitioners, Map Reduce Phases,Developing simple MapReduce Application.	**Hrs 8**

Video link : https://www.digimat.in/nptel/courses/video/106104189/L06.html	
UNIT-V	
INTRODUCTION TO PIG: Introducing Pig: Pig architecture, Benefits, Installing Pig, Properties of Pig, Running Pig, Getting started with Pig Latin, Working with operators in Pig, Working with functions in Pig. • Video link: https://www.youtube.com/watch?v=qr_awo5vz0g	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the evolution of big data with its characteristics and challenges with traditional business intelligence.
CO2	Explain the big data technologies used to process and querying the bigdata in Hadoop, MapReduce and Pig.
CO3	Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes in distributed Hadoop Ecosystem
CO4	Develop a Map Reduce application for optimizing the jobs.
CO5	Develop applications for handling huge volume of data using Pig Latin

Text Books	
1	Seema Acharya, Subhashini Chellappan,—BigData and Analytics,Wiley Publications,2nd Edition, 2014 DT Editorial Services,—BigData, Dream Tech Press,2nd Edition,2015.
2	Tom White,—Hadoop:The Definitive Guide,O'Reilly,3 rd Edition,2012.
3	Big Data Black Book, dream tech publications , 1st Edition, 2017.

Reference Books:	
1	Michael Minelli, Michele Chambers,Ambiga Dhiraj, —Big Data,Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Wiley CIO Series, 1stEdition,2013.
2	Rajiv Sabherwal, Irma Becerra- Fernandez, —Business Intelligence –Practice, Technologies and Management, John Wiley, 1st Edition,2011
3	Arvind Sathi, —Big Data Analytics: Disruptive Technologies for Changing the Game, IBM Corporation, 1st Edition,2012.

Continuous Internal Evaluation (CIE):
Theory for 50 Marks
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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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: VII		
INTRODUCTION TO DATA SCIENCE		
Course Code:	**MVJ21CS741**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To provide strong foundation for data science and application area related to information technology and understand the underlying core concepts and emerging technologies in data science.	

UNIT-I	
Introduction: Big Data and Data Science hype and getting past the hype Datacation.	**Hrs 8**

Current landscape of perspectives. Skill sets needed.Statistical Inference.Populations and samples. Statistical modeling, probability distributions, Introduction to R programming. **Video-Links** https://www.youtube.com/watch?v=KMj49syT8JM&list=PLyqSpQzTE6M-sBjDcT21Gpnj8grR2fDgc	
UNIT-II	
Exploratory Data Analysis and the Data Science Process. Basic tools (plots, graphs and summary statistics) of EDA. Philosophy of EDA. The Data Science Process. Case Study: Real Direct (online real estate) Three Basic Machine Learning Algorithms. Linear Regression, k-Nearest Neighbors (k-NN), k-means **Video Links:** https://nptel.ac.in/courses/106/101/106101163/	**Hrs 8**
UNIT-III	
Feature Generation and Feature Selection (Extracting Meaning From Data). Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination). Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. • **Video Links:** https://nptel.ac.in/courses/106/101/106101163/	**Hrs 8**
UNIT-IV	
Recommendation Systems: Building a User-Facing Data Product. Algorithmic ingredients of a Recommendation Engine. Dimensionality Reduction. Singular Value Decomposition. - Principal Component Analysis. **Video Links**: https://nptel.ac.in/courses/106/101/106101163/	**Hrs 8**
UNIT-V	
Data Visualization.Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues. Discussions on privacy, security, ethics **Video Links**: https://nptel.ac.in/courses/106/101/106101163/	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the statistical foundations of data science
CO2	Learn techniques to pre-process raw data so as to enable further analysis.
CO3	Conduct exploratory data analysis and create insightful visualizations to identify patterns
CO4	Introduce machine learning algorithms for prediction/classification and to derive insights.

CO5	Analyze the degree of certainty of predictions using statistical test and models.

Text Books	
1	Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
2	Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
3	Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

Reference Books:	
1	Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

CO5	3	3	2	3	2	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Semester: V		
INTERNET OF THINGS		
Course Code:	**MVJ21CS742**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Learn the basic issues, policy and challenges in the Internet.	
2	Get an idea of some of the application areas where Internet of Things can be applied.	
3	Understand the cloud and internet environment.	
4	Understand the various modes of communications with Internet.	

UNIT-I	
Prerequisites : Basic Knowledge about C or C++ **Introduction to IoT:** Definition – Foundations – Challenges and Issues - Identification - Security. Components in internet of things: Control Units – Sensors – Communication modules –Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks –Mobile Internet – Wired Communication-IoT Platform Overview-Raspberry pi-Arduino boards.* **Applications:** Sensors in IoT. **Video link / Additional online information (related to module if any):** • http://www.theinternetofthings.eu/what-is-the-internet-of-things. • https://www.engineersgarage.com/article_page/sensors-different-types-of-sensors/ • https://www.educba.com/applications-of-sensors/ *** Programming Assignments are Mandatory.**	**Hrs 8**
UNIT-II	
IoT Protocols: Protocol Standardization for IoT-M2M and WSN Protocols-SCADA and RFID Protocols-Issues with IoT Standardization-Protocols-IEEE 802.15.4-BACNet Protocol-Zigbee Architecture - Network layer – APS Layer – Security.*	**Hrs 8**

Applications: IoT Protocol Applications **Video link / Additional online information (related to module if any):** • https://inductiveautomation.com/resources/article/what-is-scada • https://iotbytes.wordpress.com/application-protocols-for-iot/ • https://data-flair.training/blogs/iot-protocols/ • https://www.avsystem.com/blog/iot-protocols-and-standards/ *** Programming Assignments are Mandatory.**	
UNIT-III	
Resource Management in the Internet of Things: Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object – Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behaviour of Objects.* **Applications:** RFID Applications **Video link / Additional online information (related to module if any):** RFID Applications: • https://www.digiteum.com/rfid-technology-internet-of-things • https://www.uio.no/studier/emner/matnat/ifi/INF5910CPS/h10/undervisningsmateriale/RFID-IoT.pdf *** Programming Assignments are Mandatory.**	**Hrs 8**
UNIT-IV	
Case Study and IoT Application Development: IoT applications in home-infrastructures security-Industries- IoT electronic equipment's. Use of Big Data and Visualization in IoT Industry 4.0 concepts - Sensors and sensor Node –Interfacing using Raspberry Pi/Arduino- Web Enabled Constrained Devices.* **Laboratory Sessions/ Experimental learning:**Interfacing using Raspberry Pi/Arduino **Applications:** Elements in group **Video link / Additional online information (related to module if any):** • https://www.simform.com/home-automation-using-internet-of-things/	**Hrs 8**

• https://iot5.net/iot-applications/smart-home-iot-applications/ • https://maker.pro/raspberry-pi/tutorial/how-to-connect-and-interface-raspberry-pi-with-arduino# • https://create.arduino.cc/projecthub/ruchir1674/how-to-interface-arduino-with-raspberrypi-504b06 *** Programming Assignments are Mandatory.**	
UNIT-V	
Web of Things:Web of Things versus Internet of Things-Architecture Standardization for WoT-Platform Middleware for WoT- WoT Portals and Business Intelligence-Cloud of Things: Grid/SOA and Cloud Computing-Cloud Standards – Cloud of Things Architecture-Open Source e-Health sensor platform. Video link / Additional online information (related to module if any): • https://www.water-io.com/iot-vs-wot • https://www.talend.com/resources/iot-cloud-architecture/ * Programming Assignments are Mandatory.	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the components of IoT.
CO2	Analyze various protocols of IoT.
CO3	Design portable IoT using appropriate boards
CO4	Develop schemes for the applications of IOT in real time scenarios.
CO5	Design business Intelligence and Information Security for WoT

Text Books:	
1	Honbo Zhou, ”The Internet of Things in the Cloud:A Middleware Perspective” -CRC Press-2012.
2	Dieter Uckelmann, Mark Harrison, “Architecting the Internet of Things”, Springer2011.

Reference Books:	
1	Arshdeep Bahga, Vijay Madisetti, “Internet of Things (A Hands-On-Approach)”, VPT, 2014.
2	Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
3	Luigi Atzori, Antonio Lera, Giacomo Morabito, “The Internet of Things: A Survey”, Journal on Networks, Elsevier Publications, October, 2010.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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/PSO Mapping														
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CO1	3	3	1	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	1	2	-	-	-	-	-	1	-	3	2	3
CO4	3	3	3	3	-	-	-	2	2	2	-	3	1	3
CO5	3	3	3	3	-	-	2	2	3	2	-	3	2	2

High-3, Medium-2, Low-1

Semester: V		
VISUALIZATION TECHNIQUES		
Course Code:	**MVJ21CS743**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	learn the value of visualization, specific techniques in information visualization and scientific visualization, and how understand how to best leverage visualization methods	

UNIT-I	
Introduction –Visualization Stages –Computational Support –Issues –Different Types of Tasks –Data representation –Limitation: Display Space, Rendering Time, Navigation Link.	**Hrs 8**
UNIT-II	
Human Factors –Foundation for a Science of Data Visualization –Environment-Optics – Optimal Display –Overview about Lightness, Brightness, Contrast, Constancy, Color –Visual Attention that Pops Out –Types of Data –Data Complexity –The Encoding of Values – Encoding of Relation –Relation and Connection –Alternative Canvass.	**Hrs 8**
UNIT-III	
Human Vision –Space Limitation –Time Limitations –Design –Exploration of Complex Information Space –Figure Caption in Visual Interface –Visual Objects and Data Objects – Space Perception and Data in Space –Images, Narrative and Gestures for Explanation	**Hrs 8**
UNIT-IV	
Norman's Action Cycle –Interacting with Visualization –Interaction for Information Visualization –Interaction for Navigation –Interaction with Models –Interacting with Visualization –Interactive 3D Illustrations with Images and Text –Personal View –Attitude – user perspective –Convergence –Sketching –Evaluation.	**Hrs 8**
UNIT-V	
Design –Virtual Reality: Interactive Medical Application –Tactile Maps for visually challenged People –Animation Design for Simulation –Integrating Spatial and Nonspatial Data –Innovating the Interaction –Small Interactive Calendars – Selecting One from Many– Web Browsing Through a Key Hole –Communication Analysis –Archival Galaxies	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamentals of data visualization
CO2	Acquire knowledge about the issues in data representation
CO3	Visualize the complex engineering design.
CO4	Design real time interactive information visualization system
CO5	Apply the visualization techniques in practical applications

Text/Reference Books:

1	Robert Spence, “Information Visualization:An Introduction”, Third Edition, Pearson Education, 2014.
2	Colin Ware, “Information Visualization Perception for Design”, ThirdEdition, Morgan Kaufmann, 2012.
3	Robert Spence, “Information Visualization Design for Interaction”, Second Edition, Pearson Education, 2006
4	Benjamin B. Bederson, Ben shneiderman, “The Craft of Information Visualization”, Morgan Kaufmann, 2003.
5	Thomas Strothotte, “Computational Visualization: Graphics, Abstraction and Interactivity”, Springer, 1998.
6	Matthew O.Ward, George Grinstein, Daniel Keim, “Interactive Data Visualization: Foundation, Techniques and Applications”, Second Edition, A.K.Peters/CRC Press,2015.
7	JoergOsarek, “Virtual Reality Analytics”, Gordon‟s Arcade, 2016.

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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/PSO Mapping

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CO1	3	-	-	-	1	-	-	-	-	-	-	2	2	-
CO2	3	3	3	2	-	-	-	-	1	-	1	2	2	2
CO3	2	2	2	1	3	-	-	-	-	-	1	3	2	2
CO4	3	2	3	2	1	-	-	-	-	2	3	2	2	3

CO5	3	2	3	1	-	-	-	-	-	2	3	2	2	-

High-3, Medium-2, Low-1

Semester: VII		
ETHICAL HACKING		
Course Code:	**MVJ21CS744**	**CIE Marks:50**
Credits:	**3**	**SEE Marks: 50**
Hours:		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand numerous methods of real-world information intelligence	
2	Learn about vulnerability scanners	
3	Understand techniques used to sniff traffic across a network	
4	Familiarize with the methodologies that can be used to hack into a target.	
5	Appreciate the wide variety of attacks that can be performed against a wireless network	

UNIT-I	
INTRODUCTION TO HACKING : Terminologies, Categories of Penetration Test, Writing Reports, Structure of a Penetration Testing Report, Vulnerability Assessment Summary, Risk Assessment, Methodology, Linux Basics: File Structure, Cron Job, Users, Common Applications , BackTrack, Services. **Applications:** Network packet analysis, Password guessing and cracking **Video link / Additional online information (related to module if any):** • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_process.htm • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_hacker_types.htm	**Hrs 8**
UNIT-II	
INFORMATION GATHERING, TARGETENUMERATION AND PORT SCANNING TECHNIQUES Active, Passive and Sources of information gathering, Copying Websites Locally, NeoTrace, Cheops-ng, Intercepting a Response, WhatWeb, Netcraft, Basic Parameters, Xcode Exploit Scanner, Interacting with DNS Servers, Fierce, Zone Transfer with Host Command and Automation, DNS Cache Snooping- Attack	**Hrs 8**

Scenario, Automating Attacks, SNMP - Problem, Sniffing Passwords, Solar Winds Toolset, sweep, Brute Force and Dictionary- Tools , Attack, Enumeration, Intelligence Gathering Using Shodan, Target enumeration and Port Scanning Techniques. Applications: Session hijacking, Session spoofing Video link / Additional online information (related to module if any): •https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_enumeration.htm •https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sniffing.htm	
UNIT-III	
VULNERABILITY ASSESSMENT & NETWORKSNIFFING : Introduction to Vulnerability Assessment - Pros and Cons, NMap, Updation of database, Testing SCADA Environments with Nmap, Nessus, Sniffing: Types, Hubs versus Switches, Modes, MITM Attacks, ARP Protocol Basics- working, Attacks, DoS Attacks, Dsniff tool, Using ARP Spoof to Perform MITM Attacks, Sniffing the Traffic with Dsniff, Sniffing Pictures with Drifnet, Urlsnarf and Webspy, Sniffing with Wireshark, Ettercap- ARP Poisoning, Hijacking Session with MITM Attack, ARP Poisoning with Cain and Abel, Sniffing Session Cookies with Wireshark, Hijacking the Session, SSL Strip: Stripping HTTPS Traffic, Requirements, Automating Man in the Middle Attacks, DNS Spoofing, DHCP Spoofing Applications: Network traffic sniffing, Denial of Service attacks Video link / Additional online information (related to module if any): •https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sniffing.htm •https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_tcp_ip_hijacking.htm	**Hrs 8**
UNIT-IV	
Understanding Network Protocols: Attacking Network Remote Services, Common Target Protocols, tools for cracking network remote services, Attacking SMTP, Attacking SQL Servers, Client Side Exploitation Methods: E-Mails Leading to Malicious Attachments & Malicious Links, Compromising Client Side Update, Malware Loaded on USB Sticks **Post exploitation:** Acquiring Situation Awareness, Privilege Escalation, Maintaining Access, Data Mining, Identifying and Exploiting Further Targets, Windows Exploit Development Basics.	**Hrs 8**

Applications: Exploiting buffer overflow vulnerabilities **Video link / Additional online information (related to module if any):** • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sql_injection.htm • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_exploitation.htm	
UNIT-V	
WIRELESS & WEB-HACKING **Wireless Hacking :** Requirements , Aircracking , Hidden SSIDs , Monitor Mode , Monitoring Tool- Beacon Frames on Wireshark ,Airodump-ng , Wireless Adapter in Monitor Mode , Determining the Target , Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng , Capturing Packets and Four-Way Handshake. **Web Hacking :** Attacking the Authentication , Brute Force and Dictionary Attacks , Types of Authentication , Crawling Restricted Links , Testing for the Vulnerability , Authentication Bypass with Insecure Cookie Handling , SQL injection, XSS – DOM based,BeEF,CSRF, Bypassing CSRF and BeEF with XSS, Vulnerability in FCKeditor, efront. **Applications:** Cross Site Scripting, Firewall **Video link / Additional online information (related to module if any):** • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_ddos_attacks.htm • https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_wireless.htm	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the core concepts related to malware, hardware and software vulnerabilities and their causes
CO2	Understand ethics behind hacking and vulnerability disclosure
CO3	Appreciate the Cyber Laws and impact of hacking Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies
CO4	Learn & understand different network protocols and attack strategies
CO5	Understanding the usefulness of wireless & web hacking

Text Books	
1	Rafay Baloch ,―Ethical Hacking and Penetration Testing Guide‖, CRC Press, 2015.
2	Patrick Engebretson, ―The Basics of Hacking and Penetration Testing : Ethical

	Hacking and Penetration Testing Made Easy‖, Syngress Media, Second Revised Edition, 2013.

Reference Books:	
1	Michael T. Simpson, Kent Backman, James E. Corley, ―Hands On Ethical Hacking

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: VII
BLOCKCHAIN TECHNOLOGY

Course Code:	MVJ21CS745	CIE Marks:50
Credits:	3	SEE Marks: 50
Hours:		SEE Duration: 3 Hrs

Course Learning Objectives: The students will be able to

1	Familiarize 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.

UNIT-I	
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. **Applications: Telecommunications, finance, universities** **Video link / Additional online information (related to module if any):** • https://coincentral.com/byzantine-generals-problem/ • https://www.tutorialspoint.com/distributed_dbms/distributed_dbms_databases.htm	**Hrs 8**
UNIT-II	
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. **Applications: Government, healthcare** **Video link / Additional online information (related to module if any):** 5. https://blockonomi.com/merkle-tree/	**Hrs 8**
UNIT-III	
Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. **Applications:** Decentralized Applications, Encrypted messaging applications **Video link / Additional online information (related to module if any):**	**Hrs 8**

• https://blockonomi.com/nakamoto-consensus/ • https://cointelegraph.com/explained/proof-of-work-explained	
UNIT-IV	
Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin. **Applications:** Peer - to - peer payment application. **Video link / Additional online information (related to module if any):** 6. https://blockgeeks.com/guides/smart-contracts/	**Hrs 8**
UNIT-V	
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. **Video link / Additional online information (related to module if any):** • https://www.water-io.com/iot-vs-wot • https://www.talend.com/resources/iot-cloud-architecture/	**Hrs 8**

Course Outcomes: After completing the course, the students will be able to	
CO1	Basic Cryptographic primitives used in Blockchain – Secure, Collison-resistant hash functions, digital signature, public key cryptosystems, zero-knowledge proof systems.
CO2	Policies and applications of Blockchain in Distributed databases.
CO3	Explain the Nakamoto consensus, List and describe differences between proof-of-work and proof-of-stake consensus.
CO4	Design, build, and deploy smart contracts and distributed applications.
CO5	Cryptocurrency governance, regulations and applications.

Text Books	
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

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 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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/PSO Mapping

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

High-3, Medium-2, Low-1

Semester: VIII		
PROJECT PHASE – 2 (Theory)		
Course Code: MVJ21CSP81		**CIE Marks:100**
Credits: L:T:P:S:3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To support independent learning
2	To develop interactive, communication, organization, time management, and presentation skills
3	To impart flexibility and adaptability.
4	To inspire independent and team working.
5	To expand intellectual capacity, credibility, judgment, intuition.
6	To adhere to punctuality, setting and meeting deadlines.
7	To instill responsibilities to oneself and others
8	To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - II:
Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the project and be able to defend it.Develop critical thinking and problem solving skills
CO2	Learn to use modern tools and techniques. Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
CO3	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO4	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO5	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Scheme of Evaluation :
Internal Marks: The Internal marks (50 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project. Semester End Examination: SEE marks for the project (50 marks) shall be based on Project

report, Presentation and Demonstration of the actual/model/prototype of the project, as per the norms by the examiners appointed

CIE Marks Breakup for Major Project during VIII Semester :

Seminar on Project and Demonstration	20 Marks
Report	10 Marks
Evaluation by Guide	15 Marks
Co-curricular Activities	05 Marks
Total	**50 Marks**

Breakup for SEE Marks for Major Project

Project Report , Presentation, Demonstration and Quality of Work	30 Marks
Viva- Voce	25 Marks
Total	**50 Marks**

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

Semester: VIII		
INTERNSHIP (Theory)		
Course Code: MVJ21INT82		**CIE Marks:100**
Credits: L:T:P:S:3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To get the field exposure and experience
2	To apply the theoretical concept in field application
3	To prepare the comparison statement of difference activities

Internship:
This shall be carried out by students in industry set-up related to the laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organizations and other avenues related to the computer science and engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO2	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO3	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Scheme of Evaluation :
Marks: The marks (100 marks) evaluation shall be based on final presentation of the activities undertaken during the internship, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate. Semester End Examination: Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor, a senior faculty from the department and head of the department.

Marks Breakup for Industry Training Evaluation:

Evaluation by the supervisor under whom the training was carried out	25 Marks
Evaluation by i) Relevance of the Industrial Internship	10 Marks
ii) Report	25 Marks
iii) Evaluation	40 Marks
Total	**100 Marks**

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

Semester: VIII		
TECHNICAL SEMINAR (Theory)		
Course Code: MVJ21CSS83		**CIE Marks:100**
Credits: L:T:P:S:3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.	

Seminar:
Each student, under the guidance of a Faculty, is required to choose, preferably, a recent topic of his/her interest relevant to the course of specialization. Carryout literature survey; organize the Course topics in a systematic order. • Conduct literature survey in the domain area to find appropriate topic. • Prepare the synopsis report with own sentences in a standard format. • Learn to use MS word, MS power point, MS equation and Drawing tools or any such facilities in the preparation of report and presentation. • Present the seminar topic orally and/or through power point slides. • Communicate effectively to answer the queries and involve in debate/discussion. The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop knowledge in the field of Computer Science and Engineering and other disciplines through independent learning and collaborative study.

CO2	Identify and discuss the current, real-time issues and challenges in engineering & technology. Develop written and oral communication skills
CO3	Explore concepts in larger diverse social and academic contexts.
CO4	Apply principles of ethics and respect in interaction with others.
CO5	Develop the skills to enable life-long learning

Scheme of Evaluation :
Marks: The marks (100 marks) evaluation shall be based on final presentation, to a panel comprising seminar guide, a senior faculty from the department and head of the department. Each student should submit the Seminar report at the end of semester Semester End Examination: Viva-Voce examination shall be conducted by a panel of examiners consisting of seminar supervisor, a senior faculty from the department and head of the department.

Marks Breakup for Seminar:

Relevance of the Topic	10 Marks
Report	20 Marks
Presentation	50 Marks
Viva- Voce	20 Marks
Total	**100 Marks**

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