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.**	**10 Hrs**

Web Link and Video Lectures: https://nptel.ac.in/courses/111106139	
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	**10 Hrs**

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** $y = ax^b$. **Web Link and Video Lectures:** **https://nptel.ac.in/courses/111105042**	

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: MVJ21CG32		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;	**8 Hrs**

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**	
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**	**8 Hrs**

problem. **Video link / Additional online information (related to module if any):** **Multithreading:** **https://www.youtube.com/watch?v=O_Ojfq-OIpM**	
UNIT-IV	
The collections and Framework: Collections Overview, Recent Changes to 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**	**8 Hrs**
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.	**8 Hrs**

Video link / Additional online information (related to module if any): **Java** **JDBC :https://www.youtube.com/watch?v=hEWBIJxrLBQ**	

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

High-3, Medium-2, Low-1

Semester: III
OPERATING SYSTEMS (Theory)

Course Code: MVJ21CG33		**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**	**8 Hrs**

communication.	
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;**	**8 Hrs**

Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.	
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
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: MVJ21CS34		**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, and sorting, **Array ADT :**Multidimensional Arrays, Polynomials and Sparse Matrices. **Strings:** Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples.	8 Hrs
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,	8 Hrs

Queue ADT, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues. Programming Examples.	
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	**8 Hrs**

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.

LABORATORY EXPERIMENTS

1.A courier company has number of items to b delivered to its intended customers through it salesman.

The salesman visits the following cities t 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 ha delivered maximum and minimum number o items

*To search the number of items to be delivere 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:		**CIE**

MVJ21CG35		**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 chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices.	**8 Hrs**
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**	**8 Hrs**

Counters, Changing the Counter Modulus, Decade Counters, Applications of Counters.	
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
CO1	3	3	2	2	-	-	-	-
CO2	3	3	2	2	-	-	-	-
CO3	3	3	3	2	-	-	-	-
CO4	3	3	2	2	-	-	-	-
CO5	3	3	3	2	-	-	-	-

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?discipli**	**8 Hrs**

neID=111	
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-problems. Double and triple integrals-Simple examples. **Video Link:** **1.** **http://nptel.ac.in/courses.php?disciplineID=111**	**8 Hrs**
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	
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:**	**8Hrs**

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

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 Publication, 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**
CO1	3	3	0	2	0	0	0	0
CO2	3	3	0	2	0	0	0	0
CO3	3	3	0	3	0	0	0	0
CO4	2	2	0	3	0	0	0	0
CO5	2	2	0	2	0	0	0	0

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.	**8 Hrs**

Self Study topic: Consequences of Cauchy's theorem, Cauchy residue theorem. **Web Link and Video Lectures:** https://nptel.ac.in/courses/111103070	
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 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	**8 Hrs**
UNIT-V	
Numerical methods-III: Numerical	**8**

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**	**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: MVJ21CG42		**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,**	**8 Hrs**

How Virtual Memory Works, Details of ARM MMU	
UNIT-IV	
Embedded System Components: Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems **Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (on board and external types), Embedded firmware, Other system components.**	**8 Hrs**
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
CO1	3	1	2	1	-	-	-	-
CO2	3	2	1	3	3	2	-	-
CO3	3	2	1	3	-	2	-	-
CO4	3	3	2	3	3	2	-	-
CO5	3	2	3	3	3	2	-	-

High-3, Medium-2, Low-1

Semester: IV		
COMPUTER ORGANIZATION AND ARCHITECTURE (Theory)		
Course Code: MVJ21CG43		**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, 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/**	**8 Hrs**
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**
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 AND LAB (Theory and Practice)		
Course Code: MVJ21CG44		**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

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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.

CO-PO Mapping								
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CO2	3	3	2	2	-	-	-	-
CO3	3	3	3	2	—	-	-	-
CO4	3	3	2	2	-	-	-	-
CO5	3	3	3	2	-	-	-	-

High-3, Medium-2, Low-1

Semester:IV		
DESIGN AND ANALYSIS OF ALGORITHMS &LAB (Theory and Practice)		
Course Code: MVJ21CG45		**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	8 Hrs

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.	
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. **Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines.**	**8 Hrs**

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 compute the inverse of a matrix-Examples.** **Video Link:** **1.** **http://nptel.ac.in/courses.php?disciplineID=111**	**8 Hrs**
UNIT-II	
Differential calculus: Indeterminate forms: L-Hospital rule (without proof), Total derivatives, and	**8Hrs**

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**	
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.**	**8 Hrs**

http://nptel.ac.in/courses.php?disciplineID=111	
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 Publication, 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
CO1	3	3	0	2	0	0	0	0
CO2	3	3	0	2	0	0	0	0
CO3	3	3	0	3	0	0	0	0
CO4	2	2	0	3	0	0	0	0
CO5	2	2	0	2	0	0	0	0

High-3, Medium-2, Low-1

Semester: V		
SOFTWARE ENGINEERING MANAGEMENT (Theory)		
Course Code: MVJ21SPM51		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	Describe the importance of management and functions of a manager.
2	Explain the process of planning and organizing
3	Understand principles, concept, methods and techniques of the software engineering approach to producing quality software (particularly for large, complex systems).
4	Impart skills in the design and implementation of efficient software across disciplines.
5	Gather knowledge on various maintenance methods.

UNIT-I	
Management: importance of management, definition, management functions, roles of a manager, levels of management, managerial skills, management and administration, management –a science or art, management – a profession, professional management v/s family management. Development of management thought; Early classical approaches, Neo classical approaches, modern approaches. **Video Link:https://www.youtube.com/watch?v=mub7Z8Fl3ZU**	8 Hrs
UNIT-II	
Planning: Nature, Importance of	8 Hr

planning, forms, types of plans, steps in planning, limitations of planning, making planning effective, planning skills, strategic planning in Indian industry. **Organizing: Organization Meaning, process of organizing, span of management principles of organizing, Departmentation, organization structure, committees, teams.** **Video Link:https://www.youtube.com/watch?v=pCUs3UKwYpc**	**s**
UNIT-III	
FUNDAMENTALS OF SOFTWARE ENGINEERING AND REQUIREMENTS ENGINEERING: Software Engineering Fundamentals; Software processes: Software life-cycle models; Software requirements and specifications: Requirements elicitation; Requirements analysis modelingtechniques;Functional and non-functional requirements; User requirements, System requirements, requirement validation and software requirement specification document. Prototyping - Basic concepts of formal specification techniques. **Video link / Additional online information: https://nptel.ac.in/courses/106105182/**	**8 Hrs**

UNIT-IV	
SOFTWARE DESIGN: Fundamental design concepts and principles; Design characteristics; System Models - Context, Behavioral, Data and, Object models, Architectural design- System structuring, Control models; Structured design; Object-oriented analysis and design; User interface design; Design for reuse; Design patterns; **Video link / Additional online information:** https://www.coursera.org/lecture/client-needs-and-software-requirements/3-2-4-use-cases-bZNCr	8 Hrs
UNIT-V	
SOFTWARE VALIDATION AND MAINTENANCE : **Software validation:** Validation planning; Testing fundamentals, including test plan creation and test case generation; Black-box and white-box testing techniques; Unit, integration, validation, and system testing; Object-oriented testing; Inspections. **Software evolution:** Software maintenance; Characteristics of maintainable software; Reengineering; Legacy systems; Software reuse. **Video link / Additional online information:** https://www.youtube.com/watch?v=T3q6QcCQZQg	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the importance of management and functions of a manager.
CO2	Explain the process of planning and principles of organizing
CO3	Comprehend software development life cycle and Prepare SRS document for a project
CO4	Apply software design and development techniques
CO5	Identify verification and validation methods in a software engineering project.

Reference Books	
1.	Management and Entrepreneurship , N V R Naidu ,T Krishna Rao 4th reprint.
2.	Law relating to Intellectual Property rights , B. L. Wadhera, 5th edition,Universal Law Publishing, 2011
3.	Ian Sommerville, "Software Engineering", 9th Edition, Addison-Wesley, 2011
4.	R. S. Pressman, Software Engineering, a practitioner's approach, McGraw Hill,7th Edition, 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**
CO1	2	-	-	-	-	2	2	-
CO2	2	-	-	-	-	2	2	-
CO3	2	-	-	-	-	2	2	-
CO4	2	-	-	—	-	2	-	-
CO5	2	-	-	-	-	2	-	2

High-3, Medium-2, Low-1

Semester: V		
THEORY OF COMPUTATION (Theory)		
Course Code: MVJ21CG52		**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=FGrU7vczyg** **https://www.youtube.com/watch?v=b30Pl5wS4AQ**	**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**	**8 Hrs**

information (related to module if any): https://www.youtube.com/watch?v=IhyEGNn-7Uo	

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

High-3, Medium-2, Low-1

Semester:V		
DATABASE MANAGEMENT SYSTEMS & LAB (Theory and Practice)		
Course Code: MVJ21CG53		**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	**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.**	

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.** **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**	**8 Hrs**
UNIT-II	
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, dealing with constraint violations.	**8 Hrs**

Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.** **SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL.** **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=gGGHjYbQMvw** • **https://www.youtube.com/watch?v=nclyivHlYac** **https://www.youtube.com/watch?v=64szTfLNu3o**	
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**	**8 Hrs**

applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Embedded SQL. **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** **https://www.youtube.com/watch?v=sjzlr0EsZL4**	
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, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers. **Video link / Additional online information (related to module if any):** • **https://nptel.ac.in/courses/1061060**	**8 Hrs**

93/ • https://nptel.ac.in/courses/106105175/	
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. **Introduction to Database Recovery Protocols:** Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, **File Organizations and Indexes:** Introduction, Hashing techniques, Indexing, Structures for Files. **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106106093/ • https://nptel.ac.in/courses/106105175/	**8 Hrs**

LABORATORY EXPERIMENTS
1. Creation of a database and writing SQL queries to retrieve information from the database. 2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions. 3. Creation of Views, Synonyms, Sequence, Indexes, Save point. 4. Creating an Employee database to set various constraints. 5. Creating relationship between the databases. 6. Study of PL/SQL block. 7. Write a PL/SQL block to satisfy some conditions by accepting input from the user. 8. Write a PL/SQL block that handles all types of exceptions. 9. Creation of Procedures. 10. Creation of database triggers and functions 11. Miniproject(ApplicatioDevelopment using Oracle/Mysql) a)InventoryControlSystem. b)MaterialRequirementProcessing. c)HospitalManagementSystem. d)RailwayReservationSystem. e)PersonalInformationSystem. f)WebBasedUserIdentificationSystem. g)TimetableManagementSystem. h) Hotel Management System Any 10 experiments to be conducted

Course 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.

Reference 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
3.	Silberschatz Korth and Sudharsha Database System Concepts, 6th Editio McGrawHill, 2013.
4.	Database Principles Fundamentals Design, Implementation and Management Cengage Learning 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.

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:V		
DATA COMMUNICATION & COMPUTER NETWORKS & LAB (Theory and Practice)		
Course Code: MVJ21CG54		**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	**Introduce the fundamental concepts and types of computer networks.**	
2	**Demonstrate the TCP/IP and OSI models with merits and demerits.**	
3	**Understand the difference between all communication protocols.**	

UNIT-I	
Data Communications: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies –Protocols and	**8 Hrs**

Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, ISDN Physical layer: Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks. **Video link / Additional online information (related to module if any):** **http://www.nptelvideos.in/2012/11/computer-networks.html**	
UNIT-II	
Data link layer: Introduction, Framing, and Error – Detection and Correction – Parity – LRC – CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols. 111 Medium Access sub layer: ALOHA, CSMA/CD, LAN – Ethernet IEEE 802.3, IEEE 802.5 – IEEE 802.11, Random access, Controlled access, Channelization. **Video link / Additional online information (related to module if any):** **http://www.nptelvideos.in/2012/11/computer-networks.html**	**8 Hrs**
UNIT-III	
Network layer: Logical Addressing, Internetworking, Tunneling, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols. **Video link / Additional online**	**8 Hrs**

information (related to module if any): http://www.nptelvideos.in/2012/11/computer-networks.html	
UNIT-IV	
Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services, QoS in Switched Networks. **Video link:** http://www.nptelvideos.in/2012/11/computer-networks.html	**8 Hrs**
UNIT-V	
Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP. **Video link:** http://www.nptelvideos.in/2012/11/computer-networks.html	**8 Hrs**
LABORATORY EXPERIMENTS	
1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.Screen effectiveness studies **2. Write a program for error detecting code using CRC-CCITT (16- bits).** **3. Write a program to find the shortest path between vertices using bellman-ford algorithm.** **4. Applications using TCP and UDP sockets like:** **a)Chat** **b) File Transfer** **5. Simulation of DNS using UDP sockets.** **6. Write a code for simulating ARP /RARP protocols.** **7. Implementation of Stop and Wait Protocol and Sliding Window Protocol.** **8. Write a program for congestion control**	

using leaky bucket algorithm.

9. Implement three nodes point – to- point networks with duplex links between them. Set the queue size vary the bandwidth and find the number of packets dropped.

10. Simulate the transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.

11. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.

12. Simulate simple ESS and with transmitting nodes in wireless LAN by simulation and determine the performance with respect to transmission of packets

Any 12 experiments to be conducted

Course Outcomes: After completing the course, the students will be able to	
CO1	**Interpret the basics of Computer Networks and Various Protocols.**
CO2	**Generalize functionalities and services of each layer of OSI model.**
CO3	**Explains the concept of data framing and error control mechanisms**
CO4	**Compares Different routing protocols**
CO5	**Identify the concepts of network security, Mobile and adhoc networks**

Reference Books	
1.	**Data Communications and Networking, Behrouz A. Forouzan , Fourth Edition TMH,2006.**
2.	**Computer Networks, Andrew S Tanenbaum, 4th Edition. Pearson Education, PHI.**
3.	**An Engineering Approach to Computer Networks, S. Keshav, 2 nd Edition, Pearson Education.**

4.	Computer Networking: A Top-Down Approach Featuring the Internet. James F. Kurose & Keith W. Ross, 3 rd Edition, Pearson Education.

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

High-3, Medium-2, Low-1

Semester: V		
CYBER FORENSICS AND IPR (Theory)		
Course Code: MVJ21CG551		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	Be familiar with different forensics methods	
2	Analyse various computer forensics technologies	
3	Disseminate knowledge on laws and acts to protects IPR	
4	Understanding, defining and differentiating different types of intellectual properties (IPs) and their roles in cyberspace.	

UNIT-I

Prerequisites: Basic Knowledge of crypto algorithms **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** **Video link / Additional online information:** • **https://www.youtube.com/watch?v=2ESqwX3qb94-** **https://nptel.ac.in/courses/106/104/106104119/**	**8 Hrs**
UNIT-II	
Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, 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:** • **https://www.coursera.org/lecture/cyber-conflicts/introduction-to-cybercrime-and-fundamental-issues-xndSq**	**8 Hrs**

UNIT-III	
Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Poli Video link / Additional online information: https://www.youtube.com/watch?v=qJ693ZlvceAcies	**8 Hrs**
UNIT-IV	
Protection of Intellectual Property Rights in Cyberspace in India: The Cyberspace The Relevance of Domain Names in Intellectual Property Rights, Deception by Squatting in Cyberspace, Bad Faith in Relation to Domain Name Infringement, Some Leading Cases Involving Complaints from India before WIPO, Protection of Copyright on Cyberspace, Rights of Software Copyright Owners, Infringement of Copyright on Cyberspace, Cyberspace, the Internet, Websites and the Nature of the Copyright, Linking, Hyper-Linking and Framing, Remedies for Infringement of Copyright on Cyberspace, The Liabilities of an Internet Services Provider (ISP) in Cyberspace	**8 Hrs**

Video link / Additional online information: • **https://nptel.ac.in/courses/109/105/109105112/**	
UNIT-V	
Penalties, Compensation and Adjudication of Violations of Provisions of IT Act and Judicial Review: Penalty and Compensation for Damage to Computer, Computer System, Compensation for Failure to Protect Data, Penalty for Failure to Furnish Information, Return or any Other Penalty , Adjudication of Disputes under the IT Act, Cyber Appellate Tribunal, Its Functions and Powers under the IT Act **Video link / Additional online information:** **https://www.lawctopus.com/video-lectures-law-sudhir-law-review/**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Analyze Computer Crime and Criminals and Liturgical Procedures**
CO2	**Apply the laws and regulations to the applications**
CO3	**Analyze the email tracking cyber applications**
CO4	**Understanding the protection of Intellectual Property Rights**
CO5	**Knowledge of law and acts**

Reference Books

1.	Nelson Phillips and EnfingerSteuart, –Computer Forensics and Investigations‖, Cengage Learning, New Delhi, 2009.
2.	Harish Chander, Cyber Laws and IT protections, PHI Edition
3.	Dumortier, International Encyclopedia Of Cyber Law (3vol) , Jos
4.	Bernadette H Schell, Clemens Martin, Cybercrime, ABC , CLIO Inc, California, 2004

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

High-3, Medium-2, Low-1

Semester: V		
COMPILER DESIGN (Theory)		
Course Code: MVJ21CG552		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 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**	**8 Hrs**
UNIT-II	
INTERMEDIATE CODE GENERATION: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Syntax Directed Translation Schemes, Intermediate Languages: Syntax Tree, Three Address Code, Postfix Code, Declarations, Translation of Expressions, Type Checking, Back Patching. **Video Links: https://www.youtube.com/watch?v=EpAzj7zXrbk**	**8 Hrs**
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	**8 Hrs**

– Optimal Code Generation for Expressions – Dynamic Programming Code Generation. Video Links: https://www.youtube.com/watch?v=lRvaRhPsqOo	
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/	8 Hrs
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	8 Hrs

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**

Reference 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.**
3.	**Keith D Cooper and Linda Torczon, –Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004**
4.	**V. Raghavan, –Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.**

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

High-3, Medium-2, Low-1

Semester: V		
CRYPTOGRAPHY AND NETWORK SECURITY (Theory)		
Course Code: MVJ21CG553		**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	**Acquire fundamental knowledge on the concepts of finite fields and number theory.**	
2	**To gain various block cipher and stream cipher models.**	
3	**Describe the principles of public key cryptosystems, hash functions and digital signature.**	
4	**Learn the various malicious attacks and firewall applications.**	
5	**To develop various security protocols for**	

	web and email applications

UNIT-I	
INTRODUCTION & NUMBER THEORY: Services, Mechanisms and attacks- Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques. finite fields and number theory: Groups, Rings, Fields-Modular arithmetic- Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem. **Applications: Developing cryptographic algorithms** **Video link / Additional online information (related to module if any):** **https://www.cc.gatech.edu/~echow/ipcc/hpc-course/**	**8 Hrs**
UNIT-II	
BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY:Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange- Elliptic curve arithmetic-Elliptic curve cryptography.	**8 Hrs**

Applications: Online transactions **Video link / Additional online information (related to module if any):** • **http://www.infocobuild.com/education/audio-video-courses/computer-science/IntroductionToCryptography-Ruhr/lecture-08.html**	
UNIT-III	
HASH FUNCTIONS AND DIGITAL SIGNATURES:Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – EIGamal. **Applications: Cyber forensic** **Video link / Additional online information (related to module if any):** **https://www.educba.com/md5-alogrithm/**	**8 Hrs**
UNIT-IV	
SECURITY PRACTICE & SYSTEM SECURITY: Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related	**8 Hrs**

threats – Countermeasures. **Applications: Antivirus / Malware detecting software** **Video link / Additional online information (related to module if any):** • **https://www.simplilearn.com/what-is-kerberos-article**	
UNIT-V	
E-MAIL & IP SECURITY: E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec - IP and IPv6-Authentication Header-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). **Applications: Email and Banking applications** **Video link / Additional online information (related to module if any):** • **https://www.barracuda.com/glossary/email-security**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Implement number theory for various identified attacks.**
CO2	**Design and develop the public key**

	cryptographic algorithms.
CO3	Develop the digital signature and hashing algorithms
CO4	Design a firewall for detecting malicious attacks.
CO5	Design the protocols for improving security on email, web and IP.

Reference Books	
1.	William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013.
2.	Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002.
3.	Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
4.	Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 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 Mapping								
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	-	-	-	-	-	1
CO2	3	2	2	1	-	-	-	-
CO3	2	3	1	3	-	1	1	1
CO4	3	2	2	1	-	2	-	-
CO5	2	2	3	3	-	1	1	1

High-3, Medium-2, Low-1

Semester: V		
CLOUD COMPUTING (Theory)		
Course Code: MVJ21CG554		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 understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges
2	To introduce the basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations
3	To 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	To introduce cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage;
5	To 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 Applications:	8 Hrs

Microsoft Azure, Amazon Web Services **Video link / Additional online information :** **https://www.youtube.com/watch?v=PW-V-72MJNY**	
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, 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** **Applications: PAAS(Facebook, Google App Engine)** **Video link / Additional online**	**8 Hrs**

information : **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** **Applications:** **Hardware Virtualization, Operating system Virtualization, Server Virtualization, Storage Virtualization** **Video link / Additional online information :** **https://www.youtube.com/watch?v=7m3f-P-WWbg**	**8 Hrs**
UNIT-IV	
Platform and Software as a Service:Technologies and Tools for Cloud Computing- Aneka Cloud	**8 Hrs**

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- Case Study: Evolutionary Multi objective Optimizations- Visionary thoughts for Practitioners **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	**8 Hrs**

Privacy and Security Issues- Producer_Consumer Relationship- Cloud Service Life Cycle **Applications: Network Storage,Google Apps and Microsoft office online** **Video link / Additional online information :** **https://www.youtube.com/watch?v=uj2Sb7b_Do0**	

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.**

Reference 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.**

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

CO5	3	3	3	3	3	2	-	-

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.**	**3 Hrs**

Video link: **https://nptel.ac.in/courses/121/106/121106014/**	
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, 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/**	**3 Hrs**
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/noc**	**3 Hrs**

19_ge23/preview	
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
CO1	3	3	3	1	-	2	2	1
CO2	3	3	2	1	-	1	2	-
CO3	3	3	2	1	-	2	2	-
CO4	3	3	2	2	-	2	2	-

High-3, Medium-2, Low-1

Semester: V		
RESEARCH METHODOLOGY & IPR (Theory)		
Course Code: MVJ21AEC57		**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	**Give an overview of the research methodology and explain the technique of defining a research problem.**	
2	**Explain various research designs and their characteristics.**	
3	**Explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections.**	
4	**Explain several parametric tests of hypotheses.**	
5	**Discuss leading International Instruments concerning Intellectual Property Rights.**	

UNIT-I	
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method,	**8 Hrs**

Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. **Video link / Additional online information:** **https://youtu.be/9IJscfF_irU**	
UNIT-II	
Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. **Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed** **Video link / Additional online information:** • **https://youtu.be/Yzfl3rtFOSM**	**8 Hrs**
UNIT-III	
Design of Sample Surveys: Design of	**8 Hr**

Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. **Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data.** **Video link / Additional online information:** **https://youtu.be/GVmQpGn-Zuo**	**s**
UNIT-IV	
Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis	**8 Hrs**

Video link / Additional online information : • **https://youtu.be/IEP3swFeauE**	
UNIT-V	
	8 Hrs
Intellectual Property: The Concept, Int Property System in India, Developr TRIPS Complied Regime in India, Pate 1970, Trade Mark Act, 1999,The Desi 2000, The Geographical Indications o (Registration and Protection) A Copyright Act,1957,The Protection o Varieties and Farmers' Rights Act, 2 Semi-Conductor Integrated Circuits Design Act, 2000, Trade Secrets, Utility IPR and Biodiversity, The Conven Biological Diversity (CBD) 1992, Co, International Instruments Concernin World Intellectual Property Orga (WIPO),WIPO and WTO, Paris Conven the Protection of Industrial Property, Treatment, Right of Priority, Commor Patents, Marks, Industrial Designs, Names, Indications of Source, Competition, Patent Cooperation Treaty Advantages of PCT Filing, Berne Conver the Protection of Literary and Artistic Basic Principles, Duration of Protectio Related Aspects of Intellectual P Rights(TRIPS) Agreement, Covered TRIPS Agreement, Features of the Agr	

Protection of Intellectual Property under Copyright and Related Rights, Trad Geographical indications, Industrial Patents, Patentable Subject Matter, Conferred, Exceptions, Term of pr Conditions on Patent Applicants, Patents, Other Use without Authorizatic Right Holder, Layout-Designs of In Circuits, Protection of Undisclosed Infor Enforcement of Intellectual Property UNSECO.

Course Outcomes: After completing the course, the students will be able to	
CO1	To give an overview of the research methodology and explain the technique of defining a research problem
CO2	To explain various research designs and their characteristics
CO3	To explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections
CO4	To explain several parametric tests of hypotheses
CO5	To discuss leading International Instruments concerning Intellectual Property Rights.

Reference Books	
1.	Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition,

	2018
2.	Study Material (For the topic Intellectual Property under module 5)Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013
3.	Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 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
CO1	3	3	1	-	3	-	-	-
CO2	3	3	1	-	-	-	-	-
CO3	3	3	1	-	-	-	-	-
CO4	3	3	1	-	-	-	-	-
CO5	3	3	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 behavior and mutually enriching interaction with Nature.

UNIT-I	
Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations. **Practical Sessions:** (1) Sharing about Oneself (2) Exploring Human Consciousness (3) Exploring Natural Acceptance **Video link:** • https://www.youtube.com/watch?v=85XCw8SU084 • https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3p Z3yA7g_OAQz	6 Hrs

• **https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw**	
UNIT-II	
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health. **Practical Sessions: (4) Exploring the difference of Needs of Self and Body (5) Exploring Sources of Imagination in the Self (6) Exploring Harmony of Self with the Body** **Video link:** • **https://www.youtube.com/watch?v=GpuZo495F24** • **https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw**	**6 Hrs**
UNIT-III	
Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human	**6 Hrs**

Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order. **Practical Sessions: (7) Exploring the Feeling of Trust (8) Exploring the Feeling of Respect (9) Exploring Systems to fulfill Human Goal** **Video link:** • **https://www.youtube.com/watch?v=F2KVW4WNnS** • **https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw**	
UNIT-IV	
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. **Practical Sessions: (10) Exploring the Four Orders of Nature (11) Exploring Co-existence in Existence** **Video link:** • **https://www.youtube.com/watch?v=1HR-QB2mCF0** • **https://www.youtube.com/watch?v=lfNSqOxUSpw** • **https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw**	**6 Hrs**
UNIT-V	
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession **Practical Sessions: (12) Exploring Ethical**	**6 Hrs**

Human Conduct (13) Exploring Humanistic Models in Education (14) Exploring Steps of Transition towards Universal Human Order **Video link:** • **https://www.youtube.com/watch?v=BikdYub6RYO** • **https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw**	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Explore themselves, get comfortable with each other and with the teacher**
CO2	**Enlist their desires and the desires are not vague.**
CO3	**Restate that the natural acceptance (intention) is always for living in harmony, only competence is lacking**
CO4	**Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them**
CO5	**Present sustainable solutions to the problems in society and nature**

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

Continuous Internal Evaluation (CIE):

CIE for 50 marks is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. 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

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 to enhance software quality, quality plans.

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

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

Course Outcomes

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

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

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

CO 3. Describe various software testing methods and to understand the importance of agilemethodology 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 semester

Two assignments each of **10 Marks**

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

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **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 a maximum of 3 sub-questions), **should have a mix of topics** under that module.

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

Suggested Learning Resources:

Textbooks

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGrawHill.
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=PLrjkTql3jnm9b5nr-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		
WEB DEVELOPMENT &LAB (Theory and Practice)		
Course Code: MVJ21CG62		**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	**To understand different Internet Technologies.**	
2	**To learn java-specific web services architecture**	
3	**To understand the SQL and JDBC**	
4	**To 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 **Video link / Additional online information:** **https://www.youtube.com/watch?v=QEtWL4lWlL4**	**8 Hrs**
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. **Video link / Additional online information:** • **https://www.youtube.com/watch?v=uDwSnnhl1Ng&list=PLsyeobzWxl7qtP8Lo9TReqUMkiOp446cV**	**8 Hrs**

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. **Video link / Additional online information:** • **https://www.youtube.com/watch?v=7TOmdDJcl4s&list=PLsyeobzWxl7pUPF2xjjJiG4BKC9x_GY46**	**8 Hrs**
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. **Video link / Additional online information :** • **https://www.youtube.com/watch?v=i**	**8 Hrs**

tRkLa2kq6w	
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. **Video link / Additional online information** • **https://www.youtube.com/watch?v=qk9MWbyRlhE**	**8 Hrs**
LABORATORY EXPERIMENTS	
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.** **2. Design HTML form for keeping student record and validate it using Java script.** **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.** **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.

5. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. 1.Create a Cookie and add these four user id's and passwords to this Cookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.
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.
7. Validate the form using PHP regular expression. PHP stores a form data in to database
8. Write a PHP program to display a digital clock which displays the current time of the server.
9. Creating simple application to access data base using JDBC Formatting HTML with CSS.
10. Write a Program for manipulating Databases and SQL with real time application

Any 10 experiments to be conducted

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.

Reference 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)**
3.	**Stephen Wynkoop and John Burke –Running a Perfect Website‖, QUE, 2nd Edition,1999**

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: VI

MACHINE LEARNING &LAB (Theory and Practice)		
Course Code: MVJ21CG63		**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	**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.**

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.** **Video link / Additional online information (related to module if any):** • **https://www.youtube.com/watch?v=rQ3oi9g8alY**	**8 Hrs**

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.** **Video link / Additional online information (related to module if any):** • **https://www.youtube.com/watch?v=qDcl-FRnwSU**	**8Hrs**
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** **Video link / Additional online information (related to module if any):** •	**8 Hrs**

https://www.youtube.com/watch?v=480a_2jRdKO	
UNIT-IV	
Artificial Neural Networks and Instance based Learning **Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm. Instanced Based Learning:Introduction, k-nearest neighbor learning, locally weighted regression.** **Video link:** • **https://www.youtube.com/watch?v=xbYgKoG4x2g&list=PL53BE265CE4A6C056.**	**8Hrs**
UNIT-V	
Reinforcement Learning and Deep Learning **Reinforcement Learning:Introduction, Learning Task, Q Learning.** **Deep Learning: Introduction to Deep Learning-Reasons to go Deep Learning, Introduction to Convolutional Networks ,Restricted Boltzmann Machines,Deep Belief Nets, Recurrent Nets.** **Video link:** **https://www.youtube.com/watch?v=TIlDzLZPyhY&list=PLyqSpQzTE6M_Fw**	**8 Hrs**

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LABORATORY EXPERIMENTS

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

two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

10. Write a program to implement *k*-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
11. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Any 11 experiments to be conducted

Course 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

Reference Books	
1.	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2.	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
3.	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 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
CO1	3	-	-	-	1	-	-	-
CO2	3	3	3	-	-	-	-	-
CO3	3	2	2	1	3	-	-	-
CO4	3	2	3	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-

High-3, Medium-2, Low-1

Semester: VI		
BRAIN COMPUTER INTERFACE (Theory)		
Course Code: MVJ21CG641		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	Discuss different types of BCI signals from instruments	

2	Discuss and compare different types of brain signals used for feature extraction
3	Discuss the major components of BCI which makes up the system
4	Explain the applications based on BCI
5	Use the toolbox BCILAB

UNIT-I	
What is BCI? How do BCI works, Brain computer interface types- Invasive, Partially invasive, Non-invasive, Brain signal for BCI signal- EEG, MEG, fNIRS, fMRI , Non brain signals for BCI Video link / Additional online information : https://nptel.ac.in/courses/108/108/108108167/	8Hrs
UNIT-II	
EEG Process, Temporal characteristics, Spatial Characteristics, Oscillatory EEG activity, eventrelated potentials (ERP), slow cortical potentials (SCP), and neuronal potentials. Motor Imagery BCI Video link / Additional online information : https://www.youtube.com/watch?v=PWRGe3uyS4c	8Hrs
UNIT-III	
Signal Processing-Spatial, temporal, spectral, spatio-temporal filters, Feature extraction, Machine Learning	8Hrs

Video link / Additional online information : **https://www.youtube.com/watch?v=PWRGe3uyS4c&t=214**	
UNIT-IV	
BCI monitoring hardware and hardware, BCI application-P300 speller, neuro prosthetic devices **Video link / Additional online information :** **https://www.youtube.com/watch?v=KfaGvb9YfVM**	**8Hrs**
UNIT-V	
Toolbox Architecture, Plug-in concepts, Implementing ERP Based BCI, ERP Analysis in BCI Lab **Video link / Additional online information :** **https://www.youtube.com/watch?v=PWRGe3uyS4c&t=322**	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Acquire the brain signal in the format required for the specific application**
CO2	**Preprocessing the signal for signal enhancement**
CO3	**Extract the dominant and required features**
CO4	**Classify and derive the control signals for BCI applications**
CO5	**Apply the BCI knowledge for medical applications**

Reference Books	
1.	**R. Wolpaw and Elizabeth Winter Wolpaw, "Review of "Brain- Computer Interfaces,**

	principles and practice", Biomed Engineering online
2	Brain Computer Principles and Practices",Jonathan Wolpaw ,Elizabeth Winter Wolpaw, Oxford University 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.

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

High-3, Medium-2, Low-1

Semester: VI		
VISUAL DESIGN & COMMUNICATION (Theory)		
Course Code: MVJ21CG642		**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	**Apply appropriate communication skills across settings, purposes, and audiences.**	
2	**Demonstrate knowledge of communication theory and application.**	

UNIT-I	
Need for and the Importance of Human and Visual Communication. Communication a expression, skill and process, Understanding Communication: SMRC-Model	**8Hrs**
UNIT-II	
Communication as a process. Message, Meaning, Connotation, Denotation Culture/Codes etc Levels of communication: Technical, Semantic, and Pragmatic. The semiotic landscape: language and visual communication, narrative representation	**8Hrs**
UNIT-III	
Fundamentals of Design: Definition. Approaches to Design, Centrality of	**8Hrs**

Design, Elements of Design: Line, Shape, Space, Colour, Texture. Form Etc. Principles of Design: Symmetry. Rhythm, Contrast, Balance Mass/Scale etc. Design and Designers (Need, role, process, methodologies etc.)	
UNIT-IV	
Principles of Visual and other Sensory Perceptions. Colour psychology and theory (some aspects) Definition, Optical / Visual Illusions Etc Various stages of design process-problem identification, search for solution refinement, analysis, decision making, and implementation	**8Hrs**
UNIT-V	
Basics of Graphic Design. Definition, Elements of GD, Design process-research, a source of concept, the process of developing ideas-verbal, visual, combination & thematic, visual thinking, associative techniques, materials, tools (precision instruments etc.) design execution, and presentation.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Demonstrate critical and innovative**

	thinking
CO2	Display competence in oral, written, and visual communication
CO3	Apply communication theories.

Reference Books	
1.	Communication between cultures - Larry A. Samovar, Richard E. Porter, Edwin R. McDaniel & Carolyn Sexton Roy, Monica Eckman, USA, 2012
2.	Introduction to Communication studies - John Fiske & Henry Jenkins 3rd edition, Routledge, Oxon 2011
3.	An Introduction to communication studies - Sheila Steinberg, Juta & Co., Cape Town, 2007
4.	One World Many Voices: Our Cultures - Marilyn Marquis & Sarah Nielsen, Wingspan Press, California, 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
CO1	2	1	1	-	1	1	2	-
CO2	3	3	3	3	2	-	-	-
CO3	1	-	-	1	1	-	2	3

High-3, Medium-2, Low-1

Semester: VI		
INFORMATION RETRIEVAL (Theory)		
Course Code: MVJ21CG643		**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 understand the basics of Information Retrieval.**	
2	**To understand machine learning techniques for text classification and clustering.**	
3	**To understand various search engine system operations.**	
4	**To learn different techniques of recommender system.**	

UNIT-I	
Information Retrieval – Early Developments – The IR Problem – The Users Task – Information versus Data	**8 Hrs**

Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes – The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces. **Video link / Additional online information (related to module if any):** **https://www.youtube.com/watch?v=fFxpSmyICwI**	
UNIT-II	
Basic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback. **Video link / Additional online information (related to module if any):** **https://www.youtube.com/watch?v=mOoiAOgSQFw**	**8 Hrs**
UNIT-III	

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing. **Video link / Additional online information (related to module if any):** **https://www.youtube.com/watch?v=vuc93jbO2Dw**	**8 Hrs**
UNIT-IV	
The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations — Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation. **Video link / Additional online**	**8Hrs**

information (related to module if any): **https://www.youtube.com/watch?v=JjywDlY1OJk**	
UNIT-V	
Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models. **Video link / Additional online information (related to module if any):** **https://www.youtube.com/watch?v=1JRrCEgiyHM**	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Use an open source search engine framework and explore its capabilities**
CO2	**Evaluate Boolean Model**
CO3	**Apply appropriate method of classification or clustering.**
CO4	**Design and implement innovative features in a search engine.**
CO5	**Design and implement a recommender system.**

Reference Books	
1.	**Ricardo Baeza-Yates and Berthier Ribeiro-Neto, –Modern Information**

	Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2.	Ricci, F, Rokach, L. Shapira, B.Kantor, —Recommender Systems Handbook, First Edition, 2011.
3.	C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press, 2008.
4.	Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

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

High-3, Medium-2, Low-1

Semester: VI		
GPU COMPUTING (Theory)		
Course Code: MVJ21CG644		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 learn parallel programming with graphics processing units (GPUs).	

2	To introduce different GPU programming models.

UNIT-I	
Evolution of GPU architectures – Understanding Parallelism with GPU – Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/106/105/106105220/	8Hrs
UNIT-II	
Using CUDA – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/106/105/106105220/	8Hrs
UNIT-III	
Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/106/105/10	8 Hrs

6105220/	
UNIT-IV	
OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples. Video link / Additional online information (related to module if any): • http://www.nvidia.com/object/cuda_home_new.html	8Hrs
UNIT-V	
Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster. Video link / Additional online information (related to module if any): http://www.openCL.org	8Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe GPU Architecture
CO2	Write programs using CUDA, identify issues and debug them
CO3	Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication
CO4	Write simple programs using OpenCL
CO5	Identify efficient parallel programming patterns to solve problems

Reference Books	
1.	Shane Cook, CUDA Programming: A Developers Guide to Parallel Computing

	with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2.	David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.
3.	Nicholas Wilt, CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison -Wesley, 2013.
4.	Jason Sanders, Edward Kandrot, CUDA by Example: An Introduction to General Purpose GPU Programming^, Addison – Wesley, 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
CO1	3	3	1	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-
CO3	3	3	1	2	-	-	-	-
CO4	3	3	3	3	-	-	-	2
CO5	3	3	3	3	-	-	2	2

High-3, Medium-2, Low-1

Semester: VI		
VISUALIZATION TECHNIQUES (Theory)		
Course Code: MVJ21CG645		**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 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.	**8Hrs**
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	**8Hrs**
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	**8Hrs**

Space –Images, Narrative and Gestures for Explanation	
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.	8Hrs
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	8Hrs

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

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.

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

High-3, Medium-2, Low-1

Semester:VII		
INTERNET OF THINGS & LAB (Theory and Practice)		
Course Code: MVJ21CG71		**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	**To learn the basic issues, policy and challenges in the Internet.**	
2	**To get an idea of some of the application areas where Internet of Things can be applied.**	
3	**To understand the cloud and internet environment.**	
4	**To understand the various modes of communications with Internet.**	

UNIT-I	
Introduction to IoT: Definition – Foundations – Challenges and Issues - Identification - Security. Components in	**8 Hrs**

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.* **Video link / Additional online information (related to module if any):** • **http://www.theinternetofthings.eu/ what-is-the-internet-of-things.**	
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.* **Video link / Additional online information (related to module if any):** **https://inductiveautomation.com/resources/article/what-is-scada**	**8 Hrs**
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	**8Hrs**

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.* **Video link / Additional online information (related to module if any):** **RFID Applications:** **https://www.digiteum.com/rfid-technology-internet-of-things**	
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.* **Video link / Additional online information (related to module if any):** • **https://www.simform.com/home-automation-using-internet-of-things/**	**8Hrs**
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**	**8 Hrs**

LABORATORY EXPERIMENTS

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
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. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
4. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
5. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
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.
7. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program

to print temperature and humidity readings.
8. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
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.

Any 9 experiments to be conducted

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

Reference 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.
3.	Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A Hands-On-Approach)", VPT, 2014.
4.	Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 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.

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: VII		
ARTIFICIAL INTELLIGENCE (Theory)		
Course Code: MVJ21CG721		CIE Marks:100
Credits: L:T:P:S:		SEE Marks:

3:0:0:0		**100**
Hours: 40L		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	**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.** **Video Links** • **https://www.youtube.com/watch?v=3MW3ICnkQ9k**	**8Hrs**
UNIT-II	
PROLOG- The natural Language of Artificial Intelligence: Introduction, Converting English to Prolog Facts and Rules, Goals, Prolog Terminology, Variables, Control Structures, Arithmetic operators,	**8Hrs**

Matching in Prolog, Backtracking, Cuts, Recursion, Lists, Dynamic databases, Input/Output and Streams **Using Predicate Logic: Representing simple facts in logic, representing instance and ISA relationships, Computable Functions and Predicates, Resolution, Natural Deduction.** **Video Links:** **https://www.youtube.com/watch?v=pzUBrJLIESU**	
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.** **Video Links:** **https://www.youtube.com/watch?v=ieZr_TpRwnQ**	**8Hrs**
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**	**8Hrs**

taking advice, Learning in problem solving, Induction leaning, Explanation based learning, Discovery, A Video Links: https://www.youtube.com/watch?v=_i-lZcbWkpsnalogy, Formal learning Theory, Neural Network Learning.	
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. **Video Links:** https://www.youtube.com/watch?v=zG8AJhVy5NY	**8Hrs**

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.**

Reference 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.**
3.	**Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.**
4.	**G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Fourth Edition, Pearson Education, 2002.**

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

High-3, Medium-2, Low-1

Semester: VII		
AGILE TECHNOLOGIES (Theory)		
Course Code: MVJ21CG722		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	Discuss the essence of agile development	

	methods.
2	**Carry out all stages of an agile software process in a team, to produce working software.**
3	**Provide practical knowledge of how to manage a project using Scrum framework.**
4	**Use test driven development to ensure software quality.**
5	**Should be able to demonstrate a more advanced capability to apply lean and agile development techniques to solve complex problems.**

UNIT-I	
Fundamentals of Agile: The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools	**8Hrs**
UNIT-II	
Agile Scrum Framework: Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum	**8 Hrs**

case study, Tools for Agile project management	
UNIT-III	
Agile Testing: The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester	**8Hrs**
UNIT-IV	
Agile Software Design and Development: Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.	**8Hrs**
UNIT-V	
Industry Trends: Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Understand the background and driving forces for taking an Agile approach to software development**
CO2	**Understand the business value of adopting Agile approaches.**
CO3	**Drive development with unit tests**

	using Test Driven Development
CO4	Deploy automated build tools, version control and continuous integration
CO5	Apply design principles and refactoring to achieve Agility.

Reference Books	
1.	Ken Schawber, Mike Beedle," Agile Software Development with Scrum", Pearson Education.
2.	Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide for Testers and Agile Teams" , Addison Wesley.
3.	Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall
4.	Robert Spalding: "Storage Networks the Complete Reference", Tata McGraw-Hill, 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 Mapping								
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-
CO3	3	2	`1	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-

High-3, Medium-2, Low-1

Semester: VII		
SPATIAL INFORMATION SYSTEM (Theory)		
Course Code: MVJ21CG723		**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	**Expose the students with concepts of cartography as major components of input and output related to cartography**	
2	**To provide exposure to data models and data structures in GIS and to introduce various Raster and Vector Analysis capabilities.**	
3	**To expose the concept of quality and design of cartographic outputs in open GIS environment**	

UNIT-I	
Definition of Map - Mapping Organsiation in India- Classification based on Function, Scale, Characteristics – Ellipsoid and Geoid – Co-ordinate Systems - Rectangular and Geographic Coordinates – UTM	**8 Hrs**

and UPS - Projection – Function - Types of Map Projections – Transformations – Function - Affine transformation - Choice of Map Projection – Evolution of cartography- Geo-Spatial, Spatial and Non-spatial data – Definition of GIS – Evolution GIS – Components of GIS.	
UNIT-II	
Point, Line Polygon / Area, elevation and surface –Tessellations - Attributes and Levels of Measurement - Data Sources – Ground and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitization, Registration and Georeferencing – Concepts of RDBMS - Raster Data Model – Grid – Data Encoding - Data Compression – Vector Data Model – Topological properties – Arc Node Data Structure – Raster Vs. Vector Comparison – File Formats for Raster and Vector – Data conversion between Raster and vector	**8Hrs**
UNIT-III	
Raster Data analysis: Local, Neighborhood and Regional Operations – Map Algebra – Vector Data Analysis: Topological Analysis, point-in-polygon, Line-in-polygon, Polygon-in-Polygon – Proximity Analysis: buffering, Thiessen Polygon – Non-topological analysis: Attribute data Analysis- concepts of SQL–	**8Hrs**

ODBC	
UNIT-IV	
Network – Creating Network Data - Origin, Destination, Stops, Barriers – Closest Facility Analysis, Service Area Analysis, OD Cost matrix analysis, Shortest Path Analysis – Address Geocoding – Surface Analysis – DEM, DTM - Point data to Surface interpolation – DEM Representaiton - Applications	**8Hrs**
UNIT-V	
Map Compilation – Cartographic functionalities for Map Design – Symbolization – Conventional signs and symbols – Spatial Data Quality – Lineage, Positional Accuracy, Attribute Accuracy, Completeness, Logical Consistency - Meta Data – Web based GIS: Definition, Merits - Architecture – Map Server – Spatial Data Infrastructure – Spatial Data Standards	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Acquire knowledge about cartographic principles, spatial data models and spatial analysis.**
CO2	**Understand the cartographic outputs in open GIS environment**
CO3	**Understand Network and Surface Analysis**
CO4	**Design Raster and Vector Data Analysis**
CO5	**Compare Gis Data Models And Data Input**

Reference Books	
1.	C.P. Lo, Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, 2nd Edition, Prentice Hall, 2006, ISBN-13: 9780131495029
2.	John Jensen, Ryan Jensen, Introductory Geographic Information Systems, International Edition, Pearson Publishers, 2012, ISBN-10: 0136147763, ISBN-13: 9780136147763
3.	Kang-tsung Chang, Introduction to Geographic Information Systems with Data Set CD- ROM, 6th Edition, Mc Graw Hill, 2013, ISBN-10: 0077805402,. ISBN-13: 978-0077805401

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

High-3, Medium-2, Low-1

Semester: VII		
COMPUTATIONAL PHOTOGRAMMETRY (Theory)		
Course Code: MVJ21CG724		**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 introduce basics and concepts of aerial photography, acquisition and mapping from aerial photographs using different types of stereo plotters**	

UNIT-I	
Principles - Stereoscopic depth perception – aerial photo-aerial camera -Scale – overlaps – stereoscopy – concepts – viewing and measuring system – principle of floating mark – methods of parallax measurement – vertical photographs – geometry, scale, parallax equations, planimetric mapping – Tilted photograph – Geometry, Coordinate system, Scale, Planimetric mapping	**8Hrs**
UNIT-II	
Coordinate systems for Photogrammetry - Map projections, Datums and conversions- 2D Coordinate transformations- Collinearity and Space resection- Analytical stereomodel and relative orientation- Three dimensional Coordinate transformations	**8Hrs**
UNIT-III	
Concepts of interior, relative, absolute orientation – direct georeferencing – object, image relation - collinearity and coplanarity conditions – effect of orientation elements - Elements and principles of Aerotriangulation –	**8Hrs**

Independent Models-Simultaneous bundle adjustment - ortho mosaic	
UNIT-IV	
Digital cameras- CCD camera- full frame, frame transfer, interline CCD camera - Time delay integration- spectral sensitivity of CCD sensor – geometry and radiometry problem of CCD image - Image Generation - Data Compression - formats – Georeferencing - Stereo viewing - Display modes - image matching techniques - Image measurements.	8Hrs
UNIT-V	
Review of space resection & intersection - Automatic tie point generation - Automatic Block triangulation, feature collection and plotting–DEM Generation - accuracy of DEMs, Orthorectification - regular & irregular data collection methods - contour generation - watershed delineation - Satellite Photogrammetry principles – missions - stereo image products	8Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Acquire knowledge about photogrammetry principles, methods and products generation strategies in both Analytical and digital photogrammetry system.
CO2	Understand the problem related to generation of products and solving them.

Reference Books	
1.	Edward M. Mikhail, James S.Bethel, J.Chris McGlone, Introduction on "Modern Photogrammetry", John Wiley & Sons, Inc., 2001, ISBN 0-471-30924-9
2.	Francis h. Moffitt, Edward M. Mikhail, Photogrammetry, TBS The Book Service

	Ltd, Third Edition,1980, ISBN 070022517X, 9780700225170
3.	Karl Kraus, Photogrammetry, Fundamentals and standard processes, Dümmler, 2000, ISBN 978 3 11019007 6
4.	Micheal Kasser and Yves Egels, "Digital Photogrammetry", Taylor and Francis, 2003, ISBN 0203305957, 9780203305959

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
CO1	2	1	1	-	1	1	2	-
CO2	3	3	3	3	2	-	-	-

High-3, Medium-2, Low-1

Semester: VII		
COGNITIVE SCIENCE (Theory)		
Course Code: MVJ21CG725		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 learn the basics of Cognitive Science with focus on acquisition, representation, and use of knowledge by individual minds, brains, and machines, as well as groups, institutions, and other social entities.	
2	To study the mind and intelligence, embracing psychology, artificial intelligence, neuroscience and linguistics	
3	To appreciate the basics of cognitive Psychology	

4	**To understand the role of Neuro science in Cognitive field**

UNIT-I	
The Cognitive view –Some Fundamental Concepts – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science – Artificial Intelligence: Knowledge representation -The Nature of Artificial Intelligence - Knowledge Representation – Artificial Intelligence: Search, Control, and Learning	**8Hrs**
UNIT-II	
Cognitive Psychology – The Architecture of the Mind - The Nature of Cognitive Psychology- A Global View of The Cognitive Architecture- Propositional Representation- Schematic Representation Cognitive Processes, Working Memory, and Attention- The Acquisition of Skill- The Connectionist Approach to Cognitive Architecture	**8Hrs**
UNIT-III	
Brain and Cognition Introduction to the Study of the Nervous System – Neural Representation – Neuropsychology- Computational Neuroscience - The Organization of the mind - Organization of Cognitive systems - Strategies for Brain mapping – A Case study: Exploring mindreading	**8 Hrs**
UNIT-IV	
Language Acquisition: Milestones in Acquisition – Theoretical Perspectives- Semantics and Cognitive Science – Meaning and Entailment – Reference – Sense – Cognitive and Computational Models of Semantic Processing – Information Processing Models of the Mind- Physical symbol systems and	**8Hrs**

language of thought- Applying the Symbolic Paradigm- Neural networks and distributed information processing- Neural network models of Cognitive Processes	
UNIT-V	
Reasoning – Decision Making – Computer Science and AI: Foundations & Robotics – New Horizons - Dynamical systems and situated cognition- Challenges – Emotions and Consciousness – Physical and Social Environments - Applications	8Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain, and analyze the major concepts, philosophical and theoretical perspectives, empirical findings, and historical trends in cognitive science, related to cultural diversity and living in a global community.
CO2	Use cognitive science knowledge base to create their own methods for answering novel questions of either a theoretical or applied nature,
CO3	Proficient with basic cognitive science research methods, including both theory-driven and applied research design, data collection, data analysis, and data interpretation.

Reference Books	
1.	Cognitive Science: An Introduction, Second Edition by Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein ,1995
2.	Cognitive Science: An Introduction to the Science of the Mind ,José Luis Bermúdez, Cambridge University Press, New York,2010
3.	Cognitive Psychology, Robert L. Solso, Otto H. MacLin and M. Kimberly MacLin,

	2007, Pearson Education
4.	**Cognitive Science: An Introduction to the Study of Mind (2006) by J. Friedenberg and G. Silverman**

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

High-3, Medium-2, Low-1

Semester: VII		
MOBILE AND PERVASIVE COMPUTING (Theory)		
Course Code: MVJ21CG731		**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 understand the basics of Mobile computing and Personal computing**	
2	**To learn the role of wireless networks in Mobile Computing and Pervasive Computing**	
3	**To study about the underlying wireless networks.**	
4	**To understand the architectures of mobile and pervasive applications**	
5	**To become familiar with the pervasive devices and mobile computing platforms.**	

UNIT-I	
Differences between Mobile Communication and Mobile Computing – Contexts and Names – Functions – Applications and Services – New Applications – Making Legacy Applications Mobile Enabled – Design Considerations – Integration of Wireless and Wired Networks – Standards Bodies – Pervasive Computing – Basics and Vision – Principles of Pervasive Computing – Categories of Pervasive Devices	**8Hrs**
UNIT-II	
Migration to 3G Networks – IMT 2000 and UMTS – UMTS Architecture – User Equipment – Radio Network Subsystem – UTRAN – Node B – RNC functions – USIM – Protocol Stack – CS and PS Domains –	**8Hrs**

IMS Architecture – Handover – 3.5G and 3.9G a brief discussion – 4G LAN and Cellular Networks – LTE – Control Plane – NAS and RRC – User Plane – PDCP, RLC and MAC – WiMax IEEE 802.16d/e – WiMax Internetworking with 3GPP	
UNIT-III	
Sensor Networks – Role in Pervasive Computing – In Network Processing and Data Dissemination – Sensor Databases – Data Management in Wireless Mobile Environments – Wireless Mesh Networks – Architecture – Mesh Routers – Mesh Clients – Routing – Cross Layer Approach – Security Aspects of Various Layers in WMN – Applications of Sensor and Mesh networks	**8Hrs**
UNIT-IV	
Adaptability – Mechanisms for Adaptation - Functionality and Data – Transcoding – Location Aware Computing – Location Representation – Localization Techniques – Triangulation and Scene Analysis – Delaunay Triangulation and Voronoi graphs – Types of Context – Role of Mobile Middleware – Adaptation and Agents – Service Discovery Middleware	**8Hrs**
UNIT-V	
Three tier architecture - Model View Controller Architecture - Memory Management – Information Access Devices – PDAs and Smart Phones – Smart Cards and Embedded Controls – J2ME – Programming for CLDC – GUI in MIDP – Application Development ON Android and iPhone.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Deploy 3G networks**

CO2	**Develop suitable algorithms for 4G networks.**
CO3	**Use sensor and mesh networks to develop mobile computing environment.**
CO4	**Develop mobile computing applications based on the paradigm of context aware computing.**
CO5	**Identify architecture for Application Development**

Reference Books	
1.	**Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing: Technology, Applications and Service Creation", Second Edition, Tata McGraw Hill, 2010.**
2.	**Reto Meier, "Professional Android 2 Application Development", Wrox Wiley, 2010.**
3.	**Pei Zheng and Lionel M Li, 'Smart Phone & Next Generation Mobile Computing', Morgan Kaufmann Publishers, 2006**
4.	**Frank Adelstein, 'Fundamentals of Mobile and Pervasive Computing', TMH, 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
CO1	3	-	-	-	1	-	-	-
CO2	3	3	3	-	-	-	-	-
CO3	3	2	2	1	3	-	-	-
CO4	3	2	3	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-

High-3, Medium-2, Low-1

Semester: VII		
COMPUTER APPLICATIONS IN DESIGN (Theory)		
Course Code: MVJ21CG732		**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 impart knowledge on computer graphics which are used routinely in diverse areas as science, engineering, medicine, etc**	

UNIT-I	
Output primitives (points, lines,	

curves etc.,), 2-D & 3-D transformation (Translation, scaling, rotation) windowing - view ports - clipping transformation	8Hrs
UNIT-II	
Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations. Introduction to surfaces - Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder – synthetic surfaces: Hermite bicubic surface- Bezier surface and B-Spline surface- surface manipulations.	8Hrs
UNIT-III	
NURBS- Basics- curves, lines, arcs, circle and bi linear surface. Regularized Boolean set operations - primitive instancing - sweep representations - boundary representations – constructive solid Geometry - comparison of representations - user interface for solid modeling.	8 Hrs
UNIT-IV	
Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages.	8 Hrs
UNIT-V	
Assembly modeling - interferences of positions and orientation - tolerances analysis – mass property calculations - mechanism simulation. Graphics and computing standards– Open GL Data Exchange standards – IGES, STEP etc–Communication standards.	8Hrs

Course Outcomes: After completing the

course, the students will be able to	
CO1	It helps the students to get familiarized with the computer graphics application in design.
CO2	This understanding reinforces the knowledge being learned and shortens the overall learning curve which is necessary to solve CAE problems that arise in engineering

Reference Books	
1.	David F. Rogers, James Alan Adams "Mathematical elements for computer graphics" second edition, Tata McGraw-Hill edition.2003
2.	Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc., 1992
3.	Foley, Wan Dam, Feiner and Hughes – Computer graphics principles & practices, Pearson Education – 2003.
4.	Ibrahim Zeid Mastering CAD/CAM – McGraw Hill, International Edition, 2007

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
CO1	2	2	2	-	-	-	-	-
CO2	2	2	3	-	-	-	-	-

High-3, Medium-2, Low-1

Semester: VII		
GAME DESIGN & DEVELOPMENT (Theory)		
Course Code: MVJ21CG733		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	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 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.	8 Hrs
UNIT-II	
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.	8 Hrs
UNIT-III	
Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management	8Hrs
UNIT-IV	
2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - Unity. DX Studio.	8Hrs
UNIT-V	
Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based	8Hrs

Games, Puzzle games, Single Player games, Multi Player games.	

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**

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.**

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

High-3, Medium-2, Low-1

Semester: VII

COMPUTER GRAPHICS (Theory)		
Course Code: MVJ21CG733		**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	**Understand the two dimensional graphics and their transformations**
2	**Gain knowledge about graphics hardware devices and software used.**
3	**Appreciate illumination and color models.**
4	**Understand the three dimensional graphics and their transformations.**
5	**Be familiar with understand clipping techniques.**

UNIT-I	
Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.	**8Hrs**
UNIT-II	
Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions;	**8 Hrs**

clipping operations – point, line, and polygon clipping algorithms.	
UNIT-III	
Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. **TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods**	**8Hrs**
UNIT-IV	
Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram; Intuitive colour concepts – RGB colour model – YIQ colour model – CMY colour model – HSV colour model – HLS colour model; Colour selection.	**8Hrs**
UNIT-V	
Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening. **COMPUTER GRAPHICS REALISM: Tiling the plane – Recursively defined curves – Koch curves – C curves – Dragons – space**	**8Hrs**

filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Design two dimensional graphics**
CO2	**Apply two dimensional transformations.**
CO3	**Design three dimensional graphics.**
CO4	**Apply three dimensional transformations.**
CO5	**Design animation sequences.**

Reference Books	
1.	**John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,"Computer Graphics: Principles and Practice", , 3rd Edition, Addison-Wesley Professional,2013. (UNIT I, II, III, IV)**
2.	**Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007 (UNIT V).**
3.	**Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL", 4th Edition, Pearson Education, 2010.**
4.	**Hill F S Jr., "Computer Graphics", Maxwell Macmillan" , 1990.**

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

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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
CO1	1							
CO2	1		2	2			1	
CO3	1							2
CO4	1	2				2		

High-3, Medium-2, Low-1

Semester: VII		
3D ANIMATION (Theory)		
Course Code: MVJ21CG735		**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 Understand fundamental properties of animation**	
2	**To educate the basic of animation history**	

3	To develop a simple 3D model in a software
4	To understand the topology of 3D mode
5	To educate the basic physical property of different 3D objects and environment.

UNIT-I	
3D animation, animation industry, history of 3D animation, concept of modelling, texturing, rigging, animation, lighting and rendering. Different type of video formats, pixels vector and raztor, file formats, colour depth, bit depth, frame rate, timecode.	8 Hrs
UNIT-II	
Story – developing story for 3D Script, screen play, storyboard, animatic, pre visualization, design. Character, conflict, goal, story telling principles, basic shot framing, camera movement in 3D, global surroundings. Working principles of producer, director, animator.	8Hrs
UNIT-III	
Understanding the differences between NURBS and Polygon, topology of objects, working with references, Reading anatomy- human and living organisms, breaking human anatomy into different parts. Face, facial expressions, eye movement, lip movement, Character definition. Basic poses, Curve editor.	8 Hrs
UNIT-IV	
Timing movement of object or character, space and scale.Law of inertia, movement laws, newton"s third law, working with gravity, action – reaction, motion weight and gravity, jump, walk and run.	8Hrs
UNIT-V	
Rigging – pivot positions, FK and IK, parenting, deformers, scripting, expressions, rigging workflow. Keyframe, Graph editor, dope sheet,	8Hrs

animation techniques, basic lighting, lighting and attributes, motion capture technology, real time rendering.	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Students will be able to understand the physics behind the 3D animation**
CO2	**Students will understand the basic movement of character**
CO3	**Students will develop the idea for the 3D animation movie**
CO4	**Students will understand the physics behind the different types of forces**
CO5	**Students will rig a character and animate it.**

Reference Books	
1.	**Ami Chopine, "3D art essentials" Taylor & Francis" 2012.**
2.	**Beane A. "3D animation essentials". John Wiley & Sons; 2012.**
3.	**Cabrera C. "An Essential Introduction to Maya Character Rigging with DVD". Routledge; 2012.**
4.	**King R. "3D Animation for the Raw Beginner Using Autodesk Maya 2e". CRC Press; 2019.**

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

High-3, Medium-2, Low-1

Semester: VII		
PHOTOGRAPHY (Theory)		
Course Code: MVJ21CG741		**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 create opportunities for professional and creative expression through the practice and art of photography**	

2	To understand the concept of lighting
3	To educate the importance of photo journalism
4	To inculcate aesthetic sense involved in creativity
5	To educate the student about different genres of photography

UNIT-I	
History of Photography, History of camera, Different camera formats, working of an SLR and DSLR Cameras. Features and functions of SLR and DSLR Cameras. Various camera controls. Zonesystem. Exposure. Image sensors. Different storage formats.	8Hrs
UNIT-II	
Different type of Lenses - Basic Shots and Camera Angles, Photographic Composition - View point and Camera angle-Eye Level, Low and High, Balance- Aspects of Balancing, Shapes and Lines, Pattern, Volume, Lighting, Texture, Tone, Contrast- and Colour, Framing, various Perspectives.	8Hrs
UNIT-III	
Colour Theory, Colour Temperature, Electromagnetic spectrum, Different types of Lights based on Manufacturing and photography purpose, Different lighting patterns, Light equipments, Light Reflectors and Diffusers for Portraits and other genres of photography, Light Meters and Light measurement Units. Uses of various Filters.	8Hrs
UNIT-IV	
Basics of News Photography-Essential elements of News, Importance of News photographs, Types of News photographs Spot News, Feature, Planning for News Photography-Planning of shooting	8Hrs

script, Shooting script techniques, Layout design, Qualities for a Photojournalist, Picture stories and Lens required for News Photography.	
UNIT-V	
Basic shooting and Lighting Techniques and Equipments required for different genres of Photography like Black and White, Landscape, Cityscape, Architecture, Advertising, Fashion, Food, Automobile, Sports, Travel, Children, Portrait, Still Life, Event, Silhouette, Festival and Themes.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Students will learn the principles of good composition in photography**
CO2	**Students will develop an individual style in representing the society through photographs.**
CO3	**Students will understand the function of camera.**
CO4	**Students will develop an individual style in representing the society through photographs.**
CO5	**Students will be able to understand the advanced camera operations.**

Reference Books	
1.	**Ansel Adams, The Negative,Bulfinch press, Fourteenth Edition, 2008**
2.	**Bryan Peterson, Understanding exposure, Amphoto books, 4th edition, 2016.**
3.	**BalakrishnaAiyer, Digital Photojournalism, Authors press,2005**
4.	**Ben long, Complete Digital Photography, Charles River Media, Third 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
CO1	3	1	2	1	-	-	-	-
CO2	3	2	1	3	3	2	-	-
CO3	3	2	1	3	-	2		-
CO4	3	3	2	3	3	2	-	-
CO5	3	2	3	3	3	2	-	-

High-3, Medium-2, Low-1

Semester: VII		
VIDEO PRODUCTION TECHNIQUES (Theory)		
Course Code: MVJ21CG742		**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 understand the basic and evaluation of videography
2	To understand the audio recording knowledge for various production techniques
3	To inculcate the production aesthetic sense in terms of lighting, composition, sound and usage of equipment.
4	To gain knowledge of studio equipment usage and benefits
5	To create opportunities for creative expression through the practice and production of programmes

UNIT-I	
History of Video Cameras, Different camera formats, working of an Video Camera. Features and functions video cameras, Shots and Camera angles used in various production process.	8 Hrs
UNIT-II	
Basics of sound recording. Different types of microphones and factors governing their selection. In built microphones in cameras, Mixing of Sound. Audio sweetening practical. Sound manipulation. Outdoor sound recording vs Studio recording.	8 Hrs
UNIT-III	

Lighting patterns, light equipment"s and accessories, reflectors, light measurement, control of light. Lighting for different programs, Design considerations, Economical Sets, Virtual Sets, Make-ups and costumes.	**8Hrs**
UNIT-IV	
Lighting in the studio, Different camera mounting equipment"s, Single and Multi-cameraproduction, Production control room, Use of Video mixer, Chromo keying and other visual effects. Editing the production – The Art and techniques of Editing.	**8 Hrs**
UNIT-V	
Different genres of Video programmes, Talk shows, Interviews, short film making, Public service announcements and Corporate films. Broadcast distribution, Online distribution, Festivals and Competitions	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**recognize the principles of production techniques**
CO2	**expertise in both indoor and outdoor production.**
CO3	**produce social responsible programmes to create change in the society**
CO4	**follow ethical and social and also represent the society in a good way.**
CO5	**Students become experts in handling camera and related equipments**

Reference Books	
1.	**Albert Moran and Michael Keane, Television across Asia: Television Industries, Programme formats &**

	Globalisation, Routledge Curzon, Taylor & Francis Group, 2004
2.	Belavadi Yasuki, „Video Production," Oxford University Press, 2012
3.	Gerald Millerson, Television Production, 15th Edition, Focal Press, 2012.
4.	Herbert Zettl, Television Production Handbook, 10th Edition, Wadsworth Publications,2009.

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

High-3, Medium-2, Low-1

Semester: VII		
EDITING TECHNIQUES (Theory)		
Course Code: MVJ21CG743		**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 appreciate editing as creative element for storytelling**	
2	**To understand procedures, techniques, and standard practices in video editing**	
3	**To understand the aesthetic principles and concepts of video editing**	

UNIT-I	
Definition of editing, the historical development of editing theory, audience manipulation through editing, Understanding the trends in the editing industry- New technologies in post production. Film and video formats, the principles and formats of digital video, Hardware and software requirements for nonlinear editing, introduction to various operating systems, overview of software	**8Hrs**

available for editing.	
UNIT-II	
Roles and responsibilities of editors, skills required for an successful editor, Working Principles - Considering Script as an Architeure, Understanding directional intent, Camera angles and movement, reading light, reading the actor, understanding stories and their purpose. Copyright and ethical issues in editing.	8Hrs
UNIT-III	
Definition of Shot, Scene and Sequence, Five Shot Rule, Editing Decisions, Editing Opportunities, Six Elements of Edit, Five Types of Edit, Working Practices, Importance of tone, pace and rhythm. Establishing Continuity.	8Hrs
UNIT-IV	
Styles in editing, Techniques in editing, Editing to Manipulate Time, Editing Transitions, Graphics, Animation and Plug-Ins Continuity Editing and Complexity Editing, Dynamics of Sound – discovering the beat, sound as a character, invisible sound, tone and pitch and creative usage of sound in editing. Usage of Colours based on gender, culture and personalities. Planning the nonlinear editing process: Budgeting time, personnel and space.	8Hrs
UNIT-V	
Digital Story telling - Editing styles for reality programs - News, features, bulletins, documentaries, reality shows; Editing styles fictional Narratives –Short Films, Serials, Films; Editing Styles for PSAs, Advertisements and Music Videos. Editing for sports and other live and recorded events	8Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Students will be able to understand the different principles of editing
CO2	Students will learn the application of various styles and methods of editing in their video projects
CO3	Students will understand the aesthetic reason for the edit choices made by film/video makers.
CO4	Students will understand the role of editor
CO5	Students will be able to edit the video projects.

Reference Books	
1.	Bryce Button, Nonlinear Editing: Storytelling, Aesthetics, & Craft, Focal Press, 2002
2.	Dancyger Ken, The Technique of Film and Video Editing – History, Theory and Practice. Focal Press, 2005.
3.	Koppelman Charles, Behind The Seen - How Walter Murch Edited Cold Mountain on Final Cut Pro - Pearson Publications, 2014.
4.	Lumet Sidney, Making Movies, Random House, New York, 1995.

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

High-3, Medium-2, Low-1

Semester: VII		
MOTION GRAPHICS (Theory)		
Course Code: MVJ21CG744		**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 become visually literate, including competence with the non-verbal languages of art and design**	

2	To develop visual, verbal, and written responses to visual phenomena, and organize perception and conceptualizations both rationally and intuitively
3	To learn the basic principles of storyboarding and project mapping
4	To educate the concept of tracking
5	To understand the usage of 3D in live action

UNIT-I	
General principles of motion graphics, - Different software"s used for motion graphics, Photoshop, Final cut pro, Premier Pro, After effects, Combustion, Nuke. - Create Pipeline for production. - Exercise for each software differently. - Creating a story board	8Hrs
UNIT-II	
Understanding and working with the keying concepts, Working with different types of keyer Working with Roto shots, Removing the blue/green screen using different keyers, Working with 2D tracking Working with planar tracking	8 Hrs
UNIT-III	
Working with RGB, colour waveform, colour histogram, Curves Understanding the alpha value, Colour grading of Computer generated objects, Adding the lights and shadow Matching light space and adjusting for brightness and colour Mask the region Working with layer and node based software's.	8Hrs
UNIT-IV	
Camera tracking in different software"s - Combining of graphics elements into the live action Create	8Hrs

and modify 3D objects, Importing 3D materials to various software, Create a 3D title	
UNIT-V	
Understanding audio properties, Working with different levels of audio, Different type of audio formats, Working with multi track audio, Rendering the final mix down audio, Lip sync with the visual, Export the final output.	8Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Students will able to shoot the graphics video on their own
CO2	Students will be able to assemble the green /blue mate footage
CO3	Students will be able to work with the 3D environment digitally
CO4	Students will be able to work with the audio
CO5	Students will understand the concept of rendering

Reference Books	
1.	Blazer L. Animated storytelling: Simple steps for creating animation and motion graphics. Peachpit Press; 2015.
2.	Ian Crook, Peter Beare, Motion Graphics: Principles and Practices from the Ground Up, Bloomsbury Publishing, 2017.
3.	Jackson C. After Effects for Designers: Graphic and Interactive Design in Motion. Focal Press; 2018.
4.	Jon Krasner, Motion Graphic Design: Applied History and Aesthetics Focal press, 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
CO1	3	1	2	1	-	-	-	-
CO2	3	2	1	3	3	2	-	-
CO3	3	2	1	3	-	2	-	-
CO4	3	3	2	3	3	2	–	-
CO5	3	2	3	3	3	2	-	-

High-3, Medium-2, Low-1

Semester: VII		
COMPUTER VISION (Theory)		
Course Code: MVJ21CG745		**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	**This course will enable students to** **Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range 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**	**8Hrs**

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.**	**8Hrs**
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.**	**8Hrs**
UNIT-IV	
Image Segmentation **Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.**	**8Hrs**
UNIT-V	
Pattern Analysis **Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised;**	**8Hrs**

Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.	

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.**

Reference 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.**
3.	**Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.**
4.	**K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.**

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

High-3, Medium-2, Low-1

Semester: VII		
PROJECT PHASE – 1 **(Theory)**		
Course Code: MVJ21CGPR75		**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 expand intellectual capacity, credibility, judgment, intuition.**	
5	**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 - I
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.
CO2	Learn to use modern tools and techniques
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.

CIE Marks Breakup for Major Project during VII Semester :

Relevance of the Topic	10 Marks
Report	20 Marks

Evaluation by Guide	**25 Marks**
Presentation	**30 Marks**
Viva- Voce	**15 Marks**
Total	**100 Marks**

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

High-3, Medium-2, Low-1

Semester: VIII		
PROJECT PHASE – 2 (Theory)		
Course Code: MVJ21CGP81		**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	20

and Demonstration	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
CO1	2	2	2	3	3	2	1	1
CO2	2	2	2	3	3	2	1	1
CO3	2	2	2	3	3	2	1	1
CO4	2	2	2	3	3	2	1	1
CO5	2	2	2	3	3	2	1	1

High-3, Medium-2, Low-1

Semester: VIII		
INTERNSHIP (Theory)		
Course Code: MVJ21CGINT82		**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**

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

High-3, Medium-2, Low-1

Semester: VIII		
TECHNICAL SEMINAR (Theory)		
Course Code: MVJ21CGS83		**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
CO1	2	2	2	3	3	2	1	1
CO2	2	2	2	3	3	2	1	1
CO3	2	2	2	3	3	2	1	1
CO4	2	2	2	3	3	2	1	1
CO5	2	2	2	3	3	2	1	1

High-3, Medium-2, Low-1