Syllabus of I Semester M.Sc programme, w.e.f. 2020-21
(According new regulations w.e.f. 2020-21)

Semester-I	I SEMSTER M.Sc w.e.f.2020-21								
	Course	Subject Name	Teaching Hrs per week	Practical Hrs/ week	Examination				Credits
					Duration (Hrs.)	Marks			
						Theory/ Practical	IA	Total	
Core Subject	20MSCCS 1.1	Discrete Mathematical Structures	4	--	3	80	20	100	4
	20MSCCS 1.2	Database Management Systems	4	--	3	80	20	100	4
	20MSCCS 1.3	Data structure using C++	4	--	3	80	20	100	4
	20MSCCSPL 1.4	Database Management Systems -Lab	--	4	3	80	20	100	4
	20MSCCSPL 1.5	Data structure using C++ Lab	--	4	3	80	20	100	4
Soft Core / Specialization/ Optional	20MSCSC 1.6	Computer System Architecture	4	--	3	80	20	100	4
		Total	16	8				600	24

CS: Core Subject SC: Soft Core PL: Practical

20MSCCS 1.1 : Discrete Mathematical Structures

Teaching:4 hrs./week **Max. Marks:80**
Credits:04Hrs.:52 **I. A. Marks:20**

UNIT I — 10 Hrs

Sets and Logic: Sets, propositions, conditional propositions and logical equivalence, arguments and rules of inference, quantifiers, nested quantifiers.

UNIT II — 12 Hrs

Proofs: Principles of mathematical induction, Functions,
Relations: relations, operations on relations, Properties of relations, equivalence relations, matrices of relations, Partially ordered sets, lattices, finite Boolean algebra, functions on Boolean algebra.

UNIT III — 10 Hrs

Graph Theory: Introduction of Graphs and digraphs, Paths and Cycles, Hamiltonian Cycles, adjacency and incidence matrices, vertex colouring, representations of graphs, isomorphisms of graphs, planar graphs.

UNITIV — 10 Hrs

Trees: Terminology and characterizations of trees, spanning trees, minimal spanning trees, shortest-path algorithm, binary trees, tree traversals, decision trees, isomorphism of trees.

UNITV — 10 Hrs

Semi Groups and Groups: Semigroups, products and quotients of semigroups, groups, products and quotients of groups.
Groups and coding: Coding of Binary information and error detection, decoding and error detection.

Text Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, 5/e, Tata McGraw Hill.
2. Deo N., Graph theory with application to Engineering and Computer Science, Prentice Hall of India,
3. Kolman, Busby, Ross, Discrete Mathematical Structures, Pearson Education.

Reference Books:

1. J.P. Tremblay andR.Manohar, Discrete Mathematical structures with applications to Computer Science, Tata McGraw Hill.

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20MSCCS 1.2: Database Management System

Teaching:4hrs./week **Max. Marks:80**
Credits: 04Hrs.:52 **I. A. Marks:20**

UNITI 12hrs

Introduction: Data modeling for a database, abstraction and data integration, the three-level architecture, components of DBMS, advantages and disadvantages, data associations, data model classification, Entity-Relationship model.

UNITII 10hrs

File organization and storage, secondary storage devices, operations in file, heap files and sorted files, hashing techniques, type of single level ordered index, multi-level indexes indexes on multiple keys, other types of indexes.

UNITIII 12hrs

The Relational Model: Relational database, relational algebra, relational calculus SQL- Data definition, relational database manipulation using SQL, views, embedded data manipulation.
Relational Database Design: Anomalies in a database, functional dependency, normal forms, lossless join and dependency, BCNF, normalization through synthesis, higher order normal forms.

UNITIV 10hrs

Transaction processing, desirable properties of transaction, schedules and recoverability, serializability of schedules concurrency control, locking techniques, time stamp ordering multi version concurrency control, granularity of dataitems.

UNITV 8hrs

Database recovery techniques based on deferred up data and immediate updating, shadow pages, ARIES recovery algorithm, database security and authorization, security issue access control based on granting/revoking of privileges, introduction of statistical database security.

Text Books:

1. Bipin C Desai, An Introduction to Database Systems, GalgotiaPublications.
2. Elmasri and Navathe, Fundamentals of Database Systems, AddisonWesley

References:

1. Silberschatz A, Korth H.F and Sudarshan S, Database System Concepts, Tata McGrawHill
2. S K Singh, Database Systems-Concepts, Design and Applications, PearsonEducation.
3. Bipin C. Desai, An Introduction to Database Systems, GalgotiaPublications.
4. Date, C. J., An Introduction to Database Systems, Addison-Wesley.

20MSCCS 1.3: Data structure using C++	
Teaching:4hrs./week	Max. Marks:80
Credits: 04Hrs.:52	I. A. Marks:20

UNITI **12 Hrs**

Overview of C++: Object Oriented Programming concepts, advantages, C++ program development environment, the C++ language standards, C++ as a superset of C.

Classes & Objects: Classes, structure & classes, union & classes, inline function, scope resolution operator, static class members: static data member, static member function, passing objects to function, returning objects, object assignment, constructors & destructors, friend function, friend classes.

UNITII **10 Hrs**

Overloading as polymorphism: Function & operator overloading, operator overloading restrictions, operator overloading using friend function.
Namespaces: Global namespace and namespace std, nested namespaces
Inheritance : Base class access control, inheritance & protected members, protected base Class inheritance, inheriting multiple base classes, constructors, destructors & inheritance, execution of constructor & destructor functions, passing parameters to base class constructors, granting access, virtual base classes. Virtual Functions & Polymorphism: virtual function, pure virtual functions

UNITIII **10 Hrs**
Introduction to Data Structures: Definition of Data structure and Abstract data type Classification of Data structures Linear, non-linear, homogeneous, non-homogeneous, static & dynamic. Arrays: Definition & types of array, Memory representation of one & two dimensional array, Operations: Insertion, Deletion, Traversal

UNITIV **10 Hrs**
Stack: Definition, Array implementation of stack (static stack) : Operations PUSH, POP, TRAVERSE.
Applications of stack, Infix, Prefix, Postfix representation and evaluation using stack, Use of stack in recursive implementation.
Queue: Definition, Array implementation of queue (static queue): Operations, Introduction to Circular queue Definition & implementation, Priority queue, Double ended queue Applications of queue

UNITV **10 Hrs**
Introduction to Linked List: Definition, advantages, Types of linked list: single, doubly, circular linked list, Operations: Creation, insertion, deletion & traversal of linked list

References:

1. Herbert Schildt, C++ The Complete Reference, Tata McGraw HillPublication.
2. B. A. Forouzon, R. F. Gilberge, Computer Science: A Structured Approach Using C++,
3. Stroubstrup B., The C++ Programming Language, AddisonWesley.
4. Michael T. Goodrich, Data Structures and Algorithms in C++,
5. Ellis Horowitz, SartajSahni, Dinesh Mehta, Fundamentals of Data Structures in C++

20MSCCSPL 1.4: DBMS-Lab	
Teaching:4 hrs./week Credits:04	Max. Marks:80 I. A. Marks:20

ReferenceList of Lab Assignments

1. **Database Schema for a customer-sale scenario**
   Customer(Cust id : integer, cust_name: string)
   Item(item_id: integer, item_name: string, price: integer)
   Sale(bill_no: integer, bill_data: date, cust_id: integer, item_id: integer, qty_sold: integer)

2. **Database Schema for a Student Library scenario**
   Student(Stud_no : integer, Stud_name: string)
   Membership(Mem_no: integer,Stud_no: integer)
   Book(book_no: integer, book_name:string, author: string)
   Iss_rec(iss_no:integer, iss_date: date, Mem_no: integer, book_no: integer)

3. **Database Schema for a Employee-pay scenario**
   employee(emp_id : integer,emp_name: string)
   department(dept_id: integer,dept_name:string)
   paydetails(emp_id : integer,dept_id: integer, basic: integer, deductions: integer, additions: integer, DOJ:date)
   payroll(emp_id : integer, pay_date: date)

4. **Database Schema for a Video Library scenario**
   Customer(cust_no: integer,cust_name: string)
   Membership(Mem_no: integer, cust_no: integer)
   Cassette(cass_no:integer, cass_name:string, Language: String)
   Iss_rec(iss_no: integer, iss_date: date, mem_no: integer, cass_no: integer)

5. **Database Schema for a student-Lab scenario**
   Student(stud_no: integer, stud_name: string, class: string)
   Class(class: string,descrip: string)
   Lab(mach_no: integer, Lab_no: integer, description: String)
   Allotment(Stud_no: Integer, mach_no: integer, dayof week: string)

For each of the above mentioned schema,

a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) Perform execution of atleast07 queries that focus on various DBMS concept

20MSCCSPL 1.5: Data structure using C++ Lab

Teaching:4 hrs./week
Credits:04

Max. Marks:80
I. A. Marks:20

ReferenceList of Lab Assignments

1. Write a C++ program to find roots of quadratic Equation
2. Program to do banking operations using constructor and destructor functions
3. Program to find area of cone , square and triangle using inline member function
4. Program to find factorial of a given number using friend function
5. Write a C++ program to demonstrate single inheritance of library transactions
6. Write a C++ program to demonstrate multiple inheritance on students class
7. Write a C++ program to addition and subtraction of complex numbers using operator overloading
8. Program to demonstrate polymorphism concept
9. Program to sort integers and strings using function templates
10. Program to create and append records into employee data file
11. Write a program to search an element of array using binary search method
12. Write a program sort elements of array using Selection sort method
13. Write a C++ program to do STACK operations
14. Write a C++ program to implement evaluation of Expression
15. Program to do Queue operations
16. Write a C++ program to do operations of Circular Queue
17. Write a C++ program to demonstrate Singly Liked List
18. Write a C++ program to Demonstrate Double Liked List

20MSCSC 1.6 : Computer System Architecture

Teaching:4 hrs./week **Max. Marks:80**
Credits:04Hrs.:52 **I. A. Marks:20**

UNITI **12 Hrs**

Computer Data Representation- Basic computer data types, Complements, Fixed point representation, Register Transfer and Micro-operations: Floating point representation, Register Transfer language, Register Transfer, Bus and Memory Transfers (Tree-State Bus Buffers, Memory Transfer), Arithmetic Micro-Operations, Logic Micro Operations, Shift Micro-Operations, Arithmetic logical shift unit

Basic Computer Organization and Design -Instruction codes, Computer registers, computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions,

UNITII **10 Hrs**

Basic Computer Organization and Design Instruction codes, Computer registers, computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input output and interrupt, Complete computer description, Design of Basic computer, design of Accumulator Unit

UNITIII **10 Hrs**

Programming The Basic Computer Introduction, Machine Language, Assembly Language, assembler, Program loops, Programming Arithmetic and logic operations, subroutines, I-O Programming.

Micro programmed Control: Control Memory, Address sequencing, Micro program Example, design of control Unit

UNITIV **10 Hrs**

Central Processing Unit Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, data transfer and manipulation, Program Control, Reduced Instruction Set Computer (RISC)

UNITV **10 Hrs**

Pipeline And Vector Processing Flynn's taxonomy, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction, Pipeline, RISC Pipeline, Vector Processing, Array Processors

Text Books:

1. M. Morris Mano, Computer System Architecture, Pearson publications.
2. Andrew S. Tanenbaum and Todd Austin, Structured Computer Organization, Sixth Edition, PHI

References:

1. M. Murdocca& V. Heuring, Computer Architecture & Organization, WILEY
2. John Hayes, Computer Architecture and Organization, McGrawHill

Syllabus of II Semester MSC programme, w.e.f. 2020-21
(According new regulations w.e.f. 2020-21)

Semester-II	II SEMSTER M.Sc w.e.f.2020-21								
	Course	Subject Name	Teaching Hrs per week	Practical Hrs/ week	Examination				Credits
					Duration (Hrs.)	Marks			
						Theory/ Practical	IA	Total	
Core Subject	20MSCCS 2.1	Programming using Java	4	--	3	80	20	100	4
	20MSCCS 2.2	Web Programming	4	--	3	80	20	100	4
	20MSCCSPL 2.3	Programming using JAVA Lab	-	4	3	80	20	100	4
	20MSCCSPL 2.4	Web Programming -Lab	-	4	3	80	20	100	4
Soft Core / Specialization/ Optional	20MSCSC 2.5	Data Communication and Computer Networks	4	--	3	80	20	100	4
Open Elective	20MSCOE 2.6	a. Computer fundamentals b. Graph Theory	4	--	3	80	20	100	4
	Total		16	8				600	24

CS: Core Subject SC: Soft Core OE: Open Elective PL: Practical

20MSCCS 2.1: Programming using Java

Teaching:4hrs./week **Max. Marks:80**
Credits: 04Hrs.:52 **I. A. Marks:20**

UNITI — 10 Hrs

Introduction to Java programming, The Java Virtual Machine, Variables and data types, Conditional and looping constructs, Arrays.

UNIT II — 10 Hrs

Object-oriented programming with Java Classes and Objects, Fields and Methods, Constructors, Overloading
methods, Garbage collection, Nested classes.

UNIT III — 10 Hrs

Inheritance, Overriding methods, Polymorphism, Making methods and classes final, Abstract classes and methods, Interfaces.

UNIT IV — 12 Hrs

Exception handling with try-throw-catch-finally constructs, The Exception class Packages, Package access, Documentation comments.
The Object class, Cloning objects, The JDK Linked List class, Strings, String conversions Working with types: Wrapper classes, Enumeration interface.

UNIT V — 10 Hrs

Applets, Configuring applets, Applet capabilities and restrictions, Basics of AWT and Swing, Layout Managers, Event Handling, The Action Listener interface, Panels, Classes for various controls, such as label, choice, list, , Checkbox, etc., Dialogs and frames, Using menus, Using the adapter classes, Graphics.

References:

1. HerbetSchidt and Dale Srien, Java Fundamentals - A comprehensive Introduction, TMH.
2. P.J. Deitel and H.M. Deitel, Java for Programmers, Pearsoneducation
3. P.J. Deitel and H.M. Deitel, Java: How to Program, PHI.
4. S. Malhotra and S. Choudhary, Programming in Java, Oxford Univ.Press.

20MSCCS 2.2: Web Programming

Teaching:4hrs./week **Max. Marks:80**
Credits: 04Hrs.:52 **I. A. Marks:20**

UNITI **12 Hrs**

Overview: Web page Designing using HTML, Java Script-Object, names, literals, operators and expressions-statements and features-events - windows - documents - frames - data types - built-in functions- Browser object model - Verifying forms.-HTML5- CSS3- HTML 5 canvas. XML: DTD, Namespaces, XML schemas, displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets, XMLprocessors

UNITII **12 Hrs**

PHP : Server-side web scripting, Installing PHP, Adding PHP to HTML, Syntax and Variables, Passing information between pages, Strings, Arrays and Array Functions, Numbers, Basic PHP errors/ problems. Database access with PHP and MySQL, PHP/MySQL Functions, Displaying queries in tables, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and HTTP, Type and Type Conversions.

UNITIII **10 Hrs**

Ruby on Rails: Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterators, Pattern matching. Overview of Rails, Document requests, Processing forms, Rails applications with Databases, Layouts.

UNITIV **10 Hrs**

JDBC Overview – JDBC implementation – Connection class – Statements – Catching Database Results, handling database Queries. Networking– InetAddress class – URLclass- TCP sockets - UDP sockets, Java Beans –RM.
Java Servlets – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking. Introduction to JSP.

UNITV **8 Hrs**
Introduction to Ajax: Overview of Ajax; The basics of Ajax; Rails with Ajax.

20MSCCSPL 2.3: Programming using JAVA Lab	
Teaching:4 hrs./week Credits:04	Max. Marks:80 I. A. Marks:20

Reference List of Lab Assignments

1. Write a program that asks a user to enter an integer n and then determines whether n is prime or not. Your programcan perform this by dividing n by all integers from 2 to n-1 and by checking whether the remainder is0.
2. Write a Java program to find GCD and LCM of two numbers (GCD is calculated using Euclidean Algorithm. LCM is found using factorizationmethod.).
3. Write a program that computes C(n, k), i.e. the number of k-element subsets of a set with n elements. Remember that C(n, k) = n!/(k! (n-k)!) . Your program should ask the user to enter n and k, and compute and print C(n, k).
4. Write a Java program implement basic queueoperations.
5. Write a Java program to count the frequency of words, characters in the given line oftext.
6. Write a Java program that creates an object and initializes its data members using constructor. Use constructor overloadingconcept.
7. Write a Java Program to implement inheritance and demonstrate use of method overriding(example: Bankaccount/Employee)
8. Write a program to demonstrate use of user defined package by importing the package andaccess the member variable of classes contained in thepackage..
9. Write a program to demonstrate use of interfaces for two different classes. Interface shouldalso include constants along with functionprototypes.
10. Write a program to implement the concept of Exception Handling by creating user defined exceptions
11. Illustrate creation of thread by extending Thread class/ implementing runnableinterface
12. Write a Java program that creates three threads. First thread displays “Good Morning” everyone second, the second thread displays “Hello” every five seconds and the third thread displays “Welcome” every tenseconds.
13. Illustrate thread joinconcept.
14. Write a java program to implement mouse events like mouse pressed, mouse released and mouse moved by means of adapterclasses.
15. Write a java program that creates a user interface to perform integer divisions. The user enters two numbers in the textfields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an ArithmeticException Display the exception in a message dialogbox
16. Write a Java program to illustrate basic calculator using grid layoutmanager.
17. Develop an applet that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named “Compute” isclicked.
18. Write a java program to create student report using applet, read the input using text boxes and display the o/p usingbuttons.

20MSCCSPL 2.4: Web Programming Lab	
Teaching:4 hrs./week Credits:04	Max. Marks:80 I. A. Marks:20

Reference List of Lab Assignments

1. Develop and demonstrate a XHTML document that illustrates the use external stylesheet, ordered list, table, borders, padding, color, and thetag.
2. Develop and demonstrate a XHTML file that includes Javascript script for obtaining n through prompt and computing n Fibonaccinumbers
3. Design an XML document to store information about astudent.
4. Write a PHP program to store current date-time in a COOKIE and display the "Last visited on" date-time on the web page upon reopening of the samepage.
5. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on webpage.
6. Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.
7. Using PHP and MySQL, develop a program to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with properheadings.
8. Develop aA COMPANY database browser application. The initial Web page in this application lists all the departments in the company. By following hyperlinks, the user may see more details of departments, employees, and projects in three separate Web pages. Implement the browser program using four PHP scripts: (a) companyBrowse.php: This script lists all the departments in the company in a tabular form (b) deptView.php: (c) empView.php: (d)projectView.php:
9. Implement the problem of finding employee names given their social security number as a Web application. Design two Web pages: 1. The first Web page would contain a HTML form that contains a select list of social security numbers of employees and a submit button. 2. Upon choosing a social security number and submitting the form in the first Web page produces the second Web page that lists the name of theemployee.
10. Mini Project: Illustrate online address/contact book application using PHP amdMySQL. The application should perform the following functions: (1) ADD a new contact. (2) DELETE one or more contacts. (3) SEARCH contacts by substring match on name. (4) LIST allcontacts.
11. Illustrate JDBC connectivity to update customerinformation.
12. Illustrate Simple servelet that generates plaintext.
13. Write a Servlet program to implement SessionTracking
14. JSP program for basic arithmeticoperations
15. Creating a Java program that connects to a database using JDBC Write a java programto insert the Data of newemployee.
16. Write a Java program that loads student name and branch from database It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hashtables).
17. Write a Ruby program to create a user defined function and illustrate to call thefunction.
18. Write a Ruby program to 1) Fetch the values from textbox and radio button 2) Explainthe session and cookies inrails.

20MSCSC 2.5: Data Communication and Computer Networks

Teaching:4hrs./week **Max. Marks:80**
Credits: 04Hrs.:52 **I. A. Marks:20**

UNITI **12Hrs**

Introduction: Data Communications, Networks, the internet, protocols and standards, network models– OSI model, TCP/IP protocol suite, addressing. Data and Signals: Periodic analog signals, digital signals, transmission impairment, data rate limits, performance

UNITII **10 Hrs**

Physical Layer and Media: Analog transmission: Digital-to-analog conversion, analog-to-analog conversion. Multiplexing,
Transmission media – Guided media and unguided media.
Data Link Control: Framing, flow and error control,

UNITIII **10 Hrs**

Network Layer: Logical addressing – IPV4, IPV6, Address mapping–ARP, RARP,
Transport Layer: Process to Process Delivery, User Datagram Protocol, Transmission Control Protocol, SCTP, Congestion Control.

UNITIV **10 Hrs**

Detection and Correction: Errors, redundancy, detection versus correction, Network Security- Security Services, Security in the Internet: Firewalls

UNITV **10 Hrs**

Application Layer: Domain Name Space, DDNS, Remote Logging, Electronic Mail, and File Transfer, WWW, HTTP

Text Books:

Behrouza A Forouzan, Data Communications and Networking, McGrawHill.
Computer Networks - Andrew s. Tanenbaum, PearsonEducation.

References:

Data and Computer Communications, William Stallings, Pearsoneducation
Data Communications, Computer Networks and Open Systems, fourth edition-Fred Halsall, AddisonWesley.

20MSCOE 2.6.a : Computer fundamentals and C-Programming

Teaching:4hrs./week **Max. Marks:80**
Credits: 04Hrs.:52 **I. A. Marks:20**

UNITI 12 Hrs

Introduction to Computer Systems, Interacting with the Computer, Computer Organization Early history, Basic parts and structure of a computer, Categorizing Computers, Information Processing life cycle, Essential computer hardware, Essential computer software. Keyboard, Mouse, Inputting data in other ways: Pen-based systems, Data scanning devices, input devices, Video and sound, Monitors, Printers, Plotters, Data projectors, Sound systems., CPU, Buses, Mother Board, Chip sets, Microprocessors

UNITII 10 Hrs

Storage media, Floppy drive, Hard disks, Optical media, CD-ROM, CD-R, CD-RW, DVD-ROM, Recordable DVD. Types of operating systems, Computer processing techniques, Functions of Operating Systems,
Networking, Convergence of computing with communications, Networking basics, Need for networking, Basic components of a network

UNITIII 10 Hrs

Fundamentals of Problem Solving, Introduction to C Language Creating and running programs, System development, Introduction to C Language: Background, C Programs, Identifiers, Types, Variables, Constants, Input / Output, Programming example, Tips and common programming errors

UNITIV 10 Hrs

Structure of a C Program, Expressions, Precedence and associatively, Side effects, Evaluating expressions, Type conversion, Statements, Programming examples, Software Engineering, Tips and common programming errors.
Functions, Designing structured programs, Functions in C, User-defined Functions, Inter-function communication, Standard functions, Scope, Programming examples

UNITV 10 Hrs

Arrays, Strings
Concepts, Using arrays in C, Inter-function communication, Array applications, Bubble Sort, Binary search, Two-dimensional Arrays, Multi-dimensional arrays, String concepts, C strings, String input/output, Programming examples, Software Engineering, Tips and common programming errors.

Text Books:

1. Computer fundamentals and C Programming by Balagurusamy, Tata McGraw Hill, 2003
2. V. Rajaraman, Fundamentals of Computers, PHI

20MSCOE 2.6.b :Graph Theory

Teaching:4hrs./week **Max. Marks:80**
Credits: 04Hrs.:52 **I. A. Marks:20**

UNIT I **12 Hrs**

Introduction to Graph Theory: Definitions and Examples, Sub graphs, Components, and Graph Isomorphism, Vertex Degree, Perfect graphs, Planar graphs.

UNIT II **10 Hrs**

Connectivity and Paths: Walk, Paths and Circuits, Euler Graph, Operations on Graphs, Connectivity, Hamiltonicity: Hamilton Paths and Cycles.

UNITIII **10 Hrs**

Trees : Trees, Properties of trees, Rooted binary trees, Spanning trees, Weighted graphs.
Matrix representation of graphs: Incidence Matrix, Circuit Matrix, Cut-set Matrix, Adjacency Matrix.

UNIT IV **10 Hrs**

Graph Coloring& Flows: Matchings, Vertex Coloring, Edge Coloring, Other Coloring Problems, Four Color Problems, Circulations, Flows in Network, Group-Valued Flows, Flow coloring duality

UNIT V **10 Hrs**

Graph Theory in Operation Research: Transparent Network, Extension of Max-Flow Min-Cut Theorem, minimal Cost flow, Multicommodity flow, Activity Networks in project planning, Analysis of an Activity Network.

Text Books:

1. NarsinghDeo, GraphTheorywithApplicationtoEngineeringandComputerScience,4th Edition, PHI.

Reference Books:

1. R.Diestel, Graph Theory, Springer-Verlag, 2nd Edition, 2000.

Syllabus of III Semester MSC programme, w.e.f. 2021-22
(According new regulations w.e.f. 2020-21)

Semester-III	III SEMSTER M.Sc w.e.f.2021-22								
	Course	Subject Name	Teaching Hrs per week	Practical Hrs/ week	Examination				Credits
					Duration (Hrs.)	Marks			
						Theory/ Practical	IA	Total	
Core Subject	20MSCCS 3.1	C# and .NET Programming	4	--	3	80	20	100	4
	20MSCCS 3.2	Programming using Python	4	--	3	80	20	100	4
	20MSCCSPL 3.3	C# and .NET Programming -Lab	--	4	3	80	20	100	4
	20MSCCSPL 3.4	Python Programming -Lab	--	4	3	80	20	100	4
Soft Core / Specialization/ Optional	20MSCSC 3.5	Software Engineering	4	--	3	80	20	100	4
Open Elective	20MSCOE 3.6	a. Internet of Things b. E-Commerce	4	--	3	80	20	100	4
	Total		16	8				600	24

CS: Core Subject SC: Soft Core OE: Open Elective PL: Practical

20MSCCS 3.1: C# and .NET Programming

Teaching:4hrs./week **Max. Marks:80**
Credits: 04Hrs.:52 **I. A. Marks:20**

UNIT I **12Hrs**

Overview of Dynamic Web page, introduction & features of ASP.NET, Understanding ASP.NET Controls, Applications, Web servers, installation of IIS. Web forms, web form controls -server controls, client controls. Adding controls to a web form, Buttons, Text Box , Labels, Checkbox, Radio Buttons, List Box. Adding controls at runtime. Running a web Application, creating a multiform web project. Form Validation: Client side validation, server Side validation, Validation Controls : Required Field Comparison Range. Calendar control,

UNIT II **10Hrs**

Overview of ADO.NET, from ADO to ADO.NET. ADO.NET architecture, Accessing Data using Data Adapters and Datasets, using Command & Data Reader, binding data to data bind Controls, displaying data in data grid. XML in .NET , XML basics, attributes, fundamental XML classes: Document, textwriter, textreader. XML validations, XML in ADO.NET, TheXMLDataDucument.

UNIT III **10Hrs**

Web services: Introduction, State management- View state, Session state, Application state. SOAP, web service description language, building & consuming a web service. Web Application deployment. Caching.

UNIT IV **10Hrs**

Threading Concepts, Creating Threads in .NET, managing threads, Thread Synchronization Security features of .NET, Role based security & Code access security, permissions

UNIT V **10Hrs**

C# and .NET, similarities & differences from JAVA, structure of C# program. Language features: Type system, boxing and un boxing, flow controls, classes, interfaces, Serialization and Persistence, Serializing an Object, Deserializing an Object Delegates, Reflection. VB and .NET, VB .NET features.

References:

1. Mathew Macdonald, The Complete Reference ASP.NET, TMH
2. Professional ASP.NET, Wrox Publication
3. Andrew Troelsen, Pro C# with .NET 3.0, Special Edition, Dream tech Press, India
4. Steven Holzner, VB.NET Programming Black Book, Dreamtech Publications.
5. ThuanL.Thai, Hoang Lam ".Net Framework essentials: Introduction to .NET framework", Third Edition, O'Reilly & Associates Publication
6. Jesse Liberty "Learning C#" , O'Reilly & Associates Publication
7. Matt Telles, C# programming Black Book, Dreamtech Publications.
8. ASP.NET Unleashed, BPB publication

Ad rotator Control, Internet Explorer Control.

20MSCCS3.2:Programming using Python

Teaching:4hrs./week **Max. Marks:80**
Credits: 04Hrs.:52 **I. A. Marks:20**

UNIT I **10Hrs**

Installing Python, Simple program using Python, Expressions and Values, Variables and Computer Memory, error detection, Multiple line statements, Designing and using functions, functions provided by Python, Tracing function calls in memory model, omitting return statement. Working with Text: Creating Strings of Characters, Using Special Characters in Strings, Creating a Multiline String, Printing Information, Getting Information from the Keyboard.

UNITII **10Hrs**

A Boolean Type , Choosing Statements to Execute, Nested If Statements , Remembering the Results of a Boolean Expression Evaluation , A Modular Approach to Program Organization, Importing Modules , Defining Your Own Modules, Testing Code Semi automatically Grouping Functions Using Methods: Modules, Classes, and Methods , Calling Methods the Object-Oriented Way, Exploring String Methods, Underscores.

UNIT III **12Hrs**

Storing Collections of Data Using Lists: Storing and Accessing Data in Lists, modifying Lists, Operations on Lists, Slicing Lists, Aliasing, List Methods, Working with a List of Lists. Repeating Code Using Loops: Processing Items in a List, Processing Characters in Strings, Looping Over a Range of Numbers, Processing Lists Using Indices, Nesting Loops in Loops, Looping Until a Condition Is Reached, Repetition Based on User Input, Controlling Loops UsingBreak and Continue Reading and Writing.

UNITIV **10Hrs**

Files: Kinds of files, Opening a File, Techniques for Reading Files, Files over the Internet, Writing Files, and Writing Algorithms That Use the File-Reading Techniques, Multiline Records. Storing Data Using Other Collection Types: Storing Data Using Sets, Storing Data Using Tuples, Storing Data Using Dictionaries, Inverting a Dictionary, Using the In Operator on Tuples, Sets, and Dictionaries, Comparing Collections.

UNIT V **10Hrs**

Collection of New Information Object-Oriented Programming : Understanding a Problem Domain , Function “Isinstance,” Class Object, and Class Book , Writing a Method in Class Book, Plugging into Python Syntax: More Special Methods ,Creating Graphical User interface: Building a Basic GUI, Models, Views, and Controllers, Customizing the Visual Style Introducing few more Widgets, Object-Oriented GUIs, Keeping the Concepts from Being a GUI Mess.

Text Books:

Practical Programming: An introduction to Computer Science Using Python, second edition, Paul Gries, Jennifer Campbell, Jason Montojo, The Pragmatic Bookshelf.
Learning with Python: How to Think Like a Computer Scientist Paperback – Allen Downey , Jeffrey Elkner, 2015

Reference Books:

1. Introduction to Python for Computational Science and Engineering (A beginner's guide), Hans Fangohr.
2. Exploring Python, Timothy A. Budd, McGraw Hill Education
3. Python for Informatics: Exploring Information, Charles Severance.
4. Learning Python, Fourth Edition, Mark Lutz, O’Reilly publication

20MSCCSPL 3.3: C# and .NET Programming-Lab	
Teaching:4hrs./week Credits: 04Hrs.:52	Max. Marks:80 I. A. Marks:20

Reference List of Lab Assignments

1. Describe the enumerations programming constructs, which provides a human-readable form of a series of related constant values in C#.
2. Create classes, they are reference types in C# and hence are allocated on the heap. Classes provide object-oriented constructs such as encapsulation, polymorphism, and inheritance. For instance, the program should print John. Doe twice, illustrating that objects are reference types, allocated on the heap implement the same using C#.
3. Check Whether the Entered Year is a Leap Year or Not 4
4. . Describe Arrays and Strings methods with suitable C# program
5. Program to display the addition, subtraction, multiplication and division of two number using console applications.
6. Program to display the first 10 natural numbers and their sum using console application.
7. Program to display the addition using the windows application.
8. Work with Page using ASP.Net.
9. Write a program to convert input string from lower to upper and upper to lower case.
10. Work with forms using ASP.NET.
11. Describe access data source through ADO.NET.
12. Perform operator overloading.
13. Describe delegates, events, errors and exceptions
14. Find the second largest element in a single dimensional array.
15. Program to illustrate the use of different properties in C#.
16. Demonstrate Command line arguments processing.
17. Program to multiply to matrices using Rectangular arrays.
18. Demonstrate Use of Virtual and override keyword in C# with a simple Program.

20MSCCSPL 3.4:Python Programming-Lab	
Teaching:4hrs./week Credits: 04Hrs.:52	Max. Marks:80 I. A. Marks:20

Reference List of Lab Assignments

1. Write a program to sum all the elements from n1 to n2 where n1 and n2 are positive integers
2. Input an array of n numbers and find separately the sum of positive numbers and negative numbers.
3. Write a program to search an element using linear search
4. Write a program to search an element using binary search.
5. Write a program to simulate stack.
6. using a stack evaluate an arithmetic expression.
7. Write a program to multiply two matrices.
8. Write a program to find the roots of a quadratic equation
9. Write a program to insert a number in a sorted array.
10. Write a Python Program to check whether the given string is palindrome or not using built in string manipulation methods.
11. Write a Python Program to read a word and prints the number of letters, vowels and percentage of vowels in the word using dictionary
12. Write a Python Program to check a given sentence is a pangram or not using function/Module.

20MSCSC 3.5:Software Engineering

Teaching:4hrs./week **Max. Marks:80**
Credits: 04Hrs.:52 **I. A. Marks:20**

UNIT I **10 Hrs**

Introduction to Software Engineering: FAQs about software engineering, systems engineering, system availability and reliability, software processes, project management.

UNIT II **10 Hrs**

Software Requirement: Software requirements, requirements engineering project, system models, critical systems specification, formal specification.

UNIT III
12 Hrs

Software Design: Architectural designs, distributed system architectures, application architectures, object oriented design, real-time software design, user interface design.

UNIT IV **10 Hrs**

Software Development: Rapid software development, software reuse, component-based software engineering, critical systems development, software evolution.

UNIT V **10 Hrs**

Verification, Validation and Management: Software inspections, static analysis, verification and formal methods, software testing, critical systems validation.
Managing people, software cost estimation, quality management, process improvement, configuration management.

References:

1. Sommerville, Software Engineering, 8/e, Pearson Education.
2. Pressman S. Roger, Software Engineering, Tata McGraw Hill.
3. JalotePankaj, An integrated Approach to Software Engineering, Narosa Publishing House.
4. Shooman, Software Engineering, McGraw Hill.
5. C. Ghezzi, M. Jazayeri and D. Mandrioli, Fundamentals of Software Engineering, Prentice Hall of India

20MSCOE 3.6 a: Internet of Things	
Teaching:4hrs./week Credits: 04Hrs.:52	Max. Marks:80 I. A. Marks:20

UNIT I **10 Hrs**

Fundamentals of IoT: Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoTvs M2M.

UNIT II **10 Hrs**

IoT Design Methodology: IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.

UNIT III **12 Hrs**

Building IoT With Raspberry PI: Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services –

UNIT IV **10 Hrs**

Building IoT with GALILEO/ARDUINO: Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks

UNIT V **10 Hrs**

Case Studies and Advanced Topics: Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for IoT – Data Analytics for IoT – Software & Management Tools for IoT

References:

1. ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
2. Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014. 3. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014

20MSCOE 3.6b: E-Commerce

Teaching:4 hrs./week **Max. Marks:80**
Credits:04Hrs.:52 **I. A. Marks:20**

UNITI **10Hrs**

Overview of Electronic Commerce: Main Activities of E-Commerce, Broad Goals of E-Commerce, E-Commerce technical Components, Functions of E-Commerce, Prospectus of Ecommerce, Lessons from E-commerce Evolution, Scope of E-commerce.

UNITII **10Hrs**

E-commerce Technical Architecture, E- Commerce Strategies, E-commerce Essentials, Ecommerce applications, Foundation of E-commerce, Growth of E-Commerce, Advantages of E-Commerce, Disadvantages of E-commerce, progress of E-commerce in India.

UNITIII **10Hrs**

Driving the E-Commerce revolution. E-Commerce activities, Matrix of E-commerce models, B2C, B2B, B2B Boom, E-commerce opportunity Frame work, Developing an E-commerce Strategy, International E-commerce, International Strategy Development, Dotcom Companies.

UNITIV **10Hrs**

Electronic Market:-Online Shopping, Online Purchasing, Electronic Market, Three models of Electronic Market, Markets category, International Marketing, one-to –one Marketing, Permission Marketing, pull and push technologies, B2B Hubs, B2B market places, B2B exchange.

UNITV **12Hrs**

Electronic Business: Electronic Business applications Emerging applications, Electronic Business Architecture, AMR Model for Electronic Business, Evolution of Electronic Business Application, Dotcom companies, The Indian scenario for E-Business, electronic business implementations, B2B E- commerce, B2C E-commerce, B2B Market Place.

Implementation of E-Commerce: WWW.EBAY.COM - B2C Website – Registration, Time factor, Bidding process, Growth of eBay; PayPal – New Trend in Making Payments Online; National Electronic Funds Transfer.

References:

1. C.S.V Murthy, E-Commerce Concepts. Models, Strategies, Himalaya PublishingHouse.
2. Janice Reynolds, The Complete E-Commerce Book: Design, Build & Maintain a Successful Web-based Business, CRCPress.
3. Ravi Kalakota and Andrew B Whinston, Frontiers of Electronic Commerce, PearsonEducation
4. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, E-Commerce: Fundamentals and Applications
5. Joseph, E-Commerce : An Indian Perspective,PHI
6. Kamlesh K. bajaj and Debjani Nag., E-commerce (The cutting Edge of Business) , I & II Edition, Tata McGrawHill.

Syllabus of IV Semester MSC programme, w.e.f. 2021-22
(According new regulations w.e.f. 2020-21)

Semester-IV	IV SEMSTER M.Sc w.e.f.2021-22								
	Course	Subject Name	Teaching Hrs per week	Practical Hrs/ week	Examination				Credits
					Duration (Hrs.)	Marks			
						Theory/ Practical	IA	Total	
Core Subject & Electives	20MSCCS 4.1	Digital Image Processing	4	--	3	80	20	100	4
	20MSCCS 4.2	Artificial Intelligence	4	--	3	80	20	100	4
	20MSCCSPL 4.3	Digital Image Processing-Lab using MATLAB /Python	--	4	3	80	20	100	4
	20MSCCE 4.4	a. Software Testing b. Pattern Recognition c. Cloud Computing d. Big Data Analytics e. Machine Learning	4	--	3	80	20	100	4
Soft Core / Specialization/ Optional	20MSCSC 4.5	Data Mining Techniques	4		3	80	20	100	4
Project Work	20MSCPL 4.6	Project Work	--	8	3	80	20	100	4
	Total		16	8				600	24

CS: Core Subject SC: Soft Core OE: Open Elective PL: Practical

20MSCCS 4.1:Digital Image Processing

Teaching:4 hrs./week **Max. Marks:80**
Credits:04Hrs.:52 **I. A. Marks:20**

UNIT – I **10Hrs**

Digital Image Fundamentals: The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Basic relationships between pixels..

UNIT – II **12Hrs**

Image Enhancement in the Spatial Domain: Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

UNIT – III **10Hrs**

Image Enhancement in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering. Colour Image Processing: Colour models, pseudocolor image processing, colour transformations, smoothening and sharpening..

UNIT – IV **10Hrs**

Image Restoration: A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

UNITV **10Hrs**

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation. Morphological Processing: Some basic Morphological operations.

References:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, 3/e, Pearson Education.
2. Anil K. Jain, Fundamentals of Digital Image Processing', Pearson .
3. Kenneth R. Castleman, Digital Image Processing, Pearson.
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,Digital Image Processing using MATLAB,P earson Education, Inc..
5. William K. Pratt, , Digital Image Processing, John Wiley, New York,
6. Milan Sonka et al, Image Processing, Analysis And Machine Vision, Brookes/Cole, Vikas Publishing House..

220MSCCS 4.2:Artificial Intelligence	
Teaching:4 hrs./week	Max. Marks:80
Credits:04Hrs.:52	I. A. Marks:20

UNIT I **10 Hrs**

Artificial Intelligence and problem Solving : Introduction, Intelligence Agents, Solving Problems by Searching, Beyond Classical Search, Adversarial Search and Constraint Satisfaction Problems

UNIT II **10 Hrs**

Knowledge and Reasoning:Logical Agents, First-Order Logic, Inference in First-Order Logic, Classical Planning and Planning and Acting in the Real World, Knowledge Representation

UNIT III **10 Hrs**

Uncertain Knowledge and Reasoning:Quantifying Uncertainty, Probabilistic Reasoning, Probabilistic Reasoning over Time, Making Simple Decisions and Making Complex Decisions

UNIT IV **10 Hrs**

Learning:Learning from Examples, Knowledge in Learning, Learning Probabilistic Models and Reinforcement Learning

UNIT V **12 Hrs**

Communicating, Perceiving, and Acting:Natural Language Processing, Natural Language for Communication, Perception and Robotics

Text Book:Artificial Intelligence: A Modern Approach (Third edition) by Stuart Russell and Peter Norvig

References:

Hawkins, J. and Blakeslee, S. On Intelligence. Times Books, 2004.

Dean, T., Allen, J. &Aloimonos, Y., Artificial Intelligence theory and practice. New York: Benjamin Cummings (1995).

Ginsberg, M., Essentials of Artificial Intelligence. Palo AltoCA: Morgan Kaufmann (1993).

20MSCCSPL 4.3: Digital Image Processing Lab using MATLAB / Python	
Teaching:4 hrs./week	Max. Marks:80
Credits:04Hrs.:52	I. A. Marks:20

Note : Implementation can be done either MATLAB/Python

1.Image Sampling : Write a program to change the spatial resolution to 128 x 128, 64 x 64, and 32 x 32 pixels. Resize the images back to the original size 256 x 256 images and print them for comparison purposes. Show your results using the "lenna" and "peppers" images.

2.Image Quantization : Write a program that would reduce the number of gray levels in a PGM image from 256 to: (i) 128, (ii) 32, (iii) 8, and (iv) 2. Show your results using the "lenna" and "peppers" images.

3.Histogram Equalization(a): Write aprogram to compute the histogram of an image.(b) Implement the histogram equalization technique.It is suggestedthat you debug your algorithm using a small "test" image (e.g., 5 x 5) to make sure that it works correctly.(c) Perform histogram equalization on the "boat" and "f_16" images

4. Histogram Specification : (a) Implement the histogram specification technique.It is suggestedthat you debug your algorithm using a small "test" image (e.g., 5 x 5) to make sure that it works correctly.(b) Perform histogram specification on "boat" and "f_16" images. Assume that the specified histogram for the "boat" image is the histogram of the "sf" image while the specified histogram for the "f_16" image is the histogram of the "peppers" image.

5. Spatial Filtering (Correlation):(a) Write a program to perform spatial filtering (i.e., correlation) of an image. Both the size of the mask and its values (i.e., weights) need to be variables that can be input into your program.(b) Test your programby computing the correlation between the two images below (can be downloaded from the course's webpage). Use the left image to define theweights of the mask.(c) Show and discuss your results(i.e., correlation image). How could you use the results of correlation to find the location(s) of the pattern shown (i.e., left image) in the right image?

6. Spatial Filtering(Smoothing)(a) Smoothe "lenna" and "sf" images using (1) 7x7 and 15x15 averaging filters and (2) 7x7 and 15x15 Gaussian filters (using the masks provided below). You should normalize the mask weights so they sum to one.(b) Show and discuss your results both for averaging and Gaussian smoothing.

20MSCCE 4.4 a:SoftwareTesting	
Teaching:4 hrs./week	Max. Marks:80
Credits:04Hrs.:52	I. A. Marks:20

UNITI **12Hrs**

Basics of Software Testing and Examples: Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudocode, The triangle problem, The NextDate function, The commission problem, The SATM problem. Decision Table-Based Testing: Decision tables,

UNITII **10Hrs**

Levels of Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing. Integration Testing: A closer look at the SATM system, Decomposition-based, call graph- based, Path-based integrations, Case study. System Testing: Threads, Basic concepts for requirements specification, Finding threads, Structural strategies and functional strategies for thread testing, SATM test threads, System testing guidelines, ASF (Atomic System Functions) testing example.

UNITIII **10Hrs**

Interaction Testing: Context of interaction, A taxonomy of interactions, Interaction, composition, and determinism, Client/Server Testing. Issues in Object-Oriented Testing: Units for object-oriented testing, Implications of composition and encapsulation, inheritance, and polymorphism,

UNITIV **10Hrs**

Object-Oriented Integration Testing: UML support for integration testing, MM-paths for object- oriented software, A framework for object-oriented dataflow integration testing. GUI Testing: The currency conversion program, Unit testing, Integration Testing and System testing for the currency conversion program. Object-Oriented System Testing: Currency converter UML description,

UNITV **10Hrs**

Model-Based Testing: Testing based on models, Appropriate models, Use case-based testing, Commercial tool support for model-based testing. Test-Driven Development: Test-then-code cycles, Automated test execution, Java and JUnit example, Remaining questions, Pros, cons, and open questions of TDD, Retrospective on MDD versus TDD. A Closer Look at All Pairs Testing: The all- pairs technique, A closer look at NIST study

References:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2012.
2. Aditya P Mathur: Foundations of Software Testing, Pearson, 2008.
3. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, 1st edition, John
Wiley & Sons, 2011.
4. SrinivasanDesikan, Gopalaswamy Ramesh: Software testing Principles and Practices, 1st Edition, Pearson, 2012.
5. Brian Marrick: The Craft of Software Testing, 1st edition, Pearson, 2012

20MSCCE 4.4.b:Pattern Recognition	
Teaching:4 hrs./week	Max. Marks:80
Credits:04Hrs.:52	I. A. Marks:20

UNIT I **10 Hrs**

Basics of Probability, Random Processes and Linear Algebra (recap): Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra.

UNIT II **10Hrs**

Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors, singular values, singular vectors. Bayes Decision Theory : Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features.

UNIT III **12Hrs**

Parameter Estimation Methods : Maximum-Likelihood estimation :Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation. Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbou method.

UNIT IV **10Hrs**

Dimensionality reduction: Principal component analysis - it relationship to eigen analysis. Fisher discriminant analysis - Generalised eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods. Non negative matrix factorisation - a dictionary learning method..

UNIT V **10Hrs**

Linear discriminant functions : Gradient descent procedures, Perceptron, Support vector machines - a brief introduction. Artificial neural networks: Multilayer perceptron - feedforwark neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.

Text Book:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2 S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

20MSCCE 4.4.c:Cloud Computing	
Teaching:4 hrs./week	Max. Marks:80
Credits:04Hrs.:52	I. A. Marks:20

UNIT I **10 Hrs**

Cloud Computing Basics: Cloud Computing Overview, Applications, Intranets and the Cloud, First Movers in the cloud.

UNIT II **10 Hrs**

Organization and Cloud Computing with the Titans: When You Can Use Cloud Computing, Benefits, Limitations, Security Concerns, Regulatory Issues. – Google, EMC, NetApp, Microsoft, Amazon, Salesforce.com, IBM, Partnerships.

The Business Case for Going to the Cloud: Cloud Computing Services, How Those Applications Help Your Business, Deleting Your Datacenter, Salesforce.com, Thomson Reuters.

UNIT III **10 Hrs**

Hardware and Infrastructure: Clients, Security, Network, Services.

Accessing the Cloud: Applications, Web APIs, Web Browsers.

Cloud Storage: Overview, Cloud Storage Providers, Standards – Applications, Client, Infrastructure, Service, software.

UNIT IV **12 Hrs**

Software as a Services: Overview, Driving Forces, Company Offerings, Industries.

Software plus Services: Overview, Mobile Device Integration, Providers, Microsoft Online.

Developing Applications: Google, Microsoft, Intuit Quick Base, Cast Iron Cloud, Bungee Connect, Development, Troubleshooting, Application Management.

UNIT **10 Hrs**

Local Clouds and Thin Clients: Virtualization in Your Organization, Server Solutions, Tin Clients, Cast Study: McNeilus Steel.

Migrating to the Cloud: Cloud Services for Individuals, Cloud Services Aimed at the Mid-Market, Enterprise-Class Cloud Offerings, Migration, Best practices and the future of cloud computing.

Text Books:

1. Anthony T. Vete, Toby J. Velte, Robert Elsenpeter, —Cloud Computing A Practical Approachll, McGraw-Hill, 2010.

References:

1. Barrie Sosinsky, llCloud computing Biblell, Wiley Publications, 1st Edition, 2011.
2. A. John Rhoton, —Cloud computing explainedll, Recursive press, 2010.

20MSCCE 4.4.d: Big Data Analytics

Teaching:4 hrs./week **Max. Marks:80**
Credits:04Hrs.:52 **I. A. Marks:20**

UNITI **10 Hrs**

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.

UNITII **10 Hrs**

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.

UNITIII **10 Hrs**

Artificial Neural Networks: Introduction, Neural Network representation, appropriate problems, Perceptrons, Backpropagation algorithm.

UNIIV **10 Hrs**

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm.

UNITV **12 Hrs**

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning.

Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series
in statistics.
2. EthemAlpaydın, Introduction to machine learning, second edition, MIT press.

20MSCCE 4.4.e:Machine Learning

Teaching:4 hrs./week **Max. Marks:80**
Credits:04Hrs.:52 **I. A. Marks:20**

UNIT –I **10 Hrs**

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.

UNIT II **10 Hrs**

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.

UNITIII **10 Hrs**

Artificial Neural Networks: Introduction, Neural Network representation, appropriate problems, Perceptrons, Backpropagation algorithm.

UNITIV **10 Hrs**

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm.

UNITV **12 Hrs**

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning.

Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. EthemAlpaydın, Introduction to machine learning, second edition, MIT press.

20MSCCS 4.5:Data Mining Techniques

Teaching:4 hrs./week **Max. Marks:80**
Credits:04Hrs.:52 **I. A. Marks:20**

UNIT I 10 Hrs

Introduction to Data Mining: Related technologies - Machine Learning, DBMS, OLAP, Statistics, Data Mining Goals, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications, Example: weather data.

UNIT II 12Hrs

Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model, OLAP operations, Example: loan data set , Data pre-processing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies, Introduction to Weka Data Mining System, Example experiments with Weka - filters, discretization. Data mining knowledge representation: Visualization techniques, Experiments with Weka – visualization.

UNIT III 10Hrs

Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures, Experiments with Weka - using filters and statistics. Data mining algorithms -Association rules: Motivation and terminology, Example: mining weather data, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis, Experiments with Weka - mining association rules.

UNIT IV 10Hrs

Data mining algorithms- Classification: Basic learning/mining tasks, Inferring rudimentary rules: 1R algorithm, Decision trees, covering rules, Experiments with Weka - decision trees, rules. Data mining algorithms- Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbour), linear models.

UNIT V 10Hrs

Evaluating what's been learned: Basic issues, Training and testing, Estimating classifier accuracy (holdout, cross-validation, leave-one-out), Combining multiple models (bagging, boosting, stacking), Minimum Description Length Principle (MLD), Experiments with Weka - training and testing Clustering: Basic issues in clustering, First conceptual clustering system: Cluster/2, Partitioning methods: k-means, expectation maximization (EM), Hierarchical methods: distance-based agglomerative and divisible clustering, Conceptual clustering: Cobweb, Experiments with Weka - k-means, EM, Cobweb

References:

1. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann,
2. Jiaweihan, MichelineKamber,Jian Pei, Data mining concepts and techniques, 3/e, Elsevier.
3. Margaret H. Dunham, Data Mining-Introductory and Advanced Topics, Pearson Education
4. K.P.Soman, ShyamDiwakar, and V. Ajay, Insight into Data Mining: Theory and Practice, Prentice Hall of India, 2006

12MSCPL 4.6: PROJECT WORK	
Teaching:4 hrs./week	**Max. Marks:80**
Credits:04Hrs.:52	**I. A. Marks:20**

Project work will be carried out either in the department under the supervision of guide(s) approved by the Department of Computer Science.

- Each student shall carry out an individual project in the Lab.
- The Guide shall be concerned teacher in the department.
- The Project topic should be chosen in consultation with the guide.
- The Project topics shall be based on syllabus or beyond.
- Students shall submit the project proposal/synopsis at the beginning of the semester
- Student shall carry out the analysis and design work for the chosen problem statement and develop the s/w in the Lab.
- The students are required to submit a copy of project report(dissertation) based on the work done by him/her during the project period at the end of the semester term.

The Evaluation scheme for the project work in the term exam shall be as follows :

- Internal assessment marks : 20
- External: 80