School of Computer Science, Engineering & Applications

Bharathidasan University

Tiruchirappalli - 620023

M.Sc Computer Science - Course Structure and Syllabus

(Applicable to the candidates admitted from the academic year 2022-2023 onwards)

BHARATHIDASAN UNIVERSITY
SCHOOL OF COMPUTER SCIENCE, ENGINEERING & APPLICATIONS

MASTER OF COMPUTER SCIENCE
(CHOICE BASED CREDIT SYSTEM)
REGULATIONS
(w.e.f 2022-2023)

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1. Name of the Programme: Bharathidasan University is offering a two year M.Sc. Programme to be conducted in the Department of Computer Science, Bharathidasan University.

2. Aim of the Course: The course strives to inculcate job-oriented and value based quality education in Information Technology and Commercial Application Development. At the end of the course, the students will be well-versed, particularly in core subjects with quality in inter-personal and professional skills.

3. Eligibility for Admission to the Programme: A Candidates who has passed B.Sc.(Computer Science, Computer Technology, Information Technology, Information Science, Information Systems, Software Science, Software Development), BCA of this University or from a recognized University.

4. Duration of the Course: The Course duration shall be for two years consisting of four semesters. In order to be eligible for the award of the degree the candidate shall successfully complete the course in a maximum period of four years from the date of enrolment for the first semester of the course.

5. **Choice Based Credit System:** The University follows the 'Choice Based Credit System (CBCS)' for all its programmes. Each credit is worth 12 hours of student study time, comprising all learning activities. Thus a four-credit course involves 48 study hours. This helps the student to understand the academic effort and to successfully complete a course.

6. **Structure of the Course and Evaluation Pattern:**

Internal Marks: 25 External Marks: 75

The duration of University examination for both theory and practical subjects shall be 3 hours. The maximum marks for each theory and practical course is 100. Continues Internal Assessment (CIA) will be 25. The university theory examination will be conducted for 75 marks, which will be added with Continuous Internal Assessment to make 100 marks for the course. For the conduct of University examinations in theory, the question paper for the theory examination will be set by the external examiner and for practical examination; the question paper will be set by both internal and external examiners appointed by the Department.

7. Attendance:

- Students should gain at least 75% attendance in each course.
- In each semester every candidate must compulsorily register for the examination in all the courses pertaining to that semester.
- Candidate who has less than 75% attendance of the working days in a semester will be permitted to take the ESE pertaining to that semester unless he/she gets condonation certificate.
- On the day on which a course is concluded, the course teacher of the course shall intimate the Head of the Department, the particulars of all the students who have shortage of attendance in the course offered by him/her.
- The Head of the Department should announce the names of all the students who will not be eligible to take the end semester examination in the various courses due to shortage of attendance.
- Condonation of shortage of attendance shall be given as per the provisions given below:

  The Head of the Department may condone lack of attendance for a student in a course when the student had put in at least 65% attendance for the course concerned and pays a condonotion fee of suitable amount to be prescribed by the University from time to time. A candidate who has put in less than 65% attendance must repeat the course.

8. Procedures for Awarding Marks for Internal Assessment

THEORY COURSES

- For regularity and discipline - 5 Marks
- For two assignments (Equal weightage) - 5 Marks
- For two tests to be conducted (Equal weightage) - 5 Marks
- Model examination - 10 Marks

Total –25 Marks

PRACTICAL COURSES

- For regularity and discipline - 5 Marks
- Completion of all Experiments prescribed for the course - 5 Marks
- Observation Note - 5 Marks
- For model Examination at the end of the Semester - 10 Marks

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Total - 25 Marks

In the case of CIA, a candidate who secures not less than 40% of total marks prescribed for any course shall be declared to have passed for that course, failing which the candidate has to redo the academic activities prescribed for the Continuous Internal Assessment (CIA).

9. Pattern of Question Paper (Theory)

Time 3 hours Max Marks 75

Section - A: (10 X 2 = 20 Marks)

All questions are to be answered. Two questions from each Unit

Section – B: (5X 5 = 25 Marks)

Five Questions are to be answered, Two questions from each unit in the either or Pattern

Section - C :(3 x 10 = 30 Marks)

Three Questions are to be answered out of five questions – One question from eachUnit

10. Passing Minimum for a course:

A candidate shall be declared to have passed a certain course if he/she secures not less than 40% marks in the ESE and not less than 50% in the aggregate taking CIA and ESE together. In terms of marks, the student should secure not less than 38 marks and not less than 50 in the aggregate taking CIA and ESE together.

A candidate shall be declared to have passed in the project work if he/she gets not less than 40% in the valuation of dissertation and not less than 50% in the aggregate of both the marks for valuation of dissertation and viva-voce examination to pass in project work.

11. Supplementary Examinations:

Any candidate, for whom, when the results of the exam conducted in April/May of the end of the semester are published there is just one course for which credit is to be earned and it is from the final semester, will be eligible to appear for the supplementary exam which may be conducted in the supplementary July/August provided that he/she appears for the ESE for that courses in April/May.

M.Sc., Computer Science – Programme Outcomes

S.NO	Programme Outcomes
PO1	**Disciplinary knowledge:** Capable to apply the knowledge of mathematics, algorithmic principles and computing fundamentals in the modeling and design of computer based systems of varying complexity.
PO2	**Problem analysis:** Ability to critically analyze, categorizes, formulate and solve complex problems that emerges in the field of computer science.
PO3	**Problem solving:** Give software solutions for complex scientific and business related problems.
PO4	**Cooperation / Team Work:** Function effectively as member or leader on multidisciplinary teams to accomplish a common objective.
PO5	**Communication Skills:** An ability to communicate effectively with diverse types of audience and also able to prepare and present technical documents to different groups.
PO6	**Modern tool usage:** Use contemporary techniques, skills and tools necessary for integrated solutions.
PO7	**Ethics:** Function effectively with social, cultural and ethical responsibility as an individual or as a team member with positive attitude.
PO8	Enhance the research culture and uphold the scientific integrity and objectivity.

M.Sc., Computer Science -Programme Specific Outcome

S.NO	Programme Specific Outcome
PSO1	Apply the knowledge of Computer Science to find out the solutions for real-life applications.
PSO2	To identify and utilize the state-of-the-art tools and techniques in the design and development of software products and solutions.
PSO3	Develop and deploy applications of varying complexity using the acquired knowledge in various programming languages, data structures and algorithms, database and networking skills.
PSO4	Develop techniques to enhance ability of learning.
PSO5	Ability to investigate, analyze complex problems by the application of suitable mathematical and research tools, to design Information Technology products and solutions.
PSO6	Develop class environment for generate ideas, innovation and sharing.
PSO7	Develop design solutions for appropriate algorithms of varying complexities in the field of computer science and information technology.
PSO8	To make graduates understand cross cultural, societal, professional, legal and ethical issues prevailing in industry.

M.Sc Computer Science - Course Structure and Syllabus

(Applicable to the candidates admitted from the academic year 2022-2023 onwards)

Sem	Subject Code	Course Number	Course Name	Credit	Hours / Week	Marks Int : Ext	Total
I Semester							
I	MCS22011	CC-I	Mathematical Foundation of Computer Science	4	5	25 : 75	100
	MCS22012	CC-II	Design and Analysis of Algorithms	4	5	25 : 75	100
	MCS22013	CC-III	Advanced Operating Systems	4	5	25 : 75	100
	MCS22014	CC-IV	Advanced Java Programming	4	5	25 : 75	100
	MCS22015	Elective I	Soft Computing / Cloud Computing/ Mobile Computing	4	4	25 : 75	100
	MCS22016P	CC-VP	Lab I: Algorithms Lab	2	3	25 : 75	100
	MCS22017P	CC-VIP	Lab II: Advanced Java Programming Lab	2	3	25 : 75	100
	MCS22018	Online Course-I	SWAYAM/MOOCs /NPTEL	2	-	30 : 70	100
	22VAC01	VAC-I *	Value Added Course			25 : 75	100
		Total		26	30	-	900
II Semester							
II	MCS22021	CC-VII	Advanced Database Management System	4	5	25 : 75	100
	MCS22022	CC-VIII	Cryptography and Network Security	4	5	25 : 75	100
	MCS22023	CC-IX	Compiler Design	4	4	25 : 75	100
	MCS22024	Elective II	Machine Learning / Digital Image Processing / Natural Language Processing	4	4	25 : 75	100
	MCS22025	Elective III	Web Services / Wireless Networks / Problem Solving using Python & R	4	4	25 : 75	100
	MCS22026P	CC-XP	Lab III: Advanced Database Management System Lab	2	3	25 : 75	100
	MCS22027P	CC-XIP	Lab IV: Cryptography and Network Security Lab	2	3	25 : 75	100
	EDC-I	Non major Elective / Supportive Course	Extra Disciplinary Course – I	2	2	25 : 75	100
	MCS22028	Online Course-II	SWAYAM/ MOOCs /NPTEL	2	-	30 : 70	100
		Total		28	30	-	900
Summer Internship							

III Semester							
III	MCS22031	CC-XII	Advanced Web Technology	4	5	25 : 75	100
	MCS22032	CC-XIII	Agile Technology	4	5	25 : 75	100
	MCS22033	CC-XIV	Big data Analytics	4	5	25 : 75	100
	MCS22034	Elective IV	Internet of Things/Block Chain Technology/Embedded Systems	4	5	25 : 75	100
	MCS22035	Elective V	Theory of Computing /Optimization Techniques / Statistical Computing	4	4	25 : 75	100
	MCS22036P	CC-XVP	Lab V: Web Technology Lab	2	3	25 : 75	100
	MCS22037P	CC-XVIP	Lab VI: Data Analytics Lab (Stat. Tech/ Big Data Analytics Technology using R)	2	3	25 : 75	100
	22VAC02	VAC-II*	Value Added Course –II	-	-	25 : 75	100
			Total	24	30	-	800
IV Semester							
IV	MCS22041	CC-XVII	Major Project Work Dissertation/Viva Voce/ (Industry /Research)	14	-	50 : 50	100
			Grand Total	92	90	-	2700

Total credits to be earned for the award of the degree:90

List of Elective Courses

Elective I			Elective II
1	Soft Computing	1	Machine Learning
2	Cloud Computing	2	Digital Image Processing
3	Mobile Computing	3	Natural Language Processing
	Elective III		**Elective VI**
1	Web Services	1	Internet of Things
2	Wireless Networks	2	Block Chain Technology
3	Problem Solving using Python & R	3	Embedded Systems
	Elective V		
1	Theory of Computing		
2	Optimization Techniques		
3	Statistical Computing		

List of Value Added Courses

Course Number	Course Code	Course Name
22VAC01	VAC-I	Augmented Reality Virtual Reality
22VAC02	VAC-II	Robotics

Recommended Credits Distribution: (Total should not be less than 90 Credits)

Course Type	Course	Credits	Total Credits
Core (Theory)	10	4	40
Core (Practical)	6	2	12
Core (Major Project)	1	14	14
Elective	5	4	20
Online Courses	2	2	4
EDC	1	2	2
Total	**23**	**-**	**92**

Course Number:MCS22011 **CC-I**

L-P: 4-0 **Credits: 4**

Mathematical Foundation of Computer Science

Objectives:

- To know the notations used in associated with computer science and engineering.
- To learn the rudiments of elementary mathematical reasoning (elementary proofs; proofs by induction, Normal forms).
- To understand basic set-theoretical notions: relations, functions, graphs, equivalence relations, and orderings.
- To understand the fundamentals of counting and discrete probability.
- To understand the concept of Recurrence Relations

UNIT- I

Sets Relations and Functions:

Statements and Notation-Connectives- Negation-Conjunction-Disjunction, Conditional and Bi-conditional- Statement formulas and Truth Tables.-Well-formed formulas-Tautologies, equivalence of formulas- Duality Law- Tautological Implications- Functionally Complete Sets of Connectives-Other connectives. Normal Forms: DisjunctiveNormalForms- ConjunctiveNormalForms-Principal Disjunctive Normal Forms (PDNF)- Principal Conjunctive Normal Forms (PCNF).

UNIT-II

Mathematical Logic:

Logical inferences-Methods of proof of an implication-First Order Logic and other methods of proof-Rules of Inference for Quantified Propositions- Mathematical induction. Relations and Directed Graphs- Special properties of binary relations- Equivalence relation- Ordering relations-Latticesand Enumerations.

UNIT-III

Graphs:

Operations on relations- Paths and Closures- Directed graphs and Adjacency matrices.Wars hall's algorithm- Transitive closure. Basic concepts- Representation of Graphs-Isomorphism and sub graphs-Planar graphs- Multi graphs- Euler circuits- Euler Graphs and Hamiltonian graphs-Chromatic number.

UNIT-IV

Elementary Combinations:

Basics of counting- Combinations and Permutations- Enumeration of combinations and permutations- Enumerating Combinations and Permutations with repetitions- Enumerating

permutations with constrained repetitions- The Principle of Inclusion- Exclusion.

UNIT –V

Recurrence Relations:

Generating functions of Sequences- Recurrence relations, solving recurrence relations by Substitution and Generating functions- The method of Characteristic roots- Solutions of In-homogeneous Recurrence Relations.

UNIT – VI CURRENT CONTOURS:(For continuous internal assessment only)
Contemporary Developments Related to the Course during the SemesterConcerned

Text Books:

1. Joe L. Mott. Abraham Kandel and Theodore P.Baker, Discrete Mathematics for Computer Scientists & Mathematicians. PHI,Second Edition 2017(For Units II to V).

2. J P Trembly and RManohar,Discrete Mathematical Structures with applications to Computer Science. TMH 2017 (For Unit I).

Reference Books:

1. SwapankumarChakraborthy, BikashKantiSarkar, Discrete Mathematics.Oxford

2. Dr.JRajendra Prasad, T.RamaRao, A.MadanaMohanaRao, Mathematical Foundations of ComputerScience.

E- Resources:

1.http://nptel.ac.in/courses.php
2.http://jntuk-coeerd.in/

Outcomes:

- Understand truth tables, the concept of logical equivalence and its relationship to equivalent logic circuits and NormalForms.
- Apply rules in inference theory, and extend this to predicate calculus using quantifiers.
- Able to do simple proofs by mathematical induction. Know the properties of equivalence relations and partial orderings. Understand lattices and Hassle Diagrams.
- Use graphs as representing relations, Identify isomorphism invariants of graphs, and algorithms for relations based on graphs or matrices (e.g. transitiveclosure).
- Know the fundamentals of counting and discreteprobability.

Course Number:MCS22012 **CC-II**
L-P: 4-0 **Credits: 4**

DESIGN AND ANALYSIS OF ALGORITHMS

Objectives:

- To understand and apply the algorithm analysis techniques.
- To critically analyse the efficiency of alternative algorithmic solutions for the same problem.
- To understand different Optimization techniques.
- To understand different algorithm design techniques.
- To understand the limitations of Algorithmic power.

UNIT I: Introduction - Definition of Algorithm – pseudo code conventions – recursive algorithms – time and space complexity –big-"oh" notation – practical complexities – randomized algorithms – repeated element – primality testing - Divide and Conquer: General Method - Finding maximum and minimum – Merge sort.

UNIT II: Divide and Conquer – Quicksort, Selection, Strassen's matrix multiplication – Greedy Method: General Method – Knapsack problem - Tree vertex splitting - Job sequencing with deadlines – optimal storage on tapes.

UNIT III: Dynamic Programming: General Method - multistage graphs – all pairs shortest paths – single source shortest paths - String Editing – 0/1 knapsack. Search techniques for graphs – DFS-BFS-connected components – bi-connected components.

UNIT IV: Back Tracking: General Method – 8-queens - Sum of subsets - Graph Coloring – Hamiltonian cycles. Branch and Bound: General Method - Traveling Salesperson problem.

UNIT V: Lower Bound Theory: Comparison trees - Oracles and advisory arguments - Lower bounds through reduction - Basic Concepts of NP-Hard and NP-Complete problems.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Books:

1) E. Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms", 2nd Edition, Universities Press, India, 2007.
2) Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 2009.

Reference Books:

1) Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education, 1999
2) AnanyLevitin, Introduction to the Design and Analysis of Algorithms, Pearson, 3rd Edition, 2011.
3) Gilles Brassard, Paul Bratley, Fundamentals of Algorithmics, Pearson Education, 1995.

E-Resources:

1.https://vssut.ac.in/lecture_notes/lecture1428551222.pdf

Outcomes:

- Analyze the asymptotic performance of algorithms.
- Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
- Find optimal solution by applying various methods.
- Differentiate polynomial and nonpolynomial problems.
- Apply the algorithms and design techniques to solve problems;

Course Number:MCS22013 **CC-III**
L-P: 4-0 **Credits: 4**

Advanced Operating System

Objectives:

- To study the characteristics of Multiprocessor and Multi computer
- To understand the advance concepts of distributed operating systems
- To get an insight into the various issues and solutions in distributed operating systems
- To learn about data base operating systems
- To gain knowledge on the design concepts of mobile operating systems

UNIT I:

Multiprocessor Operating Systems: System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation- memory management.

UNIT II:

Distributed Operating Systems: System Architectures- Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms- Distributed Deadlock detection

UNIT III:

Distributed Scheduling - Distributed shared memory - Distributed File system – Multimedia file systems - File placement - Caching

UNIT IV:

Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms

UNIT V:

Mobile Operating Systems: ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming – Runtime issues- Approaches to power management

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Textbooks:

1. MukeshSinghal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001

References:

1. A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001
2. Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010
3. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", Wiley, Eighth Edition, 2008.

E-Resources:

1. http://www.uobabylon.edu.iq/download/M.S%202013-2014/Operating_System_Concepts,_8th_Edition%5BA4%5D.pdf
2. http://index-of.es/Varios-2/Modern%20Operating%20Systems%204th%20Edition.pdf

Outcomes:

- Knowledge about advance concepts in OS
- Demonstrate the various issues in distributed operating systems
- Identify the different features of data base operating systems
- Ability to develop modules for Mobile devices
- Ability to develop OS for distributed operating system

Course Number:MCS22014 **CC-IV**
L-P: 4-0 **Credits: 4**

ADVANCED JAVA PROGRAMMING

Objectives:

- To impart of students to design and develop enterprise strength distributed and multitier applications – Using Java Technology.
- To understand advanced Java programming concepts like interface, threads, Swings etc.
- To impart of develop network programs in Java
- To understand Concepts needed for distributed and multi-tier applications
- To understand issues in enterprise applications development.

UNIT I - Java Fundamentals: Inheritance - Interface- Packages-Exception Handling - Applets - Java I/O streaming – filter and pipe streams – Byte Code interpretation - Threading –Swing

UNIT II - Network Programming in Java: Sockets – secure sockets – custom sockets – UDP datagrams – multicast sockets – URL classes – Reading Data from the server – writing data – configuring the connection – Reading the header – telnet application – Java Messaging services.

UNIT III - Applications in Distributed Environment: Remote method Invocation – activation models – RMI custom sockets – Object Serialization – RMI – IIOP implementation – CORBA – IDL technology – Naming Services – CORBA programming Models - JAR file creation

UNIT IV - Multi-Tier Application Development: Server side programming – servlets – Java Server Pages - Applet to Applet communication – Applet to Servlet communication - JDBC – Applications on databases – Multimedia streaming applications – Java Media Framework.

UNIT V - Enterprise Applications: Server Side Component Architecture – Introduction to J2EE – Session Beans – Entity Beans – Persistent Entity Beans.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Books:

1. Elliotte Rusty Harold, " Java Network Programming", O'Reilly publishers, 2013 (UNIT II)
2. Ed Roman, "Mastering Enterprise Java Beans", John Wiley & Sons Inc., 2004 (UNIT III & V)
3. Hortsmann& Cornell, "CORE JAVA 2 ADVANCED FEATURES, VOL II", Pearson Education, 2013 (UNIT I & IV)

Reference Books

1. Patrick Naughton, "COMPLETE REFERENCE: JAVA2", Tata McGraw-Hill, 2003.
2. Herbert Schildt, "JAVA2: COMPLETE REFERENCE", Kindle Edition, 2013

E-Resources:

1. https://docs.oracle.com/javase/tutorial/

Outcomes:

- Ability to show competence in the use of the Java programming language in the development of small to medium-sized application programs
- Develop applications using Abstract Window Toolkit
- Update and retrieve the data from the databases using JDBC-ODBC.
- Develop server-side programs using Servlets.
- Ability to demonstrate an introductory understanding of graphical user interfaces, multithreaded programming, and event-driven programming

Course Number:MCS22015 **EC-I**
L-P: 4-0 **Credits: 4**

SOFT COMPUTING

Objectives:

- Expose the students to various types of soft computing techniques
- Learn the various applications of soft computing.
- Understand perceptron's and counter propagation networks.
- Understand the concept of fuzzy logic
- Understand the genetic algorithm for solving optimization problems

Unit I:

Introduction : Neural Networks - Application Scope of Neural Networks - Fuzzy logic - Genetic Algorithm - Hybrid Systems - Soft Computing - Artificial neural network: Fundamental Concept - Evolution of Neural Networks - Basic models of Artificial Neural network - Important Terminologies of ANNs - McCulloch-pitts Neuron - Linear Separability - Hebb Network.

Unit II:

Associative Memory Networks : Introduction - Training Algorithms for Pattern Association – Auto associative Memory Network – Hetero associative Memory Network - Bidirectional Associative Memory - Hopfield Networks - Iterative Auto associative Memory Networks - Temporal Associative Memory Network.

Unit III:

UnsupervisedLeaarningNetworks : Introduction - Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps -Learning Vector Quantization – Counter propagation Networks - Adaptive Resonance Theory Network.

Unit IV:

Classical Sets And Fuzzy Sets : Introduction - Classical Sets - Fuzzy Sets - Classical Relations and Fuzzy Relations: Introduction- Cartesian Product of Relation - Classical Relation - Fuzzy Relation - Tolerance and Equivalence Relation – Non interactive Fuzzy Sets.

Unit V:

Conventional Algorithm : Introduction - Basic Operators and Terminologies in GAs -Traditional Algorithm vs Genetic Algorithm - Simple GA - General Genetic Algorithm - The Schema Theorem - Classification of Genetic Algorithm - Holland Classifier System - Genetic Programming -Application of Genetic Algorithm.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text book:

1.S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", 2008.

Reference book:

1. Eva Volna, “Introduction to Soft Computing”, Bookboon Publications, 2013

E-Resources:

1.https://www.cet.edu.in/noticefiles/274_soft%20computing%20LECTURE%20NOTES.pdf

2.https://www.tutorialspoint.com/genetic_algorithms/genetic_algorithms_quick_guide.htm

Outcomes:

- recognize the feasibility of applying a soft computing methodology for a particular problem
- identify and describe soft computing techniques and their roles in building intelligent machines
- Analyze various neural network architectures
- Able to model the fuzzy systems
- Apply genetic algorithm for optimization combinatorial optimizationproblem.

Course Number:MCS22015 **EC-I**
L-P: 4-0 **Credits: 4**

CLOUD COMPUTING

Objectives:

- To introduce the broad perceptive of cloud architecture and model.
- To be familiar with the lead players in cloud.
- To understand the concept of Virtualization.
- To understand the CRM in cloud computing.
- To know the use of cloud computing in day-to-day life.

UNIT I:Computing Paradigms

High-performance computing, parallel computing, distributed computing, cluster computing, grid computing, cloud computing, bio-computing, mobile computing quantum computing, optical computing.Nano-computing.

UNIT II: Cloud Computing Fundamentals

Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models.

UNIT III: Cloud Computing Architecture and Management

Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud application, Migrating, Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

UNIT IV:Cloud Service Models

Infrastructure as a Service, Characteristics of IaaS, Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS,

Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers. Other Cloud Service Models

UNIT V: **Cloud Service Providers**

EMC, EMC IT, Captiva Cloud Toolkit, Google Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue ,Service, Microsoft Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft Aneka Platform

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Book:

1. Essentials of Cloud Computing :K.Chandrasekhran , CRC press, 2015

Reference Book:

2. Cloud Computing: Principles and Paradigms by RajkumarBuyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.

E-Resources:

1. http://index-of.co.uk/Cloud-Computing Books/Essentials%20of%20cloud%20computing%20(2015).pdf

2. https://www.oracle.com/be/cloud/what-is-cloud-computing/

Outcomes:

- Compare the strengths and limitations of cloud computing.
- Identify the architecture, infrastructure and delivery models of cloud computing.
- Understanding the project management in the cloud environment.
- Understanding the cloud services.
- Analyze various cloud service models and apply them to solve problems on the cloud.

Course Number:MCS22015 **EC-I**
L-P: 4-0 **Credits: 4**

MOBILE COMPUTING

Objectives :

- To make the student understand the concept of mobile computing paradigm, its applications and limitations.
- To understand the typical mobile networking infrastructure through a popular GSM and GPRS protocol.
- To understand the database issues in mobile environments and data delivery models.
- To understand the platforms and protocols used in mobile environment
- To understand Androidand Apple iOS 11Mobile Operating System.

UNIT I
Mobile Computing Architecture:

Mobile IP- Cellular and WLAN Wi-Fi IEEE 802.11X Networks - Ad Hoc Networks -Wireless Personal Area Network -Mobile Enterprise Network - Mobile Cloud Network -Mobile Computing - Mobile Computing Operating System - Mobile Computing Architecture - Client–Server Computing using Mobile- WAP and HTTP Protocols- Design Considerations for Mobile Computing- Mobile Computing and the Apps -Limitations of Mobile Devices- Security Issues.

Mobile Client Devices and Pervasive Computing:

Pervasive Computing-Mobile Devices—Classifications and Characteristics- Tablet and e-Book Reader-Smart Identification Devices: Smart Cards, Labels, and Tokens-RFID- Smart Sensors, Actuators, and Mobile Robotic Systems - Smart Home and Appliances-Limitations and Devices Design Constraints-Automotive Systems

Unit II
Second-generation Architecture—GSM, GPRS and othersGSM Services-GSM System Architecture-Space Division Multiple Access, Time Division Multiple Access, and Frequency Division Multiple Access- Call Routing-Public Land Mobile Network (PLMN) Interface- GSM Subscriber Addresses and Identities- Protocols – Localization- Call Handling- Handover- Security- Introduction to SMS-General Packet Radio Service-High-speed Circuit-switched Data- Digital Enhanced Cordless Telecommunications-WLL Application

Unit III
Wireless Medium Access Control, CDMA, 3G, WiMax, 4G and 5G NetworksModulation-Medium Access Control - Exposed and Hidden Terminal Problem, Near and Far Terminal Problem, and Power Control for Medium Access- MAC Algorithms - WLAN and CSMA/CA Wireless Protocols-SDMA, TDMA, FDMA and CDMA-Direct Sequence Spread Spectrum-Frequency Hopping Spread Spectrum- Code Division Multiple Access- Applications of 3G Mobile Services-3G Mobile Services: IMT2000 and UMTs -CDMA 2000: 3G-WCDMA 3G-OFDM-High-speed Packet Access-Mimo in

HSPA-Long-term Evolution and WiMax 16E- Ultra-wide Band and Broadband Wireless Access-4G Networks: HS-OFDM, LTE Advanced and WiMax 16M-Upcoming 5G Network Features

Unit IV

Mobile IP Network Layer: Functioning of OSI Layers, and TCP/IP, IP, UDP and ICMP Protocols-Mobile IP- Packet Delivery and Handover Management-Location Management-Registration-IP Header: Encapsulation and Routes Optimization- Mobility Binding, Tunnelling, and Reverse Tunnelling- Dynamic Host Configuration Protocol-Cellular IP-Mobile IP with IPv6-Voice over IP-IP Security

Mobile Transport Layer:

Conventional Transport Layer Protocols: UDP and TCP- Indirect TCP- Snooping Transmission Control Protocol- Mobile TCP- Other Transmission Methods at TCP Layer for Mobile Networks-TCP over 2.5G/3G Mobile Networks

Unit V

Mobile Operating System- Application Programming, User and Abstract Interfaces-Linux for Mobile Devices-Proprietary OS Client Development- Development Process- Development Tools and Emulators-Apple iOS 11- Android- Differences between iOS and Android Operating Systems.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Book:

1. Mobile Computing, Rajkamal, Oxford University Press, 3rd Edition 2018.

Reference Book:

1. Mobile Computing, KumkumGarg, Pearson Education, 2015

E- Resources:

1.https://www.tutorialspoint.com/mobile_computing/mobile_computing_overview.htm

Outcome:

- Able to think and develop new mobile application.
- Able to debate on any new technical issue related to this new paradigm and come up with a solution(s)
- Able to develop new ad hoc network applications and/or algorithms/protocols.
- Able to explain & develop any existing or new protocol related to mobile environment
- Able to develop new Mobile Operating System

Course Number:MCS22016P **CC-VP**
L-P: 4-0 **Credits: 2**

LAB -I ALGORITHMS LAB

Objectives :

- To analyze worst-case running time of algorithms and understand fundamental algorithmic problems.
- To study about various designing paradigms of algorithms for solving real world problems.
- Learn to develop the efficient algorithms for the new problem with suitable designing techniques
- Learn to use different algorithms for fundamental problems in computer science and engineering work and compare with one another.
- To introduce the methods of designing and analyzing algorithms

Exercises to implement various algorithms using C/C++/Java

1. Divide and Conquer:

a. Merge Sort

b. Quick Sort

c. Maximum and Minimum

2**. Greedy Method**:

a. Knapsack Problem

b. Tree vertex splitting

c. Job Sequencing

3. Dynamic Programming:

a. Multistage graphs

b. All Pairs Shortest Paths

c. String Editing,

d. BFS and DFS.

4. Back Tracking:

a. 8 Queen Problems

b. Hamiltonian Cycles

Outcomes:

- To design algorithms using the dynamic programming, greedy method and Backtracking, algorithms.
- To compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem.
- To Identify and analyze criteria and specifications appropriate to new problems.
- To develop the efficient algorithms for the new problem with suitable designing techniques.
- To know the appropriate algorithmic design technique to specific problems.

Course Number:MCS22017P **CC-VIP**
L-P: 4-0 **Credits: 2**

LAB-II ADVANCED JAVA PROGRAMMING LAB

Objectives :

- Understand and develop Web applications
- Able to develop web application using Java Servlet and Java Server Pages technology.
- able to use advanced technology in Java such as Remote method Invocation
- Learn to use Graphical User Interface (GUI) networking, and database manipulation.
- learn how to work with JavaBeans

Exercises:

1. Program to demonstrate Applet Life Cycle
2. Simple window application using multiple components (Text field, Label, Button, CheckBoxCombo Box, etc.)
3. JDBC Program:Input data from command line and inserting it in Database.
4. Programs using TCP Sockets (like date and time server & client, echo server & client, etc.)
    i. Program Using TCP Sockets Date and Time Server
    ii. Implementation of Client-Server Communication Using TCP.
5. Programs using UDP Sockets (like simple DNS)
    i. Program using UDP Socket UDP Chat Server/Client
    ii. DNS Server to Resolve a given Host Name
6. Program to perform arithmetic operations using RMI
7. Application Development using RMI.
8. Designing online applications with JSP
9. Using servlet create a form which contain a text area, checkbox, radio button, label and text field with buttons
10. Create a servlet that gets the date and time of the system
11. Create a time zone list and retrieve any time which is given with zone using java beans

12. Develop a bean program that display a sequence of images in the form of slide show

Outcomes:

- Develop Internet Programming, using Java Applets
- learn to access database through Java programs, using Java Data Base Connectivity (JDBC)
- create dynamic web pages, using Servlets and JSP.
- invoke the remote methods in an application using Remote Method Invocation (RMI)
- Design web-based enterprise applications using Enterprise JavaBeans (EJB)

Course Number:MCS22021 **CC-VII**
L-P: 4-0 **Credits: 4**

ADVANCED DATABASE MANAGEMENT SYSTEM

Objectives:

- To Know about Database System Architectures
- To Understand about Parallel and Distributed Storage
- To Know about Parallel and Distributed Query Processing
- To Get Introduced to Parallel and Distributed Transaction Processing
- To Learn the Concepts related to Blockchain Databases

UNIT I

Database-System Architectures : Overview - Centralized Database Systems - Server System Architectures - Parallel Systems - Distributed Systems - Transaction Processing in Parallel and Distributed Systems - Cloud-Based Services

UNIT II

Parallel and Distributed Storage : Overview - Data Partitioning - Dealing with Skew in Partitioning - Replication - Parallel Indexing - Distributed File Systems - Parallel Key-Value Stores

UNIT III

Parallel and Distributed Query Processing : Overview - Parallel Sort - Parallel Join - Other Operations - Parallel Evaluation of Query Plans - Query Processing on Shared-Memory Architectures - Query Optimization for Parallel Execution - Parallel Processing of Streaming Data - Distributed Query Processing

UNIT IV

Parallel and Distributed Transaction Processing : Distributed Transactions - Commit Protocols - Concurrency Control in Distributed Databases - Replication - Extended Concurrency Control Protocols - Replication with Weak Degrees of Consistency - Coordinator Selection - Consensus in Distributed Systems

UNIT V

BlockchainDatabases : Overview - Blockchain Properties - Achieving Blockchain Properties via Cryptographic Hash Functions - Consensus - Data Management in a Blockchain - Smart Contracts - Performance Enhancement - Emerging Applications

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text book:

1. Database System Concepts, AviSilberschatz, Henry F. Korth, S. Sudarshan, Seventh Edition,McGraw-Hill Publication,2017

Reference Book:

1. Advanced Database Management System by RiniChakrabarti, ShilbhadraDasgupta, Dreamtech Publication, 2020

E- Resources:

1.https://www.db-book.com/db7/

Outcomes:

- Know the Basics of Database System Architectures
- Understand the Concepts in Parallel and Distributed Storage
- Know about Parallel and Distributed Query Processing
- Understand Parallel and Distributed Transaction Processing
- Have an Idea about Blockchain Databases

Course Number:MCS22022 **CC-VIII**
L-P: 4-0 **Credits: 4**

CRYPTOGRAPHY AND NETWORK SECURITY

Objectives:

- To Know about Cryptography and Network Security Concepts
- To Understand the Basic Concepts of Classical Encryption Techniques
- To Know the Working of Advanced Encryption Standard and RSA
- To Get Introduced to Public-Key Cryptosystems
- To Learn the Concepts related to Network Access Control and Cloud Security

UNIT I

Computer and Network Security Concepts : Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - Fundamental Security Design Principles - Attack Surfaces and Attack Trees - A Model for Network Security Standards

UNIT II

Classical Encryption Techniques : Symmetric Cipher Model - Substitution Techniques - Transposition Techniques - Rotor Machines - Steganography - Block Ciphers and the Data Encryption Standard : Traditional Block Cipher Structure - The Data Encryption Standard - A DES Example - The Strength of DES - Block Cipher Design Principles

UNIT III

Advanced Encryption Standard : Finite Field Arithmetic - AES Structure - AES Transformation Functions - AES Key Expansion - An AES Example - AES Implementation - Public-Key Cryptography and RSA : Principles of Public-Key Cryptosystems - The RSA Algorithm

UNIT IV

Other Public-Key Cryptosystems :Diffie-Hellman Key Exchange : Elgamal Cryptographic System : Elliptic Curve Arithmetic - Elliptic Curve Cryptography - Digital Signatures :Digital Signatures - Elgamal Digital Signature Scheme - Schnorr Digital Signature Scheme - NIST Digital Signature Algorithm - Elliptic Curve Digital Signature Algorithm

UNIT V

Network Access Control and Cloud Security : Network Access Control - Extensible Authentication Protocol - IEEE 802.1X Port-Based Network Access Control - Cloud Computing - Cloud Security Risks and Countermeasures - Data Protection in the Cloud - Cloud Security as a Service - Addressing Cloud Computing Security Concerns

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Book:

Cryptography and Network Security Principles and Practice, William Stallings, 7th Edition, Pearson Education Limited. 2017

Reference Book:

Cryptography and Network Security, AtulKahate, 4th Edition, Pearson Education Limited. 2015

E-Reference:

1.http://www.cs.vsb.cz/ochodkova/courses/kpb/cryptography-and-network-security_-principles-and-practice-7th-global-edition.pdf

Outcomes:

- Know the Basics of Cryptography and Network SecurityConcepts
- Study the Different Basic Concepts of Classical Encryption Techniques
- Know about the Different Concepts in Advanced Encryption Standard and RSA
- Understand the Public-Key Cryptosystems
- Know about Network Access Control and Cloud Security

Course Number:MCS22023 **CC-IX**
L-P: 4-0 **Credits: 4**

COMPILER DESIGN

Objectives:

- To Know the Basics of Compiler
- To Understand the Basic Concepts of Parsing
- To Know the Functionality of Abstract Syntax Tree
- To Get Introduced to Intermediate Representations
- To Learn the Concepts related to Code Generation and Code Optimization

UNIT I

Introduction : A Compiler - The Importance of Compilers - A Quick Tour : The Compiler Toolchain - StagesWithin a Compiler - Example Compilation - Scanning : Kinds of Tokens - A Hand-Made Scanner - Regular Expressions - Finite Automata - Deterministic Finite Automata - Nondeterministic Finite Automata - Conversion Algorithms - Converting REs to NFAs - Converting NFAs to DFAs - Minimizing DFAs - Limits of Finite Automata - Using a Scanner Generator - Practical Considerations

UNIT II

Parsing : Overview - Context Free Grammars - Deriving Sentences - Ambiguous Grammars - LL Grammars - Eliminating Left Recursion - Eliminating Common Left Prefixes - First and Follow Sets - Recursive Descent Parsing - Table Driven Parsing - LR Grammars - Shift-Reduce Parsing - The LR(0) Automaton - SLR Parsing - LR(1) Parsing - LALR Parsing - Grammar Classes Revisited - The Chomsky Hierarchy

UNIT III

The Abstract Syntax Tree : Overview - Declarations - Statements - Expressions - Types - Putting it All Together - Building the AST Semantic Analysis : Overview of Type Systems - Designing a Type System - The B-Minor Type System - The Symbol Table - Name Resolution - Implementing Type Checking - Error Messages

UNIT IV

Intermediate Representations : Introduction - Abstract Syntax Tree - Directed Acyclic Graph-Control Flow Graph - Static Single Assignment Form - Linear IR - Stack Machine IR - Examples - GIMPLE - GNU Simple Representation - LLVM - Low Level Virtual Machine - JVM - Java Virtual Machine -

Memory Organization : Introduction - Logical Segmentation - Heap Management - Stack Management - Stack Calling Convention - Register Calling Convention - Locating Data - Program Loading

UNIT V

Code Generation : Introduction - Supporting Functions - Generating Expressions - Generating Statements - Conditional Expressions - Generating Declarations - Optimization : Overview - Optimization in Perspective - High Level Optimizations - Constant Folding - Strength Reduction Loop Unrolling - Code Hoisting - Function Inlining - Dead Code Detection and Elimination - Low-Level Optimizations - Peephole Optimizations - Instruction Selection - Register Allocation - Safety of Register Allocation - Priority of Register Allocation - Conflicts Between Variables - Global Register Allocation - Optimization Pitfalls - Optimization Interactions

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Book:

Introduction to Compilers and Language Design, Douglas Thain, Lulu Publications, 2020

Reference Book:

Compiler Design, Karthi M, Sudha Rani S, Rajkumar Y, Wiley Publication, 2019

E- Resources:

1. https://www3.nd.edu/~dthain/compilerbook/compilerbook.pdf

Outcomes:

- Know the Basics of Compiler
- Study the Concepts in Parsing
- Know about Abstract Syntax Tree
- Understand Intermediate Representations
- Understand the Concepts in Code Generation and Code Optimization

Course Number:MCS22024 **EC-II**
L-P: 4-0 **Credits: 4**

MACHINE LEARNING

Objectives:

- To Know the Concepts in Machine Learning
- To Understand the Basic Activities of Machine Learning
- To Know the Functionality of Modeling and Evaluation in Machine Learning
- To Get Introduced to Feature Engineering in Machine Learning
- To Learn the Different Types of Learning in Machine Learning

UNIT I

Introduction to Machine Learning : Introduction - Human Learning - Types of Human Learning - Learning under expert guidance - Learning guided by knowledge gained from experts - Learning by self - Machine Learning - Machines learning - Well-posed learning problem - Types of Machine Learning - Supervised learning - Unsupervised learning - Reinforcement learning - Comparison – supervised, unsupervised, and reinforcement learning - Problems Not To Be Solved Using Machine Learning - Applications of Machine Learning - Banking and finance, Insurance, Healthcare, State-of-The-Art Languages/Tools In Machine Learning, Python, R, Matlab, SAS, Other languages/tools, Issues in Machine Learning

UNIT II

Preparing to Model : Introduction - Machine Learning Activities - Basic Types of Data in Machine Learning - Exploring Structure of Data - Exploring numerical data - Plotting and exploring numerical data - Exploring categorical data - Exploring relationship between variables - Data Quality and Remediation - Data quality - Data remediation - Data Pre-Processing - Dimensionality reduction - Feature subset selection

UNIT III

Modelling and Evaluation : Introduction - Selecting a Model - Predictive models - Descriptive models - Training a Model (for Supervised Learning) - Holdout method - K-fold Cross-validation method - Bootstrap sampling - Lazy vs. Eager learner - Model Representation and Interpretability - Underfitting - Overfitting - Bias – variance trade-off - Evaluating Performance of a Model -

Supervised learning – classification - Supervised learning – regression - Unsupervised learning – clustering - Improving Performance of a Model

UNIT IV

Basics of Feature Engineering : Introduction - Feature - Feature Engineering - Feature Transformation - Feature construction - Feature extraction - Feature Subset Selection - Issues in high-dimensional data - Key drivers of feature selection – feature relevance and redundancy - Measures of feature relevance and redundancy - Overall feature selection process - Feature selection approaches

UNIT V

Other Types of Learning : Introduction - Representation Learning - Supervised neural networks and multilayer perceptron - Independent component analysis (Unsupervised) - Autoencoders - Various forms of clustering - Active Learning - Heuristics for active learning - Active learning query strategies - Instance-Based Learning (Memory-based Learning) - Radial basis function - Pros and cons of instance-based learning method - Association Rule Learning Algorithm - Apriori algorithm - Eclat algorithm - Ensemble Learning Algorithm - Bootstrap aggregation (Bagging) - Boosting - Gradient boosting machines (GBM) - Regularization Algorithm

UNIT VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Book:

Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson Education Press, 2018

Reference Book:

Machine Learning, AnuradhaSrinivasaraghavan, Vincy Elizabeth Joseph, Wiley Publications, 2019

E- Resources:

https://jp.b-ok.as/book/15096921/7f7e13

Outcomes:

Know the Basic Concepts in Machine Learning

- Study the Different Activities of Machine Learning
- Know about Modelling and Evaluation in Machine Learning
- Understand about Feature Engineering in Machine Learning

- Understand the Different Types of Learning in Machine Learning

Course Number:MCS22024 **EC-II**
L-P: 4-0 **Credits: 4**

DIGITAL IMAGE PROCESSING

Objectives:

- To Know the Basics of Image Processing
- To Understand the Concepts Intensity Transformations and Spatial Filtering
- To Know about Image Restoration and Reconstruction
- To Get Introduced to Wavelets and Image Compression
- To Learn the Concepts related Color Image Processing

Unit I

Digital Image Fundamentals : The Origins of Digital Image Processing - Examples of Fields that Use Digital Image Processing - Fundamental Steps in Digital Image Processing - Components of an Image Processing System - Digital Image Fundamentals : Elements of Visual Perception - Light and the Electromagnetic Spectrum - Image Sensing and Acquisition - Image Sampling and Quantization - Some Basic Relationships Between Pixels - Introduction to the Basic Mathematical Tools Used in Digital Image Processing

Unit II

Intensity Transformations and Spatial Filtering : Basic Intensity Transformation Functions - Histogram Processing - Fundamentals of Spatial Filtering - Smoothing (Lowpass) Spatial Filters - Sharpening (Highpass) Spatial Filters - Highpass, Bandreject, and Bandpass Filters from Lowpass Filters - Combining Spatial Enhancement Methods - Using Fuzzy Techniques for Intensity Transformations and Spatial Filtering

Unit III

Image Restoration and Reconstruction : A Model of the Image Degradation/Restoration process - Noise Models - Restoration in the Presence of Noise Only—Spatial Filtering - Periodic Noise Reduction Using Frequency Domain Filtering - Linear, Position-Invariant Degradations - Estimating the Degradation Function - Inverse Filtering - Minimum Mean Square Error (Wiener) Filtering - Constrained Least Squares Filtering - Geometric Mean Filter - Image Reconstruction from Projections

Unit IV

Wavelets and Image Compression : A Model of the Image Degradation/Restoration process 366
Noise Models - Restoration in the Presence of Noise Only—Spatial Filtering - Periodic Noise Reduction Using Frequency Domain Filtering - Linear, Position-Invariant Degradations - Estimating the Degradation Function - Inverse Filtering - Minimum Mean Square Error (Wiener) Filtering - Constrained Least Squares Filtering - Geometric Mean Filter - Image Reconstruction from Projections

Unit V

Color Image Processing **:**Color Fundamentals : Color Models - Pseudo color Image Processing - Basics of Full-Color Image Processing - Color Transformations - Color Image Smoothing and Sharpening - Using Color in Image Segmentation - Noise in Color Images - Color Image Compression

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Book:

Digital Image Processing, Rafael C. Gonzales, Richard E. Woods, Fourth Edition, Pearson Education, 2018.

Reference Book:

Digital Image Processing, S Jayaraman, S Esakkirajan, T Veerakumar, Second Edition, McGraw Hill Publication, 2020

E- Resources:

1.https://www.codecool.ir/extra/2020816204611411Digital.Image.Processing.4th.Edition.www.EBooksWorld.ir.pdf

Outcomes:

- Know the Basics of Image Processing
- Understand the Different Concepts in Intensity Transformations and Spatial Filtering
- Know about the Concepts in Image Restoration and Reconstruction
- Understand about Wavelets and Image Compression
- Understand about Color Image Processing.

Course Number:MCS22024 **EC-II**
L-P: 4-0 **Credits: 4**

Natural Language Processing

Objectives:

- To Know the Basics of Natural Language Processing
- To Understand Nonlinear classification and Linguistic applications of classification
- To Know the Concepts in Unsupervised learning
- To Get Introduced to the Language Models
- To Learn the Different Applications of Sequence Labeling

UNIT I

Introduction : Natural Language Processing and its Neighbors - Three themes in Natural - Learning : Linear Text Classification - The Bag of Words - Na¨ıve Bayes - Discriminative - Loss Functions and Large-Margin Classification - Logistic Regression - Optimization - *Additional Topics in Classification

UNIT II

Nonlinear classification :Feedforward neural networks - Designing neural networks - Learning neural networks - Convolutional neural networks .- Linguistic applications of classification : Sentiment and opinion analysis - Word sense disambiguation - Design decisions for text classification - Building datasets

UNIT III

Learning without supervision : Unsupervised learning - K-means clustering - Expectation-Maximization (EM) - EM as an optimization algorithm - How many clusters? - Applications of expectation-maximization - Word sense induction - Semi-supervised learning - Multi-component modeling - Semi-supervised learning - Multi-view learning - Graph-based algorithms - Domain adaptation - Supervised domain adaptation - Unsupervised domain adaptation - *Other approaches to learning with latent variables - Sampling - Spectral learning

UNIT - IV

Language models : N-gram language models - Smoothing and discounting - Recurrent neural network language models - Evaluating language models - Out-of-vocabulary words - Sequence labeling : Sequence labeling as classification - Sequence labeling as structure prediction - The Viterbi algorithm - Hidden Markov Models - Discriminative sequence labeling with features - Neural sequence labeling - *Unsupervised sequence labeling

UNIT V

Applications of sequence labeling : Part-of-speech tagging - Morphosyntactic Attributes - amed Entity Recognition - Tokenization - Code switching - Dialogue acts - Formal language theory : Regular languages - Context-free languages - *Mildly context-sensitive languages

UNIT VI CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text book :

1.Natural Language Processing by Jacob Eisenstein, MIT Press, 2018

Reference book :

2.Natural Language Processing by Ela Kumar, WILEY Publications, 2011

E- Resources:

1.https://cseweb.ucsd.edu/~nnakashole/teaching/eisenstein-nov18.pdf

Outcomes:

- Know the Basics of Natural Language Processing
- Study about Nonlinear classification and Linguistic applications of classification
- Know about the Concepts in Unsupervised learning
- Understand the Language Models
- Understand the Different Applications of Sequence Labeling.

Course Number:MCS22025 **EC-III**
L-P: 4-0 **Credits: 4**

Web Services

Objectives:

- To Know the Basics of Web Services
- To Understand the Basic Concepts in Virtual Machines
- To Know the Programming Constructs Used in Web Services
- To Get Introduced to Deployment in Web Services
- To Learn the Concepts related to Security in Web Services

UNIT I

Amazon Web Services : Cloud Computing - AWS - Benefit from using AWS - Cost - Comparing Alternatives - Exploring AWS Services - Interacting with AWS - Creating an AWS account - Creating a billing alarm to keep track of AWS bill

UNIT II

Using Virtual Machines - EC2 : Exploring a virtual machine - Monitoring and debugging a virtual machine - Shutting down a virtual machine - Changing the size of a virtual machine - Starting a virtual machine in another data center - Allocating a public IP address - Adding an additional network interface to a virtual machine - Optimizing costs for virtual machines

UNIT III

Programming the infrastructure: The command-line, SDKs, and CloudFormation : Infrastructure as Code - Using the command-line interface - Programming with the SDK - Using a blueprint to start a virtual machine

UNIT IV

Automating deployment: CloudFormation, Elastic Beanstalk, and OpsWorks : Deploying applications in a flexible cloud environment - Comparing deployment tools - Creating a virtual machine and run a deployment script on startup with AWS CloudFormation - Deploying a simple web application with AWS Elastic Beanstalk - Deploying a multilayer application with AWS OpsWorks Stacks

UNIT V

Securing your system: IAM, security groups, and VPC : Responsible for security - Keeping the software up to date - Securing the AWS account - Controlling network traffic to and from your virtual machine - Creating a private network in the cloud: Amazon Virtual Private Cloud (VPC)

UNIT VI

CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Book:

1.Amazon Web Services in Action, Michael Wittig, Andreas Wittig, Second Edition, Manning Publications, 2019

Reference Book:

2.Amazon web services for mobile developers : building apps with AWS, Mishra, Abhishek, Sybex Publications, 2018

E- Resources:

1.https://s3-ap-southeast-1.amazonaws.com/tv-prod/documents%2Fnull-Amazon+Web+Services+in+Action.pdf

Outcomes:

- Know the Basics of Web Services
- Study the Basic Concepts in Virtual Machines
- Know about the Programming Constructs Used in Web Services
- Understand and Get Introduced to Deployment in Web Services
- Learn the Concepts related to Security in Web Services.

Course Number:MCS22025 **EC-III**
L-P: 4-0 **Credits: 4**

Wireless Networks

Objectives:

- To Know the Basics of Wireless and Mobile Networks
- To Understand the Basic Concepts in Long-Term Evolution
- To Know the about WPAN,WiGig,WMAN and WiMAX
- To Get Introduced to Wireless Sensor Networks
- To Learn the Concepts in Mobile-Edge Computing

UNIT I

Introduction to Mobile and Networks: Mobile and wireless generation networks - IEEE technologies - Mobile Networks: Cellular network - Principles of cellular network functionalities - 1G networks - 2G networks - 3G networks - 4G networks - 5G networks

UNIT II

Long-Term Evolution : Relevant features of LTE - Network architecture and protocols - Control and user planes - Multimedia broadcast and multicast service - Stream Control Transmission Protocol - Network discovery and selection - Radio resource management - Authentication and authorization - Fundamentals of the MAC layer in LTE - Fundamentals of the LTE physical layer - 5G : From LTE Advanced to 5G: the big transition - Some characteristics envisioned for 5G - 5G frequencies - High and low platforms - Cloud-RAN

UNIT III

WPAN and WiGig : Wireless Personal Area Network - IEEE 802.15 - Bluetooth - UWB - WiGig - WirelesssHD - WLAN and WiFi : IEEE 802.11 - WiFi architecture - Saving energy -IEEE 802.11a, b and g - WMAN and WiMAX : Background on IEEE 802.16e - The physical layer - 9.3. An example of WiMAX and WiFi integration - QoS management - Mechanisms of channel access - IEEE 802.16m or mesh for WiMAX - IEEE 802.16h or cognitive radio for WiMAX

UNIT IV

Sensor Networks - RFID - Using - EPC global - RFID security - Mifare - Near-field communication - The Internet of Things in the home - Fog Networking - Connection of Things

UNIT V

Mobile-Edge Computing : Network virtualization - Network virtualization technology - OpenFlow - Network Virtualization - Isolation - 13.3.2. Extensive network virtualization - The Cloud - Mobile-edge computing use cases

UNIT VI

CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Book :

1.Mobile and Wireless Networks, Khaldoun Al Agha,GuyPujolle,Tara Ali-Yahiya, Wiley Publications, 2016

Reference Book:

1.Wireless Networking Absolute Beginner's Guide, Michael Miller, Pearson Education, 2013

E- Resources:

1. https://www.academia.edu/39154325/Mobile_and_Wireless_Networks

Outcomes:

- Know the Basics of Wireless and Mobile Networks
- Study and Understand the Basic Concepts in Long-Term Evolution
- Know about the about WPAN,WiGig, WMAN and WiMAX
- Understand the Basics of Wireless Sensor Networks
- Learn the Concepts in Mobile-Edge Computing

Course Number:MCS22025 **EC-III**
L-P: 4-0 **Credits: 4**

Problem Solving using Python & R

Objectives:

- To Know the Basics of Python Programming
- To Understand the Various Constructs in Python Programming
- To Know the Files Operations in Python Programming
- To Get Introduced to R Programming
- To Learn the Various Constructs in R Programming

UNIT I

Python Basics and Functions - Variables – Operators – statements – Getting In Puts – Boolean Conditions – Alternative , Chained and Nested Conditions – Catching Expectations – Function Calls – Built-in Functions – Type Conversion Function and Math Function – creating New Functions, Parameters and Arguments – Need for Functions.

UNIT II

Loops - While Statement – Infinite Loops – Continue Statement – For Loops – Countingand Summing Loops – Maximum and Minimum loops. - Strings - Traversal through Strings – String Slice – looping and counting in Strings – The in Operator – String Comparison – String Methods – Parsing Strings – Format Operator.

UNIT III

Files - Opening Files – Text Files – Reading Files – Searching Through Files – Selecting Files Names from User – Writing Files. - List - Traversing List – List Operations – List Slice – List Methods – Deleting elements – Built – in List functions – Objects, Value, Aliasing – List Arguments.

UNIT IV

Introduction to R: R Program – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Few commands to get started: installed.packages(), packageDescription(), help(), find.package(), library()

- Input and Output – Entering Data from keyboard – Printing fewer digits or more digits – Special Values functions : NA, Inf and –inf.

UNIT V

R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame – R - Variables: Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables - R Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - R Decision Making: if statement, if – else statement, if – else if statement, switch statement – R Loops: repeat loop, while loop, for loop - Loop control statement: break statement, next statement.

UNIT VI

CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text books :

1. Python Programming Fundamentals – A beginners Hand book, Nischay Kumar Hegde, 2018.

2.R Programming for Beginners, SandipRakshit, McGraw Hill Education (India), 2017.

Reference books :

1.Think Python, Allen B. Downey, 2nd edition, O Reilly Publishers, 2016.

2. Learning R, Richard Cotton, O'Reilly, 2013.

E- Resources:

1.https://dw2bukz.cf/book.php?id=DDZRDwAAQBAJ

2. https://www.mheducation.co.in/r-programming-for-beginners-9789352604555-india

Outcomes:

- Know the Basics of Python Programming
- Study the Different Constructs in Python Programming
- Know about the Files Operations in Python Programming
- Get Introduced to R Programming
- Various Constructs in R Programming

Course Number:MCS22026P **CC-XP**
L-P: 4-0 **Credits: 2**

Lab III: Advanced Database Management System Lab

Objectives:

- To Know the Concepts Behind the Advanced Database Management Techniques
- To Understand the Logic of Advanced Database Management Techniques
- To Know the Implementation of Advanced Database Management Techniques
- To Apply Present Compatible Programming Language for Advance Database Management Techniques
- To Test Whether the Result of the Program is Correct or Not

LIST OF PROGRAMS

1. Write a Program to Perform Transaction Processing for a Database
2. Write a Program to do Data Partitioning in a Database
3. Write a Program to Perform Parallel Indexing for a Database
4. Write a Program to do Parallel Sort in a Database
5. Write a Program to do Parallel Join in a Database
6. Write a Program to Perform Distributed Transactions for a Database
7. Write a Program to Perform Concurrency Control for a Database
8. Write a Program to do Replication in a Database

Outcomes:

- Understand and apply the Advance Database Management Techniques in applications,
- Evaluate the Logic in Advance Database Management Techniques to establish appropriate strategies for development and deployment.
- Understand the Art of Advance Database Management Programming
- Develop and apply Current Standard-Compliant Programming Techniques for the Successful Deployment of Advance Database Management Techniques Applications.

- Understand the Testing and Debugging of the Program Written

Course Number:MCS22027P **CC-XIP**
L-P: 4-0 **Credits: 2**

Lab IV: Cryptography and Network Security Lab

Objectives:

- To Know the Concepts Behind the Network Security Algorithms
- To Understand the Logic of Network Security Algorithms
- To Know the Implemention of Network Security Algorithms
- To apply Present Compatible Programming Language for Network Security Algorithms
- To Test Whether the Result of the Program is Correct or Not

LIST OF PROGRAMS:

1. Write a Program to do Encryption and Decryption using Ceasar Cipher

2.For a Given Text, Perform Encryption and Decryption using Data Encryption Standard

3.Write a Program to do Encryption and Decryption using Advanced Encryption Standard

4.For a Text of 30 Words, Perform Encryption and Decryption using RSA (Rivest–Shamir–Adleman Algorithm)

5.Write a Program to do Encryption and Decryption using Diffie-Hellman Key Exchange

6.Write a Program that Performs Encryption and Decryption using Elliptic Curve Arithmetic

7.Write a Program to do Encryption and Decryption using Digital Signature

8. For a Given Text and Image, Perform Steganography

Outcomes:

- Understand and apply the Network Security Principles and methods for delivering and maintaining Security in applications,
- Evaluate and Logic in Network Security Algorithms to establish appropriate strategies for development and deployment.
- Understand the Art of Network Security Programming

- Develop and apply Current Standard-Compliant Programming Techniques for the Successful Deployment of Security Applications.
- Understand the Testing and Debugging of the Program Written

Course Number: MSC22031 **CC-XII**
L-P: 4-0 **Credits: 4**

ADVANCED WEB TECHNOLOGY

Objectives:

- Students can build web applications using ASP and client side script technologies use with Microsoft's IIS,
- Can build XML applications with DTD and style sheets that span multiple domains ranging from finance to vector graphics for use with legacy browsers.
- Students will be familiar with client server architecture.
- Able to develop a web application using java technologies.
- Students will gain the skills of project-based experience that are needed for web application and development careers.

Unit I: BASIC WEB TECHNOLOGY PROTOCOL

History of the Internet and World Wide Web – HTML 4 protocols – HTTP, SMTP, POP3, MIME, IMAP. Introduction to JAVA Scripts – Object Based Scripting for the web. Structures – Functions – Arrays – Objects.

Unit II: DYNAMIC WEB TECHNOLOGY

Introduction – Object refers, Collectors all and Children. Dynamic style, Dynamic position, frames, navigator, Event Model – On check – On load – Onenor – Mouse rel – Form process – Event Bubblers – Filters – Transport with the Filter – Creating Images – Adding shadows – Creating Gradients – Creating Motion with Blur – Data Binding – Simple Data Binding – Moving with a record set – Sorting table data – Binding of an Image and table.

Unit III: SPEECH RECOGNITION

Audio and video speech synthesis and recognition - Electronic Commerce – Eusiness Model – E-Marketing – Online Payments and Security – Web Servers – HTTP request types – System Architecture – Client Side Scripting and Server side Scripting – Accessing Web servers – IIS – Apache web server.

Unit IV: SQL AND ASP

Database, Relational Database model – Overview, SQL – ASP – Working of ASP – Objects – File System Objects – Session tracking and cookies – ADO – Access a Database from ASP – Server side

Active-X Components – Web Resources – XML – Structure in Data – Name spaces – DTD – Vocabularies – DOM methods.

Unit V: SERVLET

Introduction – Servlet Overview Architecture – Handling HTTP Request – Get and post request – redirecting request – multi-tier applications – JSP – Overview – Objects – scripting – Standard Actions – Directives.

UNIT VI:
CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Books:

1. Deitel&Deitel, Goldberg, "Internet and world wide web – How to Program",Pearson Education Asia, 2001.

Reference books:

1. Eric Ladd, Jim O' Donnel, "Using HTML 4, XML and JAVA", Prentice Hall of India – QUE, 1999.

2. Aferganatel, "Web Programming: Desktop Management", PHI, 2004.

3. Rajkamal, "Web Technology", Tata McGraw-Hill, 2001.

E- Resources:

1. https://www.javatpoint.com/dhtml
2. https://www.keil.com/pack/doc/mw/Network/html/group__ws__web__technologies.html

Outcomes:

- Students can design and implement dynamic websites with a good aesthetic sense of designing and latest technical know-how's.
- Students can have a Good grounding of Web Application Terminologies,Internet Tools, E – Commerce and other web services.
- Students are able to develop a dynamic webpage by the use of javascript and DHTML.
- Students will be able to write a well formed / valid XML document.

- Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on the DBMS table.

Course Number:MCS22032 **CC-XIII**
L-P: 4-0 **Credits: 4**

AGILE TECHNOLOGIES

Objectives:

- To understand how an iterative, incremental development process leads to faster delivery of more useful software
- To understand the essence of agile development methods
- To understand the principles and practices of extreme programming
- To understand the roles of prototyping in the software process
- To understand the concept of Mastering Agility

UNIT I: Software Engineering:

Software Process and Agile Development Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile Process-Extreme programming-XP Process.

UNIT II: Requirements Analysis and Specification:

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management, Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III: Agile Methodologies:

Introduction: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?:Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor
Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility

UNIT IV: Practicing XP:

Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous

Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, **Documentation Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating **Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

UNIT V: Mastering Agility:

Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :**Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput
Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver frequently, Seek Technical Excellence: Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery.

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text books:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, McGraw-Hill International Edition, 2010. (Unit 1 and 2)
2. Jamesshore, Chromatic, "The Art of Agile Development (Pragmatic guide to agile software development)", O'Reilly Media, Shroff Publishers, 2007 (Unit 3, 4 and 5)
3. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.

Reference Books:

1. Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices", Prentice Hall; 1st edition, 2002
2. Craig Larman, "Agile and Iterative Development A Manger's Guide", Pearson Education, First Edition, India, 2004.

E- Resources:

1. https://poetiosity.files.wordpress.com/2011/04/art_of_agile_development.pdf

Outcomes:

- Students possess the following understanding, skills, abilities and judgment.
- Students can describe the relationship between stakeholder, product, and process

- Students can specify, implement, and evaluate a system based on what different stakeholders perceive as valuable
- Learned knowledge will reflect on the own and the team's learning strategies
- Students can adopt XP Lifecycle, XP Concepts and Adopting XP.

Course Number:MCS22033 **CC-XIV**
L-P: 4-0 **Credits: 4**

BIG DATA ANALYTICS

Objectives:

- To explore the fundamental concepts of big data analytics.
- To understand big data security.
- To understand the applications using Map Reduce Concepts.
- To learn Hive and HBase Apache Hive configuration, creating tables and working on the database.
- To learn Pig, its installation and working on its various functions.

Unit I

Fundamentals of Big Data Understanding Big Data: Concepts and Terminology – Big Data Characteristics – Types of Data – Case Study Background – Drivers for Big Data Adoption: Information and Communication Technology – Big Data Analytics Lifecycle

Unit II

Fundamentals of Hadoop Core components of Hadoop- Apache Hadoop – HDFS Daemons – MapReduce Daemons – HDFS High Availability Daemons – Benefits and Challenges of HDFS – File Sizes, Block Sizes and Block Abstraction in HDFS – Data Replication – How does HDFS Store, Read, and Write Files? – Data Serialization Options – File System Shell Commands for HDFS

Unit III

HDFS and MapReduce Choosing Key and Value Types for MapReduce Jobs – The Relationship of Input Keys to Output Keys – Sorting Keys and Values – Sort and Shuffle Process – MapReduce Job Configuration and Submission Hadoop Distributed File System – MapReduce Framework – Setting the Environment – Hadoop Cluster Modes – Running a MapReduce Job with the MR1Framework - Running a MapReduce Job with the Yarn Framework – Running Hadoop Streaming

Unit IV

Hive and HBase Apache Hive: Setting the Environment – Configuring Hadoop, Hive – Starting HDFS, Hive Server, CLI – Creating and Using a Database– Creating a Managed Table – Loading data into a Table – Creating a Table using LIKE – Adding Data into a Table from Queries – Adding

Data using INSERT INTO TABLE - Adding Data using INSERT OVERWRITE – Creating a table using CREATE TABLE AS SELECT – Altering, Truncating and Dropping a Table– Creating an External Table – Apache HBase: Setting the Environment - Configuring Hadoop, Hive and HBase – Starting the HBase and HBase Shell – Creating HBase Table – Adding Data to a Table – Listing all Tables – Getting a Row of Data – Scanning a Table – Counting the Number of Rows in a Table – Altering a Table – Deleting a Table Row, Column – Disabling and Enabling a Table – Truncating and Dropping a Table – Determining If Table Exists – Creating a Hive External Table stored by HBase.

Unit V

Pig Introduction – Installing and Running Pig – Grunt – Pig‘s Data Model – Introduction to Pig Latin – Advanced Pig Latin – Developing and Testing Pig Latin Scripts – Making Pig Fly – Writing Evaluation and Filter Functions – Writing and Loading Store Function

Unit VI:

CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Books:

1. Alan Gates, ―Programming Pig‖, Oreilly Publication, 2011.
2. Deepak Vohra, ―Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools‖, Apress, 2016.
3. Thomas Erl, WajidKhattak, Paul Buhler, ―Big Data Fundamentals Concepts, Drivers & Techniques‖, Service Tech Press, 2015.
4. SoumendraMohanty, MadhuJagadeesh and HarshaSrivatsa, “Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics” Apress Media, Springer Science, Business Media New York, 2013
5. AnandRajaraman, Jure Leskovec, Jeffery D. Ullman, “Mining of Massive Datasets”, Springer, July 2013.
6. Tom White, “Hadoop: The definitive Guide”, O'Reilly Media, 2010.

Reference Book

1. Noreen Burlingame , ―The little book on Big Data‖, New Street publishers, 2012.
2. Anil Maheshwari, ― Data Analytics‖, McGraw Hill Education, 2017.

E-Resources:

1. https://intellipaat.com/tutorial/hadoop-tutorial/

Outcomes:

- Know about big data platform and its analysis techniques
- Design efficient algorithms for mining the data from large volumes.
- Explore the technologies associated with big data analytics such as NoSQL, Hadoop and Map Reduce.
- Possess the knowledge of Hive and HBase Apache Hive and ability of Setting the Environment, Configuring Hadoop, Hive, Starting HDFS, Hive Server and CLI.
- Able to Install and Run Pig, Grunt and design Pig's Data Model.

Course Number:MCS22034 **EC-IV**
L-P: 4-0 **Credits: 4**

INTERNET OF THINGS

Objectives:

- To provide a Complete Knowledge about the Internet of Things
- Understand where the IoT concept fits within the broader ICT industry and possible future trends.
- Appreciate the role of Big Data, Cloud / Fog and Edge Computing in a typical IoT system.
- Describing the Emerging Field of IoT Data Analytics
- An Overview about Edge/Fog Computing Paradigm

Unit I :Demystifying the IoT Paradigm

Strategically Sound IoT - The Brewing and Blossoming Trends in IT Space -Envisioning the Internet of Things Era - Illustrating the Device-to-Device/ Machine-to-Machine Integration Concept - The Aspect of Device-to-Cloud (D2C) Integration - The Emergence of the IoT Platform as a Service (PaaS) - Digging into the Cloud-to-Cloud (C2C) Integration Paradigm - Describing the Sensor-to-Cloud Integration Concept - Azure IoT Hub Device Management - The Prominent IoT Realization Technologies - The Key Application Domains - The Emerging IoT Flavors

Unit II :Realization of IoT Ecosystem Using Wireless Technologies

Introduction - Architecture for IoT Using Mobile Devices - Mobile Technologies for Supporting IoT Ecosystem-Energy Harvesting for Power Conservation in the IoT System - Mobile Application Development Platforms - Mobile Use Cases for IoT - Low Power Wide Area Networking Technologies -

Unit III : The Next-Generation Clouds for IoT Applications and Analytics

Introduction - Reflecting the Cloud Journey - About the Cloud Technology - The Cloud Service Ecosystem - The Key Motivations for Cloud-Enabled Environments - A Look at Cloud-Inspired Enterprise Transformations - IoT and Cloud-Inspired Smarter Environments - The Era of Hybrid Clouds - Envisioning Federated Clouds - Special-Purpose Clouds - The Emergence of Edge/Fog

Clouds - The Architectural Components of the Smarter Traffic System - Tending toward Software-Defined Clouds - The Building Blocks of Software-Defined Clouds -Software-Defined Storage (SDS) - The Onset of Cognitive Clouds

Unit IV :Describing the Emerging Field of IoT Data Analytics

The Principal Steps toward Knowledge Discovery and Dissemination - The Rewarding Repercussions of the Data Explosion - Describing Big Data Analytics - The Strategic Importance of Big Data Analytics - Big Data Analytics: The Prominent Use Cases - Real-Time and Streaming Analytics - Expounding the IoT Data Analytics Domain - The Key Drivers for IoT Data Analytics - The Key Movements and Motivations of IoT Data - The Emergence of Edge Clouds for Real-Time Insights - Deep Diving and Digging into Edge Analytics - The Renowned Edge Analytics Use Cases - The Architectural Components of the Smarter Traffic System - The Key Capabilities of Next-Generation IoT Data Analytics Platforms- The Prime Modules of IoT Data Analytics Platforms - The Reference Architecture for IoT Data Analytics Platform - Need for Cloud-Based IoT Data Analytics - The Distinct Capabilities of IoT Data Analytics Platforms

Unit V : Expounding the Edge/Fog Computing Paradigm

Introduction - The Introduction of Fog/Edge Computing - Illustrating the Game-Changing IoT Journey - Describing the Fog Computing-Like Concepts - The Use Cases of Fog/Edge Computing – Importance of Fog Computing Crucial for IoT Success - Delving into Fog/Edge Analytics - Edge Analytics: The Prominent Use Cases - Carving Out Edge Clouds for Edge Analytics - Introducing Integrated Fog Computing Platforms - The Eclipse Kura—An IoT Device Management and Analytics Platform - Every ware Software Framework

Unit VI: CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Book:

1. The Internet of Things Enabling Technologies, Platforms, and Use Cases, Pethuru Raj, Anupama C. Raman, CRC Press, 2017

Reference Book:

1. Internet of Things - From Research Innovation to Market Deployment by OvidiuVermesan and Peter Friess, River Publishers, 2014.

E-Resources:

1. https://en.wikipedia.org/wiki/Internet_of_things
2. https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT
3. https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/

Outcomes:

- Understand the concepts of Internet of Things.
- Understand the concept of IoT Ecosystem.
- Know the concepts in Fog Computing and Edge Computing
- Can build IoT with embedded things.

- Can perform analytics using Edge/Fog computing paradigm.

Course Number:MCS22034 **EC-IV**
L-P: 4-0 **Credits: 4**

BLOCK CHAIN TECHNOLOGY

Objectives:

- To Introduce the Concepts of Blockchain Technologies.
- To be familiar with the types of Blockchain.
- To understand the concept of Private and Public Blockchain
- To understand the Security in Blockchain Technology.
- To know the Applications of Blockchain Technology.

UNIT I:FUNDAMENTALS OF BLOCK CHAIN

Introduction - Origin of Blockchain–Blockchain Solution - Components of Blockchain - Components of Blockchain - Block in Blockchain - The Technology and the Future

UNIT II: BLOCKCHAIN TYPES AND CONSENSUS MECHANISM

Introduction - Decentralization and Distribution - Types of Blockchain - Consensus Protocol - CRYPTOCURRENCY - BITCOIN, ALTCOIN and TOKEN: Introduction - Bitcoin and Cryptocurrency Basics - Types of Cryptocurrency - Cryptocurrency Usage

UNIT III : PUBLIC BLOCKCHAIN SYSTEM

Introduction - Public Blockchain - Popular Public Blockchains - The BitcoinClockchain–EtherumBlockchain

UNIT IV: PRIVATE BLOCKCHAIN SYSTEM

Introduction - Key Characteristics of Private Blockchain - Why We Need Private Blockchain - Private Blockchain Examples - Private Blockchain and Open Source - E-Commerce Site Examples -

Varous Commands in E-Commerce Blockchain - Smart Contract in Private Environment - State Machine - Different Algorithms of Permissioned Blockchain - Byzantine Fault - Multichain

UNIT V: SECURITY IN BLOCKCHAIN

Introduction - Security Aspects in Bitcoin - Security and Privacy Challenges of Blockchain in General - Performance and Scalability - Identity Management and Authentication - Regularity Compliance and Assurance - Safeguarding Blockchain Smart Contract - Security Aspects in Hyperledger Fabric - APPLICATIONS OF BLOCKCHAIN: Blockchain in Banking and Finance – Blockchain in Healthcare.

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Book:

1.Blockchain Technology, ChandramouliSubramaniam, Asha A George, Abhilash K A, MeeraKarthikeyan, University Press, 2020

Reference Books:

1. Blockchain Basics: A Non-Technical Introduction, Daniel Drescher, Apress, 2017

2. BlockChainFrom Concept to Execution, DebajaniMohanty, BPB, 2018

E-Resourses:

1. https://www.pdfdrive.com/blockchain-books.html

2.https://www.blockchain.com/

Outcomes:

- Understand the Basic Idea of Block chain Technology.
- Identify the Differences between Public and Private Block chain Technologies.
- Know about Crypto currency - Bit coin, Altcoin and Token
- Understanding the Security Challenges
- Know about Applications in Block chain Technology.

Course Number:MCS22034 **EC-IV**
L-P: 4-0 **Credits: 4**

EMBEDDED SYSTEM

Objectives:

- To introduce students to the modern embedded systems
- To show how to understand and program such systems using a concrete platform built around.
- To understand the working concepts of Embedded programming.
- To understand the concepts of Real time operating systems.
- To learn the working principle of Embedded design & case study.

Unit I: Embedded System

Introduction to Embedded Systems - 8051 And Advanced Processor Architectures, Memory organization, and Real World Interfacing.

Unit II: Device and Communication

Devices and Communication Buses For Devices Network - Device Drivers And Interrupts Servicing Mechanism

Unit III: Embedded programming concepts

Programming Concepts and Embedded Programming in C, C++ and Java - Program Modeling Concepts in Single and Multiprocessor Systems Software-Development Process.

Unit IV:Real time operating system

Real Time Operating Systems- I: Inter Process Communication and Synchronization of Processes, Task and Threads - Real Time Operating Systems.

Unit V: Embedded Design & Case study

Design Examples And Case Studies Of Program Modeling And Programming With RTOS - 1 - Design Examples And Case Studies Of Program Modeling And Programming With RTOS – 1

Unit VI: CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

TextBook:

1. "**Embedded Systems Architecture, Programming and Design**" - Raj Kamal TMH - Second Edition - 2008 ISBN-13: 978-0-07-066764-8.

References Book:

1. "**The 8051 Microcontroller and Embedded Systems**" - Muhammad Ali Mazidi, Janice Mazidi&RolinMckinlay - Prentice Hall - 2006.

E- Resources:

1.https://www.coursera.org/courses?query=embedded%20systems.

Outcomes:

- Know what an embedded system
- Understand the general process of embedded system development.
- Comprehend important embedded system terminology.
- Experience common aspects of embedded system development.
- Understand embedded system R&D project and related activities it involves.

Course Number:MCS22035 **EC-V**
L-P: 4-0 **Credits: 4**

THEORY OF COMPUTATION

Objectives:

- To learn the mathematical foundations of computation including automata theory
- To learn the theory of formal languages and grammars
- To learn the notions of algorithm - decidability - complexity - and computability
- To enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.
- To understand an undecidable problem RE.

Unit I

Introduction to formal proof – Additional forms of proof – Inductive proofs – FiniteAutomata (FA) – Deterministic Finite Automata (DFA) – Non- deterministic FiniteAutomata (NFA) – Finite Automata with Epsilon transitions.

Unit II

Regular Expression – FA and Regular Expressions – Proving languages not to beregular – Closure properties of regular languages – Equivalence and minimization ofAutomata.

Unit III

Context-Free Grammar (CFG) – Parse Trees – Ambiguity in grammars and languages – Definition of the Pushdown automata – Languages of a Pushdown Automata –Equivalence of Pushdown automata and CFG– Deterministic Pushdown Automata.

Unit IV

Normal forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM. A language that is not Recursively Enumerable (RE).

Unit V:

An undecidable problem RE – Undecidable problems about Turing Machine – Post's Correspondence Problem – The classes P and NP.

Unit VI

CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Books:

1. Peter Linz - ―An Introduction to Formal Languages and Automata‖ -Fifth Edition -Narosa - 2012

2. J.E. Hopcroft - R. Motwani and J.D. Ullman - ―Introduction to Automata Theory - Languages and Computations‖ - second Edition - Pearson Education - 2007.

Reference Books:

1. H.R. Lewis and C.H. Papadimitriou - ―Elements of the theory of Computation‖ - Second Edition - Pearson Education - 2003.

2. Thomas A. Sudkamp -‖ An Introduction to the Theory of Computer Science -Languages and Machines‖ - Third Edition - Pearson Education - 2007.

3. Raymond Greenlaw an H.James Hoover -― Fundamentals of Theory of Computation - Principles and Practice‖ - Morgan Kaufmann Publishers - 1998.

4. MichealSipser - ―Introduction of the Theory and Computation‖ - Thomson Brokecole - 1997.

5. J. Martin - ―Introduction to Languages and the Theory of computation -‖ Third Edition - Tata McGraw Hill - 2007.

E- Resources:

1. https://en.wikipedia.org/wiki/Theory_of_computation
2. https://www.geeksforgeeks.org/introduction-of-theory-of-computation/
3. https://www.section.io/engineering-education/introduction-to-theory-of-computation/

Outcomes:

- Observe the basic concepts of NFA and DFA.
- Interpret the theory of formal languages and grammars.
- Consociate the mathematical proofs for computation and algorithms.

- Work on FA and Regular expression.
- Perform operations on languages using Normal forms for CFG – Pumping Lemma for CFL

Course Number:MCS22035 **EC-V**
L-P: 4-0 **Credits: 4**

OPTIMIZATION TECHNIQUES

Objectives

- To make students understand about the basic of Linear Programming.
- To understand the estimation of various cost for project managements.
- To familiarize the students with Inventory control problems.
- To expose Dynamic programming approach for Priority Management employment.
- To expose the students with different ways of Transportation Algorithms and its Solutions.

Unit I: Linear Programming Problem

Linear Programming Problem (LPP): Mathematical Formulation of Linear Programming Problem - Graphical Solution of LPP - Canonical and standard forms of linear programming problem- Simplex method for solving LPP

Unit II: Transportation and Assignment Problems

Transportation Model: North West corner Method, Least Cost method, and Vogel's Approximation Method. Assignment Model: Hungarian assignment model – Travelling Sales Man Problem.

Unit III: CPM/PERT

Project Scheduling PERT/CPM Networks – Fulkerson's Rule – Measure of Activity – PERT Computation – CPM Computation – Resource Scheduling.

Unit IV: Non-Linear Optimization Models

Simplex Method – Gradient of function – Steepest Descent method – Conjugate Gradient method

Unit V: Unconstraint Optimization Models

Particle Swarm Optimization method – Ant Colony optimization algorithm – Fruit Fly method – FireFly method

Unit VI: CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Books:

1. KantiSwarup, P. K. Gupta, and Man Mohan, Operations Research, Sultan Chand and Sons, New Delhi, 2014. (Unit 1, 2, and 3)

2. S. S. Rao, Engineering Optimization: Theory and Practice, JOHN WILEY & SONS, INC., 2009. (Unit 4)

3. Bo Xing and Wen-Jing Gao, Innovative Computational Intelligence: A Rough Guide to 134 Clever Algorithms, Springer, 2014. (Unit 5)

Reference Books:

1. Hamdy A. Taha, Operations Research: An Introduction, Pearson, 2010

E- Resources:

1. https://www.shsu.edu/~eco_dgf/web_chapter_a.pdf
2. https://neos-guide.org/optimization-tree

Outcomes:

- Understand the basic concept of Linear Programming.
- Estimate cost for various project managements.
- Get familiarize with Inventory control problems.
- Get exposure on Dynamic programming approach.
- Expose different ways of Transportation Algorithms.

Course Number:MCS22035 **EC-V**
L-P: 4-0 **Credits: 4**

STATISTICAL COMPUTING

Objectives:

- To make students understand the basics of Correlation, Scatter Diagram, Data collection, Sampling, Random Variable.
- To understandthe basic elements of Statistical Inference, Regression, and Correlation. Point and interval concepts.
- To analysis Merits and Limitations of Coefficient of Correlation, Linear Regression Equations, Merits and Limitations of Sampling and Methods of Sampling-
- To analysis of the various Python built-in modules and packages which enrich the programming ability of students.
- To apply the Coefficient of Correlation and Probable Error of r, Coefficient of Determination, Testing of Hypothesis, Merits and Limitations of Coefficient of Correlation, Spearman's Rank Correlation

UnitI:

Correlation - Definition of Correlation- Scatter Diagram- Kari Pearson's Coefficient of Linear Correlation- Coefficient of Correlation and Probable Error of r- Coefficient of Determination - Merits and Limitations of Coefficient of Correlation- Spearman's Rank Correlation(7.1-7.9.4).

UnitII:

Regression Analysis - Regression and Correlation(Intro)- Difference between Correlation and Regression Analysis- Linear Regression Equations -Least Square Method- Regression Lines- Properties of Regression Coefficients- Standard Error of Estimate. (8.1-8.8)

UnitIII:

Probability Distribution and mathematical Expectation- Random Variable- Defined - Probability Distribution a Random Variable- Expectation of Random Variable- Properties of Expected Value and Variance(12.2-12.4).

UnitIV:

Sampling and Sampling Distributions - Data Collection- Sampling and Non-Sampling Errors – Principles of Sampling-- Merits and Limitations of Sampling- Methods of Sampling- Parameter and Statistic- Sampling Distribution of a Statistic- Examples of Sampling Distributions- Standard Normal, Student's t, Chi-Square (x2) and Snedecor's F- Distributions(14.1-14.16).

UnitV:

Statistical Inference- Estimation and Testing of Hypothesis - Statistical Inference- Estimation- Point and interval- Confidence interval using normal, t, and x2Distributions- Testing of Hypothesis- Significance of a mean - Using t Distribution(15.1-15.10.2).

Unit VI:

CURRENT CONTOURS (For continuous internal assessment only):
Contemporary Developments Related to the Course during the SemesterConcerned

Text Books:

1. K.L. Sehgal, "Quantitative Techniques and Statistics", First Edition, Himalaya Publishing House, 2011.

Reference Books:

1. N. P. Bali, P. N. Gupta, C. P. Gandhi, "A Textbook of Quantitative Techniques", First Edition, Laxmi Publications, 2008.

2. U. K. Srivastava, G. V. Shenoy, S. C. Sharma, "Quantitative Techniques for Managerial Decisions", Second Edition, New Age International Publishers, 2005.

3. David Makinson, "Sets, Logic, and Maths for Computing", Springer, 2011.

4. Christopher Chatfield," Statistics for Technology- A Course in Applied Statistics, Third Edition", CRC Press, 2015.

E- Resources:

1. https://www.wiley.com/en-in/ Statistical+Computing%3A+An+Introduction +to+Data+Analysis+using+S+Plus+-p-9780471560401

Outcomes:

- Perform correlation and its methods.
- Apply the correlations using Scatter Diagram- Kari Pearson's method.

- Do Regression Analysis - Regression and Correlation, Difference between Correlation and Regression Analysis, Linear Regression Equations.
- Apply Statistical Inference of Estimation and Testing of Hypothesis.
- Apply Point and interval with confidence interval using normal, t, and x2 distributions.

Course Number:MCS22036P **CC-XVP**
L-P: 4-0 **Credits: 2**

LAB V : WEB TECHNOLOGY LAB

Objectives:

- To develop an ability to design and implement static and dynamic websites.
- To understand and create links, alignment and colour in texts.
- To understand ASP methodologies for the creation of dynamic websites.
- To understand XML and its various style sheet applications.
- To use Javascript for the development of web sites.

Problems:

1. Create a HTML table with rows & columns and split them using Rowspan and Colspan.
2. Create a web page in the format of front page of a news paper using Text links. Align the text with colors.
3. Write an XML document to display your bio-data. Write an XSL style sheet and attach that to the XML document. Validate the document using DTD or XSD.
4. Write an ASP program to prepare Employee pay bill using Java Script.
5. Write an ASP program to prepare student performance evaluation document using Java Script.

Outcomes:

- Design and implement dynamic websites with a good aesthetic sense of designing and latest technical know-how's.
- Have a Good grounding of Web Application Terminologies, Internet Tools, E – Commerce and other web services.
- Get introduced in the area of Online Game programming.
- Develop dynamic websites using XML and different XSL style sheets.
- Design dynamic websites using ASP and JavaScript.

Course Number:MCS22037P **CC-XVIP**

L-P: 4-0 **Credits: 2**

LAB VI :DATA ANALYTICS USING R – LAB

Objectives:

- To implement mathematical aggregation operators in "R-script".
- To understand the Statistical operations in "R".
- To learn KNN applications for data processing.
- To understand different data analytics techniques.
- To understand the practical application of data processing.

Problems:

1. To get the input from the user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) using in R.
2. To perform data import/export (.CSV, .XLS, .TXT) operations using data frames in R.
3. To get the input matrix from the user and perform Matrix addition, subtraction, multiplication, inverse transpose, and division operations using vector concept in R.
4. To perform statistical operations (Mean, Median, Mode, and Standard deviation) using R.
5. To perform data pre-processing operations i) Handling Missing data ii) Min-Max normalization
6. To perform dimensionality reduction operation using PCA for Houses Data Set
7. To perform Simple Linear Regression with R.
8. To perform K-Means clustering operation and visualize for iris data set
9. Write R script to diagnose any disease using KNN classification and plot the results.
10. To perform market basket analysis using Association Rules (Apriori).

E-Resources:

1. https://www.analyticsvidhya.com/trainings/data-analytics-using-r-analytics-lab/
2. https://r4ds.had.co.nz/introduction.html
3. https://www.youtube.com/watch?v=32o0DnuRjfg

Outcomes:

- Perform numerical operations by developing programs using R language.
- Perform statistical operations through R language.
- Perform data pre-processing operations by applying R language.
- Perform market basket analysis using Association Rules by applying Apriori algorithm using R language.
- Perform different data processing techniques through R language.

Course Number:MCS22037P **CC-XVIP**
L-P: 4-0 **Credits: 2**

LAB VI: STATISTICAL COMPUTING – LAB

Objectives:

- Learn how to using statistical functions in Excel
- Implement the advanced data analysis tool
- Learn to apply the Test of Hypothesis concerning the population means.
- Learn to apply different statistical methodologies for computing
- Learn and understand the application of ANOVA tests.

List of Programs:

Implement the following statistical concepts and computation in Ms-Excel

1. Compute the descriptive statistics of a dataset

2. Calculate Test of Hypothesis concerning the population means

3. Calculate the difference between the mean of two populations

4. Calculate ANOVA test

    i. Single-factor ANOVA Test,

    ii. Two way ANOVA without Replication

    iii. Two way ANOVA with Replication

5. Calculate Goodness-of-fit Test for Discrete Random Variables

6. Calculate the Test Hypothesis Concerning the Variance of Two Populations

7. Calculate Linear Correlation and Regression Analysis between two variables and find the model that predicts one variable in terms of another.

8. Calculate Moving Average and Exponential Smoothing

9. Calculate Binomial Distribution for discrete and continuous random variables

10. Calculate Regression analysis for the given problem

Outcomes:

- Apply statistical functions for the real-time data
- Perform data analysis of any real-world problem using advanced data analysis tools in Ms-Excel.
- Apply descriptive statistics of a dataset for computing.
- Use ANOVA tests on dataset for statistical computing.
- Calculate Binomial Distribution for discrete and continuous random variables.

Value Added Course

Course Code: 22VAC01 **VAC-I**

Augmented Reality and Virtual Reality

Objectives:

- To introduce the importance of augmented reality and its need.
- To create awareness on augmented reality and its application for the society.
- Visual Perception is used to develop the future Business and Industry.
- To know about Virtual Reality and their Applications.
- To know about Interface to the Virtual World

UNIT I

Introduction to Augmented Reality

History of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality

UNIT II

Augmented Reality Hardware

Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception, Requirements and Characteristics, Spatial Display Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications..

UNIT III

Introduction to Virtual Reality

Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output-Visual, Aural & Haptic Displays, Applications of Virtual Reality.

UNIT IV

Representing the Virtual World

Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR

UNIT V

Visual Perception

Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information

Reference books:

1. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494
3. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
4. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

E-Resources:

- https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf
- http://lavalle.pl/vr/book.html

Outcomes:

- Students can able to understand the importance of augmented reality and its need.
- Students can acquire in-depth knowledge on augmented reality and its application.
- Students can be familiarizing with Visual Perception is used to develop the future.
- Students can understand the basic concept Virtual Reality.
- Students can able get interpretation about the Virtual Reality and augment reality.

Course Code: 22VAC02 **VAC-II**

ROBOTICS

Objectives:

- To introduce the importance of Robotics for Industrial needs.
- To create awareness on Robotics and its application for the society.
- Robot programming Methods is used to develop the future Business and Industry.
- To know about Operational Capabilities level of Robot and their Applications.
- To know about Internal Sensors and External Sensors for Robot.

UNIT I

Fundamental of Robotics

Historical Development of Robotics – Industrial Robot – Classification – Degree of Freedom and Degree of Motion – Manipulation of Robot Components.

UNIT II

Robot Programming

Robot programming Methods-Advantages and Disadvantages of Robot-Requirements for a Robot Ina Industry –Specification for a Robot

UNIT III

Modular Components

Operational Capabilities level of robot-Modular Robot Components –Wrist Mechanism-Numerical Examples.

UNIT IV

Robot Sensors

Internal Sensors-ExternalSensors-Force-Sensors-Thermocouples-Performance Characteristics

Of Robot-Static Performance Characterstics-Dynamic performance Characteristics.

UNIT V:

Advanced Robot Systems

Heuristics Decision for Robot-Fuzzy logic for robot control-Artificial Neural in Robotics-Robot Calibration.

Reference books:

1. AppuuKuttan ,K.K,Robotics, I.K International Publishing House Pvt. Ltd.
2. Danny Staple, Learn Robotics Programming, PacktPublisher.
3. Bijoy K. Ghosh, ,Bhaskar Kumar Ghosh Ning, Control in Robotics and Automation:Sensor-based Integration, Academic Press

E-Resources:

1.https://www.geeksforgeeks.org/robotics

2.https://www.britannica.com/technology/robot-technology

Outcomes:

- Students can able to understand the importance of the importance of Robotics.
- Students can acquire in-depth knowledge on Robotics and its application for the society.
- Students can be familiarizing with Robot programming Methods.
- Students can understand the basic concept and the operational capabilities of Robot.
- Students can able get interpretation about Internal Sensors and External Sensors for Robot.