Kalinga University Atal Nagar (C.G.)

SCHEME OF EXAMINATION
& SYLLABUS

of

MSC (Computer Science)
Master of Science in Computer Science

UNDER

Faculty of Information Technology

w.e.f. Session 2021-22

Kalinga University, Raipur
M.Sc Computer Science (2Years Programme)
w.e.f 2021-2022 Session

Semester I					
Paper Code	**Paper**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total marks**
MSCS101	Advance Programming Java	3	70	30	100
MSCS102	Python Programming	3	70	30	100
MSCS103	Computer Organization & Architecture	3	70	30	100
MSCS104	Discrete Mathematics	3	70	30	100
MSCS105	Digital Signal Processing	3	70	30	100
MSCS106-P	Advance Programming Java-**Lab**	2	30	20	50
MSCS107-P	Python Programming-**Lab**	2	30	20	50
MSCS108-P	Computer Organization & Architecture-Lab	2	30	20	50
	Total	**21**	**440**	**210**	**650**

Semester II					
Paper Code	**Paper**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total marks**
MSCS201	Theory of Automata & Formal Languages	3	70	30	100
MSCS202	Computer Network	3	70	30	100
MSCS203	Operating Systems	3	70	30	100
MSCS204	Computer Graphics and Visualization	3	70	30	100
	Elective-I (Any One)	3	70	30	100
MSCS205A	Cryptography & Network Security				
MSCS205B	Data Warehousing & Data Mining				
MSCS205C	Software Project Management				
MSCS205D	Cloud Computing				
MSCS205E	Compiler Design				
MSCS206P	Computer Network-**Lab**	2	30	20	50
MSCS207P	Operating Systems-**Lab**	2	30	20	50
	Total	**19**	**410**	**190**	**600**

* Student has to undergo for Mini Project/Internship Assessment completion of 2nd Semester which is to be evaluated in 3rd Semester

Semester III					
Paper Code	**Paper**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total marks**
MSCS301	Artificial Intelligence	3	70	30	100
MSCS302	Software Engineering & Testing	3	70	30	100
MSCS303	Web Technology	3	70	30	100
MSCS304	Digital Image Processing	3	70	30	100
	Elective-II (Any One)	3	70	30	100
MSCS305A	Big Data				
MSCS305B	Simulation & Modeling				
MSCS306P	Artificial Intelligence-**Lab**	2	30	20	50
MSCS307P	Software Engineering & Testing **-Lab**	2	30	20	50
MSCS308P	Web Technology-**Lab**	2	30	20	50
MSCS309P	Mini Project & Internship Assessment	2	30	70	100
	Total	**23**	**470**	**280**	**750**

Semester IV					
Paper Code	**Paper**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total marks**
	ELECTIVE –III (Any One)	3	70	30	100
MSCS401A	Privacy & Security in Online Social Media				
MSCS401B	Soft Computing				
MSCS401C	Pattern Recognition				
MSCS401D	Data Analytics				
MSCS401E	Software Quality Engineering				
	ELECTIVE –IV (Any One)	3	70	30	100
MSCS402A	Blockchain Architecture				
MSCS402B	Neural Network				
MSCS402C	Internet of Things				
MSCS402D	Distributed Database Systems				
	ELECTIVE –V (Any One)	3	70	30	100
MSCS403A	Mobile Computing				
MSCS403B	Computer Graphics and Animation				
MSCS403C	Natural Language Processing				
MSCS403D	Machine Learning Techniques				
MSCS403E	Quantum Computing				
MSCS404P	Major Project	10	150	50	200
	Total	**19**	**360**	**140**	**500**

Syllabus

MSCCS 1st Year
Ist Semester

MSC(CS) (Master of Science in Computer Science) FIRST YEAR SYLLABUS SEMESTER-I

Advance Programming Java
(MSCS101)

UNIT – I

Importance and features of Java, *Language Construct of java including* Keywords, constants, variables and looping and decision making construct, Classes and their implementation, Introduction to JVM and its architecture including set of instructions. Overview of JVM Programming. Internal and detailed explanation of a valid .class file format. Instrumentation of a .class file, Byte code engineering libraries, Overview of class loaders and Sandbox model of security.

Introducing classes, objects and methods: defining a class, adding variables and methods, creating objects, constructors, class inheritance. Arrays and String: Creating an array, one and two dimensional arrays, string array and methods, Classes: String and String Buffer classes, Wrapper classes: Basics types, using super, Multilevel hierarchy abstract and final classes, Object class, Packages and interfaces, Access protection, Extending Interfaces, packages.

UNIT – II

Exception Handling: Fundamentals exception types, uncaught exceptions, throw, throw, final, built in exception, creating your own exceptions,

Multithreaded Programming: Fundamentals, Java thread model: priorities, synchronization, messaging, thread classes, Runnable interface, inter thread Communication, suspending, resuming and stopping threads.

Input/Output Programming: Basics, Streams, Byte and Character Stream, predefined streams, Reading and writing from console and files.

Using Standard Java Packages (lang, util, io, net). Networking: Basics, networking classes and interfaces, using java.net package, doing TCP/IP and Data-gram Programming, RMI (Remote Method Invocation).

UNIT – III

Event Handling: Different Mechanism, the Delegation Event Model, Event Classes, Event Listener Interfaces, Adapter and Inner Classes, Working with windows, Graphics and Text, using AWT controls, Layout managers and menus, handling Image, animation, sound and video, Java Applet**.**

The Collection Framework: The Collection Interface, Collection Classes, Working with Maps & Sets

JDBC: Introduction to DBMS & RDBMS, DBC API, JDBC Application Architecture, Obtaining a Connection, JDBC Models: Two Tier and Three Tier Model, ResultSet, Prepared Statement, Callable Statement.

UNIT – IV

RMI (Remote Method Invocation): Introduction, Steps in creating a Remote Object, Generating Stub & Skeleton, RMI Architecture, RMI packages.

Java Bean: Introduction, Bean Architecture, Using the Bean Development Kit, Creating simple bean-properties, methods and events, Packing beans- the manifest & the jar, Java bean package, Introduction to NetBean.

Swing : Introduction to JFC (Java Foundation Classes), Features of Swing, Comparison with AWT, Advanced Control.

Text books:

1. Patrick Naughton and Herbertz Schildt, “Java-2: The Complete Reference”, TMH, 1999.
2. Bill Vanners, “Inside Java Virtual Machine”, TMH, 2nd Ed.
3. Rick Dranell, “HTML 4 unleashed”, Techmedia Publication, 2000
4. Shelley Powers, “Dynamic Web Publishing”, 2nd Ed., Techmedia, 1998.
5. Paul Dietel and Harvey Deitel, “Java How to Program”, PHI, 8th Ed., 2010.

References Books:

1. E. Balaguruswamy, “Programming with Java: A Primer”, TMH, 1998.
2. Horstmann, “Computing Concepts with Java 2 Essentials”, John Wiley.
3. Decker and Hirshfield, “Programming Java: A Introduction to Programming Using JAVA”, Vikas Publication, 2000.
4. N.P Gopalan and J. Akilandeswari, “Web Technology- A Developer’s Perspective”, PHI, 2007.
5. Eric Jendrock, Jennfer Ball and Debbei Carson, “The Java #EE5 Tutorial”, Pearson, 3rd Ed., 2007.

Advance Programming Java-Lab
(MSCS106P)

List of experiments:

1. Create GUI to present a set of choices for a user to select stationary products and display the price of
   Product after selection from the list.
2. Create GUI to demonstrate typical Editable Table which describing Employee for a software company.
3. Create GUI to demonstrate swing components using student registration form.
4. Create a Remote Object for simple arithmetic operators. Use AWT/SWING to create user interface.
5. Write an RMI application using call back mechanism
6. Develop Servlet Question-Answer Application usingHttpServletRequest and HttpServletRequest interfaces.
7. Develop Servlet application to accept HTNO of a student from client and display the memorandum of marksfrom the server
8. JSP Programs
   a. Create a JSP page that prints temperature conversion (from Celsius to Fahrenheit) chart
   b. Create a JSP page to print current date and time
   c. Create a JSP page to print number of times page is referred after the page is loaded.
9. Write a simple JSP application to demonstrate the use of implicit object (at least 5).
10. Develop a Hibernate application to Store Feedback of Website Visitors in MySQL Database.
11. Develop a JSP Application to accept Registration Details from the user and store database table.
12. Develop a JSP Application to Authenticate User Login as per the Registration Details.If Login Success then forward User to Index Page otherwise show Login failure Message.
13. Develop a web Application to add items in the inventory using JSF.
14. Write EJB applications using stateless session beans and state-full session beans.
15. Develop a Room Reservation System Application using Entity Beans.
16. Create Three-tire application using Servlets, JSP, EJB.

Python Programming
(MSCS102)

Course Objectives:

- To Introduce Python Programming Language as Multipurpose Programming Language with Features and Applications.
- To Learn Installing Python and Introducing Cross Multiplatform Usage of Python.
- To Practice Basic Language Features of Python and Implement Oops Concepts Using Python.
- Learn core python structures and flow control, Create and run python functions
- Explore the python library functions for various purpose

Course Outcomes:

- Install and use Python on Various Platform.
- Understand and Explain various features of Python language
- Design and Develop Python applications for data analysis using object-oriented concept
- Build package and modules in Python with reusability and exception Aspect
- Write and execute Simple programs for sorting and searching in Python.

UNIT - I

Introduction to python: python interpreter, using python as calculator, python shell, indentation. Atoms, identifiers and keywords, literals, strings, operators (arithmetic operator, relational operator, logical or Boolean operator, assignment, operator, ternary operator, bit wiseoperator, increment or decrement operator).

UNIT - II

Creating python programs: input and output statements, control statements(branching, looping,conditional statement, exit function, difference between break, continue and pass.), defining functions, default arguments, errors and exceptions. Iteration and recursion: conditional execution, alternative execution, nested conditionals, the return statement.

UNIT - III

Recursion, stack diagrams for recursive functions, multiple assignment, the while statement, tables, two-dimensional tables. Strings and lists: string as a compound data type, length, traversal and the for loop, string slices, string comparison, a find function.

UNIT - IV

Looping and counting, list values, accessing elements, list length, list membership, lists and for loops, list operations, list deletion. Cloning lists, nested lists Object oriented programming: introduction to classes, objects and methods, standard libraries.

UNIT - V

Data structures: arrays, list, set, stacks and queues. Searching and sorting: linear and binary search, bubble, selection and insertion sorting.

References:

- T. Budd, Exploring Python, TMH, 1st Ed, 2011
- How to think like a computer scientist: learning with Python / Allen Downey, Jeffrey Elkner, Chris Meyers. 1st Edition – Freely available online.
- http://docs.python.org/3/tutorial/index.html
- http://interactivepython.org/courselib/static/pythonds

Python Programming Lab
(BCS107P)

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
2. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria :
    a. Grade A: Percentage >=80
    b. Grade B: Percentage>=70 and <80
    c. Grade C: Percentage>=60 and <70
    d. Grade D: Percentage>=40 and <60
    e. Grade E: Percentage<40
2. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input paramters from user.
3. WAP to display the first n terms of Fibonacci series.
4. WAP to find factorial of the given number.
5. WAP to find sum of the following series for n terms: 1 – 2/2! + 3/3! - - - - - n/n!
6. WAP to calculate the sum and product of two compatible matrices.

MSCS103 : COMPUTER ORGANIZATION & ARCHITECTURE

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Describe functional units of digital system and explain how arithmetic and logical operations are performed by computers	K_2, K_3
CO 2	Describe the operations of control unit and write sequence of instructions for carrying out simple operation using various addressing modes.	K_2, K_4
CO 3	Design various types of memory and its organization.	K_3
CO 4	Describe the various modes in which IO devices communicate with CPU and memory.	K_2, K_3
CO 5	List the criteria for classification of parallel computer and describe various architectural schemes.	K_1, K_2
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. **Processor organization:** general registers organization, stack organization and addressing modes.	**08**
II	**Arithmetic and logic unit:** Look ahead carries adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers.	**08**
III	**Control Unit:** Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Pipelining. Hardwire and micro programmed control: micro-program sequencing, concept of horizontal and vertical microprogramming.	**08**
IV	**Memory:** Basic concept and hierarchy, semiconductor RAM memories, 2D & 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and optical disks Virtual memory: concept implementation.	**08**
V	**Input / Output:** Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	**08**

Suggested Readings:

1. John P. Hayes, "Computer Architecture and Organization", McGraw Hill.
2. William Stallings, "Computer Organization and Architecture-Designing for Performance", Pearson Education.
3. M. Morris Mano, "Computer System Architecture", PHI.
4. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", McGraw-Hill.
5. BehroozParahami, "Computer Architecture", Oxford University Press.
6. David A. Patterson and John L. Hennessy, "Computer Architecture-A Quantitative Approach", Elsevier Pub.
7. Tannenbaum, "Structured Computer Organization", PHI.

MSCS104 : Discrete Mathematics		
Course Outcome (CO)	**Bloom's Knowledge Level (KL)**	
At the end of course , the student will be able to		
CO 1	Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions	K_1, K_2
CO 2	Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic	K_2, K_3
CO 3	Identify and prove properties of Algebraic Structures like Groups, Rings and Fields	K_3, K_4
CO 4	Formulate and solve recurrences and recursive functions	K_3, K_4
CO 5	Apply the concept of combinatorics to solve basic problems in discrete mathematics	K_1, K_3
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Set Theory:** Introduction, Size of sets and Cardinals, Venn diagrams, Combination of sets, Multisets, Ordered pairs and Set Identities. **Relation:** Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation. **Functions:** Definition, Classification of functions, Operations on functions, Recursively defined functions.	**08**
II	**Posets, Hasse Diagram and Lattices:** Introduction, Partial ordered sets, Combination of Partial ordered sets, Hasse diagram, Introduction of lattices, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. **Boolean Algebra:** Introduction, Axioms and Theorems of Boolean algebra, Boolean functions. Simplification of Boolean functions, Karnaugh maps, Logic gates.	**08**
III	**Propositional:** Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection. **Predicate Logic:** Theory of Predicates, First order predicate, Predicate formulas, Quantifiers, Inference theory of predicate logic.	**08**
IV	**Algebraic Structures:**Introduction to algebraic Structures and properties. Types of algebraic structures: Semi group, Monoid, Group, Abelian group and Properties of group. Subgroup, Cyclic group, Cosets, Permutation groups, Homomorphism and Isomorphism of groups. **Rings and Fields:** Definition and elementary properties of Rings and Fields.	**08**
V	**Natural Numbers:** Introduction, Piano's axioms, Mathematical Induction, Strong Induction and Induction with Nonzero Base cases. **Recurrence Relation & Generating functions:** Introduction and properties of Generating Functions. Simple Recurrence relation with constant coefficients and Linear recurrence relation without constant coefficients. Methods of solving recurrences. **Combinatorics:** Introduction, Counting techniques and Pigeonhole principle, Polya's Counting theorem.	**08**

Suggested Readings:

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", McGraw Hill, 2006.
2. B. Kolman, R.C Busby and S.C Ross, "Discrete Mathematics Structures", Prentice Hall ,2004.
3. R.P Girimaldi, "Discrete and Combinatorial Mathematics", Addison Wesley, 2004.
4. Y.N. Singh, "Discrete Mathematical Structures", Wiley- India, First edition, 2010.
5. Swapankumar Sarkar, "A Textbook of Discrete Mathematics", S. Chand & Company PVT. LTD.V.
6. Krishnamurthy, "Combinatorics Theory & Application", East-West Press Pvt. Ltd., New Delhi.
7. Liptschutz, Seymour, "Discrete Mathematics", McGraw Hill.
8. J.P. Trembely&R.Manohar, "Discrete Mathematical Structure with application to Computer Science", McGraw Hill.

DIGITAL SIGNAL PROCESSING
MSCS105

Course Learning Outcomes:

CO1: To study the modern digital signal processing algorithms and applications.
CO2: To study the analysis of discrete time signals.
CO3: Comprehensive knowledge to use of digital systems in real time applications
CO4. Apply the algorithms for wide area of recent applications.

Unit 1

Signals and Signal Processing - Characterization and classification of Signals, Typical signal processing operations, Typical Signal Processing Applications, Advantage of Digital Signal Processing.

Unit 2

Classification of signals –Introduction to vector space - The concept of frequency in continuous and discrete time signals -Sampling of analog signals – Sampling theorem – Quantization and Coding – Digital to analog conversion .

Unit 3

Time Domain Representation of signals and systems - Discrete time signals, Operations on sequences, Discrete time Systems, Linear Time invariant Discrete Time Systems-convolution sum – correlation of discrete time signals , Z-Transform.

Unit 4

Frequency Analysis of Signals - Frequency Analysis of Continuous Time Signals, Frequency Analysis of Discrete Time Signals, Fourier Transform of discrete time signals –Discrete Fourier Transform (DFT). FFT(Qualitative idea only)-Wavelet Transform - FIR and IIR Filters

Reference Books:

1. Proakis, John G. and Dimitris G. Manolakis. Digital signal processing: principles algorithms and applications. Pearson Education India, 2001.

2. Roberts, Michael J. Signals and systems: analysis using transform methods and MATLAB. McGraw-Hill Higher Education, 2011.
3. Oppenheim, Alan V., and Ronald W. Schafer. Digital Signal Processing [by] Alan V. Oppenheim [and] Ronald W. Schafer.Prentice-Hall, 1975.
4. Antoniou, Andreas. Digital signal processing.McGraw-Hill, 2016.
5. Rabiner, Lawrence R., Bernard Gold, and C. K. Yuen. Theory and application of digital signal processing. Prentice-Hall, 2007.

MSCS108P: COMPUTER ORGANIZATION & ARCHITECTURE LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to		
CO1	Design and verify combinational circuits (adder, code converter, decoder, multiplexer) using basic gates.	K_6
CO2	Design and verify various flip-flops.	K_3
CO3	Design I/O system and ALU.	K_3
CO4	Demonstrate combinational circuit using simulator	K_2

1. Implementing HALF ADDER, FULL ADDER using basic logic gates.
2. Implementing Binary -to -Gray, Gray -to -Binary code conversions.
3. Implementing 3-8 line DECODER. Implementing 4x1 and 8x1 MULTIPLEXERS.
4. Verify the excitation tables of various FLIP-FLOPS.
5. Design of an 8-bit Input/ Output system with four 8-bit Internal Registers.
6. Design of an 8-bit ARITHMETIC LOGIC UNIT.
7. Design the data path of a computer from its register transfer language description.
8. Design the control unit of a computer using either hardwiring or microprogramming based on its register transfer language description.
9. Implement a simple instruction set computer with a control unit and a data path.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

MSCCS 1st Year
IInd Semester

MSCS (Master of Science in Computer Science)
FIRST YEAR SYLLABUS SEMESTER-II

MSCS201: THEORY OF AUTOMATA & FORMAL LANGUAGES		
Course Outcome (CO)	**Bloom's Knowledge Level (KL)**	
At the end of course , the student will be able to		
CO 1	Define various types of automata for different classes of formal languages and explain their working.	K_1, K_2
CO 2	State and prove key properties of formal languages and automata.	K_1, K_3
CO 3	Construct appropriate formal notations (such as grammars, acceptors, transducers and regular expressions) for given formal languages.	K_3, K_4
CO 4	Convert among equivalent notations for formal languages.	K_3
CO 5	Explain the significance of the Universal Turing machine, Church-Turing thesis and concept of Undecidability.	K_2
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Basic Concepts and Automata Theory:** Introduction to Theory of Computation- Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages, Deterministic Finite Automaton (DFA)- Definition, Representation, Acceptability of a String and Language, Non Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ε-Transition, Equivalence of NFA's with and without ε-Transition, Finite Automata with output- Moore machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata, Myhill-Nerode Theorem, Simulation of DFA and NFA.	**08**
II	**RegularExpressionsandLanguages:**RegularExpressions,Transition Graph,Kleen'sTheorem, Finite Automata and Regular Expression-Arden's theorem, Algebraic Method Using Arden's Theorem, Regular and Non-Regular Languages- Closure properties of Regular Languages, Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma, Decidability- Decision properties, Finite Automata and Regular Languages, Regular Languages and Computers, Simulation of Transition Graph and Regular language.	**08**
III	**Regular and Non-Regular Grammars**: Context Free Grammar(CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity, Regular Grammars-Right Linear and Left Linear grammars, Conversion of FA into CFG and Regular grammar into FA, Simplification of CFG, Normal Forms- Chomsky Normal Form(CNF), Greibach Normal Form (GNF),Chomsky Hierarchy, Programming problems based on the properties of CFGs.	**08**
IV	**Push Down Automata and Properties of Context Free Languages**: Nondeterministic Pushdown Automata (NPDA)- Definition, Moves, A Language Accepted by NPDA, Deterministic Pushdown Automata(DPDA) and Deterministic Context free Languages(DCFL),	**08**

	Pushdown Automata for Context Free Languages, Context Free grammars for Pushdown Automata, Two stack Pushdown Automata, Pumping Lemma for CFL, Closure properties of CFL, Decision Problems of CFL, Programming problems based on the properties of CFLs.	
V	**Turing Machines and Recursive Function Theory** : Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction, Modifications of Turing Machine, Turing Machine as Computer of Integer Functions, Universal Turing machine, Linear Bounded Automata, Church's Thesis, Recursive and Recursively Enumerable language, Halting Problem, Post Correspondence Problem, Introduction to Recursive Function Theory.	**08**

Suggested Readings:

1. J.E. Hopcraft, R. Motwani, and Ullman, "Introduction to Automata theory, Languages and Computation", Pearson EducationAsia,2nd Edition.
2. J. Martin, "Introduction to languages and the theory of computation", McGraw Hill, 3rd Edition.
3. C. Papadimitrou and C. L. Lewis, "Elements and Theory of Computation", PHI.
4. K.L.P. Mishra and N. Chandrasekaran ,"Theory of Computer Science Automata Languages and Computation" , PHI.
5. Y.N. Singh, "Mathematical Foundation of Computer Science", New Age International.

Computer Network
(MSCS202)

Course Objectives:

1. To make student know, the network architecture comprising of hardware & software technologies, also to provide the basic Knowledge of data Communication.
2. To make students know, the insight working of network in terms of layered architecture, which includes a set of protocol and its implementation.
3. To make students know, the practical aspect of working of Ethernet in terms of IEEE standards.
4. To make students know, the general principles of network in terms of routing algorithm and Internet architecture and addressing.
5. To make students know, the security aspects in network and implementing it through various methodologies.

Course Outcome:

1. The students will be able to understand the structure and organization of computer networks; including the division into layers, role of each layer, and relationships between the layers.
2. The students will have basic understanding of Communication techniques and functioning of physical layer.
3. The students will be able to understand the basic concepts of data link layer properties; including the flow control mechanisms.
4. The students will be able to understand the basic concepts of application layer protocol design i.e.
5. Thestudentswillbeabletounderstandthebasicconceptsofnetworksecurityconcepts; including authentication, integrity and system security design challenges.

UNIT-I Introduction:
Layered Network Architecture, ISO- OSI Model, Introduction to TCP/IP Model.; Data Communication Techniques: Pulse Code Modulation (PCM), Differential Pulse Code Modulation (DPCM), Delta Modulation (DM).; Multiplexing Techniques: Frequency Division, Time Division, Statistical Time Division Multiplexing; Transmission Media: Wires, Cables, Radio Links, Satellite Link, Fiber Optic.

UNIT-II Data Link Layer Protocols:
Noise Free Channels Protocol: Stop and Wait Protocols, Sliding Window Protocol, Noisy Channels Protocols: Stop and Wait ARQ, Sliding Window ARQ: Go Back and Selective Repeat ARQS, ISDN, Asynchronous Transfer Mode (ATM), ATM cells, Header and Cell Formats, Error Detection And Correction: Single and Burst Error, Parity Check Codes, Cyclic Redundancy Code & Hamming Code.

UNIT-III Medium Access Control Sub Layer:
Concept of Random Access, Pure ALOHA, Throughput characteristics of ALOHA, Throughputs for finite and infinite populations, S-ALOHA, LAN: IEEE 802.3, 802.4 and 802.5 Protocols, Performance of Ethernet, Token Ring Protocol, FDDI Protocol, Distributed Queue Dual Bus (DQDB) Protocol.

UNIT-IV Network and Transport Layer Protocols:
General Principles, Virtual Circuits and Data-grams, Windows Flow Control, Packet Discarding, Traffic Shaping, Choke RSVP, Network Devices: Bridges, Routers and Gateways, Routing Algorithms**:** Optimality principle, Shortest Path Routing- Dijkstra, Distance Vector

Routing, Link State Routing, Flow Based Routing, Multicasting Routing, Flooding and Broadcasting, Flow and Congestion Control, Internet Architecture and Addressing, Transport Layer: Design Issues, Quality of Services, Primitives, Connection Management: Addressing, Connection Establishment and Releases, Flow Control and Buffering, Crash Recovery, Protocols: Transmission Control Protocol (TCP), User Datagram Protocol UDP).

UNIT-V Application Layer Protocols and Other Networks:
Cryptography: Substitution and Transposition, Ciphers, Data Encryption Standard (DES), DES Chaining, Breaking DES, Public key Cryptography, Authentication Protocols, Virtual LAN (VLAN), Virtual Private Network (VPN).

Text Books:

1. A.S. Tanenbaum " Computer Network: Second Ed. Prentice Hall, India(tan)
2. B.A. Frouzan, Data Communication , Tata McGraw Hill.

Reference Books:

1. D. Berekas and R. Gallager, " Data Networks", second Ed. Prentice Hall, India
2. D.E. Coner," Intertworking with TCP/IP", Vol-I. Prentice Hall India.
3. G.E. Keiser, " Local Area Networks", McGraw Hill, International Ed.
4. W. Stalling, "Data & Computer Communications", Maxwell Macmillan International Ed.

Computer Network-Lab
(MSCS206P)

List of experiments:

1. Program to identify the category of the IP address for the given IP address
2. Program to implement sliding window protocol
3. Program for Socket pair system call usage in IPC
4. Program for Socket options using signals
5. Program to implement Echo concurrent Stream Server
6. Program to implement Echo concurrent stream client
7. Program to implement Listener and Talker
8. Program to implement TCP time service
9. Program to implement UDP time service
10. Program to implement Ping service
11. Program to implement Route tracing program
12. Program to implement File Transfer Protocol
13. Program to implement any Shortest path routing Algorithm
14. Program to implement Distance Vector Routing Implementation
15. Program to implement ICMP Error Message simulations
16. Program to implement Reverse Address Resolution Protocol

Note:

 Recommended to use Open Source Software likeFedora, Ubuntu, CentOS, etc...
 Strictly recommended to write above programs using C language on Linux systems.

MSCS203 : OPERATING SYSTEMS		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to		
CO 1	Explain main components, services, types and structure of Operating Systems.	K_2
CO 2	Apply the various algorithms and techniques to handle the various concurrency control issues.	K_3
CO 3	Compare and apply various CPU scheduling algorithms for process execution.	K_2
CO 4	Identify occurrence of deadlock and describe ways to handle it.	K_3
CO 5	Explain and apply various memory, I/O and disk management techniques.	K_5
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction**: Operating System Structure- Layered structure, System Components, Operating system functions, Classification of Operating systems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multi process Systems, Multithreaded Systems, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.	**08**
II	**Concurrent Processes**: Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation, Classical Problem in Concurrency- Dining Philosopher Problem, Sleeping Barber Problem, Inter Process Communication models and Schemes, Process generation.	**08**
III	**CPU Scheduling:** Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.	**08**
IV	**Memory Management:** Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.	**08**
V	**I/O Management and Disk Scheduling**: I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.	**08**

Suggested Readings:

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts",Wiley Publication.
2. Sibsankar Halder and Alex A Arvind, "Operating Systems", Pearson Education.
3. Harvey M Dietel, "An Introduction to Operating System", Pearson Education.
4. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, Pearson Education.
5. Harris, Schaum's Outline Of Operating Systems, McGraw Hill

Operating System-Lab
(MSCS207P)

List of experiments:

1. Write shell programs using ‘case’, ‘then’ and ‘if’ & ’else’ statements.
2. Write shell programs using while, do-while and for loop statements.
3. Write a program to create a child process using fork(), exec() system calls and use other system calls.
4. Write a program to convert upper case to lower case letters of a given ASCII file.
5. Write a program to program to search the given pattern in a file.
6. Write a program to implementation of Signals in UNIX.
7. Write a program to simulate UNIX commands like ls, grep, cp.
8. Write a program to demonstrate FCFS and SJF process schedules on the given data.
9. Write a program to demonstrate CPU Priority and Round Robin Scheduling on the given burst time and arrival times.
10. Write a program to simulate Inter Process Communication using pipes.
11. Write a program to implementing Producer and Consumer problem using Semaphores.
12. Write a program tosimulate Bankers Algorithm for Dead Lock Avoidance
13. Write a program tosimulate Bankers Algorithm Dead Lock Prevention.
14. Write a program tosimulate Paging Techniques of memory management.
15. Write a program tosimulate FIFO, LRU, LFU Page replacement algorithms.
16. Write a program tosimulate Sequential, Indexed, and Linked file allocation strategies.

Note:
 Recommended to use Open Source Software likeFedora, Ubuntu, CentOS, etc...
 Recommended to write programs using C/C++ on Linux systems.

COMPUTER GRAPHICS AND VISUALIZATION
(MSCS204)

Course Learning Outcomes:

CO1:Understanding the concepts of Graphics Input Output devices
CO2:Analysis of algorithms such as line drawing, circle drawing
CO3:Understanding 2D&3D transformations and projection
CO4: Understanding fundamentals of visualization

Unit 1
Basic concepts in Computer Graphics – Types of Graphic Devices – Interactive Graphic inputs – Raster Scan and Random Scan Displays.Line Drawing Algorithm- DDA, Bresenham's algorithm – Circle Generation Algorithms –Mid point circle algorithm, Bresenham's algorithm- Scan Conversion-frame buffers – solid area scan conversion – polygon filling algorithms.

Unit 2
Two dimensional transformations.Homogeneous coordinate systems – matrix formulation and concatenation of transformations. Windowing concepts –Window to Viewport Transformation- Two dimensional clipping-Line clipping – Cohen Sutherland,Polygon clipping-Sutherland Hodgeman algorithm, Three dimensional object representation, Polygon surfaces, Quadric surfaces – Basic 3D transformations.

Unit 3
Three-dimensional viewing : Overview of 3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformations, orthogonal projections (axonometric and isometric, orthogonal projection coordinates, clippingwindow and orthogonal projection view volume, Normalization transformation), Oblique parallel projections (Cavalier and cabinet projections, Clipping window and Oblique parallel-projection view volume, Oblique parallel projection transformation matrix, normalization transformation), Perspective projections (transformation coordinates, perspective- projection equations, vanishing points, view volume, transformation matrix, symmetric and oblique perspective-projection frustum, Normalized perspective-projection transformation coordinates), 3D clipping algorithms (region codes, point and line clipping, polygon clipping)

Unit 4
3D Object representation: Quadric surfaces, superquadrics, spline representations.Visible surface detection methods : Classification, Back-face detection, depth-Buffer method, Abuffer method. Wireframe visibility methods.Illumination models and surface rendering methods :Light sources, Surface lighting effects, Basic illumination models (Ambient light, Diffuse reflection, Specular reflection and the Phong model), polygon rendering methods (constant intensity surface rendering, Gouraud surface rendering, Phong surface rendering), Ray tracing methods – basic Ray- tracing algorithm.

Text Books:

1. Donald Hearn and M. Pauline Baker, Computer Graphics, PHI, 2e, 1996
2. E. Gose, R. Johnsonbaugh and S. Jost., Pattern Recognition and Image Analysis, PHI PTR, 1996 (Module VI – Image Processing part)
3. William M. Newman and Robert F. Sproull , Principles of Interactive Computer Graphics. McGraw Hill, 2e, 1979
4. Zhigang Xiang and Roy Plastock, Computer Graphics (Schaum's outline Series), McGraw Hill, 1986.

References:

1. David F. Rogers , Procedural Elements for Computer Graphics, Tata McGraw Hill, 2001.
2. M. Sonka, V. Hlavac, and R. Boyle, Image Processing, Analysis, and Machine Vision,

Thomson India Edition, 2007.
3. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Pearson, 2017.

Cryptography and Network Security
(MSCS205A)

Course Objectives:

1. To make student know, the essentials of computer security, also to provide the basic knowledge of security issues.
2. To make students know, different cryptography techniques namely public and private key cryptography.
3. To make students understand, network security protocol including firewall.
4. The students will be able to know advanced attacking techniques.

Course Outcome:

1. The students will be able to understand cyber security fundamentals.
2. The students will have basic understanding of cryptography techniques and function.
3. The students will have in depth understanding of network security algorithms including Firewall.
4. The students will be able to know various advanced attacking techniques.
5. The students will be able to know various cyber security policies.

UNIT- I FOUNDATION OF CRYPTOGRAPHY AND SECURITY: -The OSI Security Architecture, A model for network Security, Symmetric cipher model Substitution techniques Mathematical Tools for Cryptography: Modular Arithmetic, Euclid's Algorithm. Design Principle of Block ciphers: Theory of Block Cipher Design, Feistel ciphers, DES and Triple DES, Strength Of DES, Modes of Operation (ECB, CBC, OFB, CFB).

UNIT- II PUBLIC KEY CRYPTOGRAPHY: - Prime Numbers and Testing for Primality, Principles of public key Cryptosystems RSA, Key Management Diffie- Hellman, key exchange, Hashes and Message Digests: Message Authentication codes, MD5, SHA-1, HMAC.

UNIT- III DIGITAL SIGNATURES, CERTIFICATES, AND STANDARDS: - Digital Signature Standard
(DSS and DSA),Authentication: Kerberos V4, Electronic Mail Security: Pretty Good Privacy (PGP), **System Security**: Computer Virus, Firewall and Design Principles, Electronic Commerce Security: Secure Electronic Transaction (SET).

UNIT- IVCYBER SECURITY FUNDAMENTALS & ATTACKING TECHNIQUES: Security Concepts:
Cyber Crimes and Criminals: Definition of cyber-crime, types of cyber-crimes and types of cyber-criminals. Antiforensics: Use of proxies, use of tunneling techniques. Fraud techniques: Phishing and malicious mobile code, Rogue antivirus, Click fraud. Threat Infrastructure: Botnets, Fast Flux and advanced fast flux.

UNIT–V CYBER SECURITY POLICY CATALOG: Cyber Governance Issues, Internet Names and Numbers, Copyrights and Trademarks, Email and Messaging, Cyber User Issues, Cyber Crime, Geo location, Privacy, Cyber Conflict Issues, Intellectual Property Theft, Cyber Espionage.

Text Books:
(1) Cryptography and Network Security, William Stalling, PHI.

(2) Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2003.
(3) Cyber Security Essentials, James Graham, Richard, Ryan CRC press, 2011.

Reference Books:

(1) Cyber Security policy Guidebook, Jennifer, Jason, Paul, Marcus, Jeffery, Joseph. Wiley Publication,2012.
(2) Robertra Bragg “Network Security: The Complete Reference”, Tata McGraw Hill.

Data Warehousing & Data Mining
(MSCS205B)

Course Objectives:

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

Course Outcomes:

- Upon completion of the course, the students should be able to:
- Design a Data warehouse system and perform business analysis with OLAP tools.
- Apply suitable pre-processing and visualization techniques for data analysis
- Apply frequent pattern and association rule mining techniques for data analysis
- Apply appropriate classification and clustering techniques for data analysis

Unit - I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP)

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

Unit - II DATA MINING – INTRODUCTION

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

Unit - III DATA MINING – FREQUENT PATTERN ANALYSIS

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

Unit - IV CLASSIFICATION AND CLUSTERING

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines –— Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

Unit - V WEKA TOOL

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

References Books:

1. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, ShyamDiwakar and V. Ajay, ―Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.

3. Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.
4. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

Software Project Management
(MSCS205C)

Course Objective:

- Understand the concepts of Software Engineering and Project Management.
- Familiarize Project Management framework and Tools.
- Apply knowledge of Project Life Cycle to implement the projects.
- Apply the requirement specification and designing tools along with UML.
- Understand the techniques of project scheduling & project implementation.
- Learn software cost estimation and software quality assurance techniques.

Course Outcome:

- Define the key concepts of Software Project Management.
- Demonstrate understanding of the requirements Analysis and Application of UML Models.
- Make use of estimation logic for estimation of software size as well as cost of software.
- Examine the need of change management during software development as well as application of quality tools.
- Assess various factors influencing project management, quality assurance and risk assessment.
- Develop process for successful quality project delivery.

Unit - I

An Overview of Software Project Management: Introduction to Project, Project Management, Difference between Software Engineering & Software Project Management. An Overview of IT Project Management: Define project, project management framework, The role of project Manager, Systems View of Project Management, Stakeholder management,Leadership in Projects: Modern Approaches to Leadership & Leadership Styles.

Unit - II

Software Process Models: Project phases and the project life cycle, Waterfall Model, Evolutionary Process Model: Prototype and Spiral Model, Incremental Process model: Iterative approach, RAD model, Agile Development Model: Extreme programming, Scrum.

Software Requirement Analysis and Design: Types of Requirement, Feasibility Study, Requirement Elicitation Techniques: Interviews, Questionnaire, Brainstorming, Facilitated Application Specification Technique (FAST), Requirement Analysis and Design: Data Flow Diagram (DFD), Data Dictionary, Software Requirement Specification (SRS).

Unit - III

Object Oriented Analysis and Design: UML Overview, The Nature and purpose of Models, UML diagrams(Use Case diagram, Activity Diagram, Class & Object Diagram, Sequence Diagram, State Transition Diagram, Deployment Diagram).

Software Project Planning & Software Cost Estimation: Business Case, Project selection and Approval, Project charter, Project Scopemanagement, Creating the Work Breakdown Structures (WBS). Software Estimation: Size Estimation: Function Point (Numericals). CostEstimation: COCOMO (Numericals), COCOMO-II (Numericals)till Early design model.

Unit - IV

Project Scheduling and Procurement Management: Relationship between people and Effort: Staffing Level Estimation, Effect of schedule

Change on Cost, Project Schedule, Schedule Control, Critical Path Method (CPM) (Numericals), Basics of Procurement Management, Change Management.

Software and System Quality Management: Overview of ISO 9001, SEI Capability Maturity Model, McCalls Quality Model, Six Sigma, Formal Technical Reviews, Tools and Techniques

for Quality Control, Pareto Analysis, Statistical Sampling, Quality Control Charts and the seven Run Rule.

Unit - V

Software Risk Management: Identify IT Project Risk, Risk Analysis and Assessment, Risk Strategies, Risk Monitoring and Control, Risk Response and Evaluation.

The Project Implementation Plan and Closure: The Project Implementation Plan and Closure : Project Implementation Administrative Closure.

Reference Books:

1. Software Engineering, 5th and 7th edition, by Roger S Pressman, McGraw Hill publication.
2. Managing Information Technology Project, 6edition, by Kathy Schwalbe, Cengage Learning publication.
3. Information Technology Project Management by Jack T Marchewka Wiley India publication.
4. Software Engineering 3rd edition by KK Agrawal, Yogesh Singh, New Age International publication.
5. The Unified Modelling Language Reference manual, Second Edition, James Rambaugh,Iver Jacobson, Grady Booch, Addition- Wesley.+
6. Object-Oriented Modeling and Design with UML, Michael Blaha, James Rumbaugh, PHI(2005).

Cloud Computing
(MSCS205D)

COURSE OBJECTIVES

- To understand Cloud Computing concepts, technologies, architecture and applications
- To understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization
- To understand different cloud programming platforms and tools to develop and deploy applications on cloud

COURSE OUTCOMES

Upon successful completion of this course students should be able to:

1. Develop and deploy cloud application using popular cloud platforms
2. Design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud and building private cloud.
3. Make recommendations on cloud computing solutions for an enterprise.

Unit - I

Introduction - Overview of Computing Paradigms: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Cloud Computing (NIST Model) Properties and Characteristics of Cloud. Cloud Computing Architecture - Cloud computing stack Service Models (XaaS): Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service(SaaS) Deployment Models: Public cloud, Private cloud, Hybrid cloud. Data Center Architecture.

Unit - II

Cloud Resource Virtualization - Introduction to virtualization Different approaches to virtualization Hypervisors Machine Image Virtual Machine(VM) Process VM vs System VM Resource Virtualization: Server, Storage, Network Full Virtualization vs Para Virtualization Operating System Support for Virtualization Virtual Machine(resource) Provisioning and Manageability VM Placement, VM Migration.

Unit - III

Service Management in Cloud Computing - Service Level Agreements(SLAs) Billing & Accounting Economics of scaling Managing Data: Database & Data Stores in Cloud, Large Scale Data Processing.

Unit - IV

Task Scheduling in Cloud - Scheduling Algorithms for Computing Clouds Fair Queuing Start Time Fair Queuing Borrowed Virtual Time Cloud Scheduling Subject to Deadlines Scheduling MapReduce Applications Subject to Deadlines.

Unit - V

Cloud Security - Cloud Security Risks, Trust, Operating System Security, VM Security, Security of Virtualization, Security Risks Posted by Shared Images, Security Risks Posted by Management OS, Data privacy and security Issues, Identity & Access Management, Access Control, Authentication in cloud computing,Case Study - Microsoft Azure, Amazon EC2

Reference Books:

1. Dan C Marinescu, Cloud Computing, Theory and Practice, MK Elsevier
2. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley
3. Barrie Sosinsky, Cloud Computing Bible, Wiley
4. Jim Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, MK Elsevier

Compiler Design
(MSCS205E)

Course objectives:

1. To introduce various phases of compiler design.
2. To introduce the major concept areas of language translation and compiler design
3. To develop an awareness of the function and complexity of modern compilers.
4. To introduce code optimization techniques.

Course Outcome:

1. Students will have a concrete view on the theoretical and practical aspects of compiler design
2. Students will be able to apply ideas and techniques discussed to various software design
3. Students will be able to understand the complexity of compiler.
4. Students will be able to understand the working of runtime environment.

UNIT- I Introduction:

Introduction to Compiler, single and multi-pass compilers, Translators, Phases of Compilers, Compiler writing tools, Bootstrapping, Finite Automata and Lexical Analysis: Role of Lexical Analyzer, Specification of tokens, Recognition of tokens, Regular expression, Finite automata, from regular expression to finite automata, transition diagrams, Implementation of lexical analyzer, Tool for lexical anal yzer–LEX, Error reporting.

UNIT- II Syntax Analysis and Parsing Techniques:

Context free grammars, Bottom-up parsing and top down parsing, Top down Parsing: elimi nation of left recursion, recursive descent parsing, Predictive Parsing; Bottom Up Parsing: Operator precedence parsing, LR parsers, Construction of SLR, canonical LR and LALR parsing tables, Construction of SLR parse tables for ambiguous grammar.

UNIT- III Syntax Directed Translation & Intermediate code generation:

Synthesized and inherited attributes, dependency graph, Construction of syntax trees, bottom up and top down evaluation of attributes, Sattributed and L-attributed definitions. Postfix notation; Three address code, quadruples, triples and indirect triples, Translation of assignment statements, control flow, Boolean expressions.

UNIT- IV Runtime Environment:

Storage organization, activation tree, activation record, allocation strategies: stack and heap, symbol table management, dynamic storage allocation: implicit and explicit.

UNIT- V Code Optimization & Code Generation:

Basic blocks and flow graphs, Optimization of basic blocks, Loop optimization, Loop invariant computations. Issues
in the design of Code generator, simple Code generator.

Text Books:

1. Compilers-Principles, Techniques and Tools by Alfred V.Aho, Ravi Sethi and J.D. Ullman, AddisonWesley.
2. PrinciplesofCompilerDesign, AlfredV. AhoandJ.D.Ullman,Narosa Publication.

Reference Books:

1. Compiler design in C by A.C. Holub, Prentice Hallof India.

2. Compiler construction (Theory and Practice) by A. Barret William and M. Bates (Galgotia Publication).
3. Compiler Design, Kakde, Compiler Design, Galgotia Publication.

Syllabus

MSCCS 2nd Year
3rd Semester

Artificial Intelligence
(MSCS301)

Course Objectives:

1. To make students learn to define problem of complex nature , state space of problem domain and searching techniques to solve them.
2. To make students understand concept of heuristic and how it is applied to solve AI based problem along with mechanism to represent knowledge structures and inference procedure.
3. To make student learn processing of natural language and challenges associated with it.
4. To make students understand basics of Machine learning
5. To make students understand concept of Expert System, its design issues and applications

Course Outcome:

1. Student will have ability to understand and define different AI problem and apply suitable problem solving technique.
2. Student will have ability to define the heuristics and apply them for solving complex problem with understanding of different heuristic based search techniques.
3. Student will develop an understanding of game playing techniques
4. Student will have understanding of different knowledge structure and inference mechanism with ability to apply them in intelligent solutions of complex problem.

UNIT-I General overview of AI & Search techniques:
Introduction to AI, Problem Solving: State space representation, characteristic of problem; Control Strategies Production systems, Blind searches: Depth first, Breadth first search.
Informed Search: Hill climbing; Branch and Bound technique; Best first search, Constraint Satisfaction problems.

UNIT-II Heuristic Search techniques & Knowledge Representation:
A* algorithm; Problem reduction AND-OR graph and AO* algorithm; Game Playing: Minimax search procedure; Alpha-Beta cutoffs; **Knowledge representation:** First Order Predicate Calculus; Skolemnisation; Resolution Principle and Unification Algorithm; Semantic Networks; Frame Systems ; Scripts; Conceptual Dependency.

UNIT-III Natural Language Processing, Planning and Uncertainty:
Phases of NLP; Recursive Transition Nets (RTN); Augmented Transition Nets (ATN); Planning Overview – An Example Domain: The Blocks Word; Component of Planning Systems; Goal Stack Planning (linear planning); Non-linear Planning using constraint posting; Probabilistic Reasoning and Uncertainty; Probability theory; Bayes Theorem and Bayesian network.

UNIT-IV Machine learning Paradigms:
Components of learning system; supervised and unsupervised learning; Reinforcement learning; Inductive learning: Decision trees deductive learning: Probability based reasoning, Clusteringk means fuzzy C means; hierarchal clustering, Introduction of Artificial Neural network.

UNIT-V Expert system and application:
Introduction to Expert Systems, Architecture of Expert Systems; characteristic of expert system, Rule based expert system: forward chaining, applications of expert system, Expert System Shells; Knowledge Acquisition; tools for knowledge acquisition Case Studies: MYCIN,

Text Book:
1. Elaine Rich and Kevin Knight: Artificial Intelligence- Tata McGraw Hill.
2. Saroj Kaushik: "Artificial Intelligence", Cenage Learning
3. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems- Prentice Hall of India.
4. B. Yegnanarayana:"Artificial Neural Networks", Prentice Hall of India.
Reference Books:
1. Nils J. Nilsson: Principles of Artificial Intelligence- Narosa Publishing house.
2. Artificial Intelligence : A Modern Approach, Stuart Rusell, Peter Norvig, Pearson Education,2nd Edition
3. Artificial Intelligence, Winston, Patrick, Henry, Pearson Education.
4. Siman Haykin,"Neural Netowrks"Prentice Hall of India
5 John Yen,rezaLangari:"Fuzzy Logic" Pearson Education.

Artificial Intelligence Lab
(MSCS306P)

List of experiments:

1. Write a program to demonstrate Inference Concept in Prolog.
2. Write a program to implement and check Car Data Base system.
3. Write a program on External Goal.
4. Write a program on internal Goal.
5. Write a program for testing the Graph.
6. Write a program on FAIL predicate to find all Solutions.
7. Write a program on Recursion to print a set of numbers.
8. Write a program to process List with Header.
9. Write a program on Exclusion using FAIL predicate.
10. Write a program on List processing with fail predicate.
11. Write a program to implement Login mechanism without recursion.
12. Write a program to implement Login mechanism with Repeat Predicate.
13. Write a program to implement Login mechanism without repeat predicate with recursion.
14. Write a program to test whether an element is a member of list or not.
15. Write a program on CUT predicate to prevent backtracking.
16. Write a program addition of two integers using built-in predicates.
17. Write a program to find square root of a number.
18. Write a program comparison operators.
19. Write a program to implement simple Counter.

Software Engineering and Testing
(MSCS302)

Course Objectives

- To discuss the software engineering discipline, its evolution, impact and emergence of software engineering and explain the development and use of different software life cycle models for real-life industrial applications.
- To discuss different aspects of software project management, risk management and configuration management and explain various requirement elicitation, analysis and specification techniques.
- To discuss various software design methodologies, the impact of cohesion and coupling measures on the goodness of the software design.
- To discuss the importance of practicing different coding standards, guidelines and different testing strategies along with software reliability metrics and software quality management techniques & standards.

Course Outcomes

After reading this subject, students will be able to:

1. Choose a proper life cycle model for different real-life industrial projects, prepare the SRS document, design the software using function-oriented approach (DFDs) and object-oriented approach (UML diagrams), code it, and test the developed software using different software testing strategies.
2. Understand the concepts of computer aided software engineering (CASE) and use different CASE tools in the development, maintenance and reuse of software systems.

Unit - I

Software development life cycle and Project Management: Software development life cycle (SDLC) models, software project management, project planning, project estimation, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

Unit - II

Requirements analysis and specification: Requirements gathering and analysis, software requirements specification, formal systems specification, axiomatic specification, algebraic specification.

Unit - III

Software Design: Outcome of a design process, cohesion and coupling, layered arrangement of modules, approaches to software design, function-oriented software design: overview of SA/SD methodology, structured analysis, DFDs, structured design, detailed design, design review, object-oriented software design: UML diagrams, use case modelling, unified process, OOD goodness criteria, user interface design, types of user interfaces, component-based GUI development.

Unit - IV

Coding and Testing: Coding standards and guidelines, code review, software documentation, unit testing, black-box testing, white-box testing, debugging, integration testing, system testing.

Unit - V

Software reliability and Quality management: Software reliability, Statistical testing, software quality, ISO 9000, SEI CMM, PSP, Six sigma, CASE Tools, Software maintenance, Software reuse.

Reference Books:

1. R. S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill Publications , 2006
2. R. Mall, Fundamentals of Software Engineering, PHI Learning , 2014
3. I.Sommerville, Software Engineering, Pearson Education , 2006
4. A.Behferooz and F. J. Hudson, Software Engineering Fundamentals, Oxford University Press, 2000

Software Engineering & Testing Lab

(MSCS307P)

Course Objective:

- To develop SRS document, design documents such as ER Diagrams, DFDs, UML Diagrams etc. for some given software project.
- To develop efficient codes for some given software projects and test the developed code using different tools.
- To implement different software project management techniques.
- To use different computer aided software engineering (CASE) tools.

Course Outcomes:

After reading this subject, students will be able to:

- Develop SRS document, design documents such as ER Diagrams, DFDs, UML Diagrams etc. for a given software project.
- Develop efficient codes for a given software project using appropriate coding standards and guidelines and test the developed code using different tools.
- Implement different software project management techniques such as FP, COCOMO, CPM, PERT etc.
- Know the use of different computer aided software engineering (CASE) tools in the development, maintenance and reuse of software systems.

Experiment List:

1. Prepare the SRS document for each of the following problems. You should identify the appropriate requirements for each problem Draw the Use Case diagrams, Domain Models, and Class Diagrams. Draw the Sequence Diagrams and Collaboration Diagrams for each Use Case, Draw the State Chart Diagrams and Activity Diagrams, wherever necessary develop the corresponding software using Java with an interactive GUI and appropriate Database. Also, formally specify the following systems using Z and Petrinet.
    a. Develop software to automate the book keeping activities of a 5 star hotel
    b. The local newspaper and magazine delivery agency wants to automate the various clerical activities associated with its business. Develop a software for this.
    c. A small automobile spare parts shop sells the spare parts for vehicles of several makes and models. Each spare part is typically manufactured by several small industries. To streamline the sales and supply ordering, the shop owner wants to automate the activities associated with his business. Develop a software for this.
    d. Develop a software for the automation of the dispensary of Kalinga University.
    e. Develop a software for automating various activities of the Estate Office of Kalinga University.
    f. Develop a word processing software with some limited number of facilities such as making bold italics, underline, cut, copy and paste etc.
    g. Develop a graphics editor software package, using which one can create / modify several common types of graphics entities.
    h. Develop a software for automating various activities of the departmental offices of Kalinga University.
2. Write a C function for searching an integer value from a large sorted sequence of integer values stored in array of size 100, using the binary search method. Build the control flow graph of this function using any compiler writing tool. Write a program in

Java to determine its cyclomatic complexity. Identify the linearly independent paths and generate the test cases using path coverage based strategy.

3. Write a program in Java to determine the number of defects still remaining after testing, using error seeding methodology.
4. Calculate Unadjusted Function Point (UFP), Complexity Adjustment Factor (CAF) and Function Point (FP) for the following problem.

   Number of user inputs=32
   Number of user outputs=60
   Number of user inquiries=24
   Number of files=8
   Number of external interfaces=2
   Assume all weighting factors to be average and all complexity adjustment values to be average.
   Number of user inputs=24 (Weighting factor is average)
   Number of user outputs=46 (Weighting factor is simple)
   Number of user inquiries=8 (Weighting factor is complex)
   Number of files=4 (Weighting factor is average)
   Number of external interfaces=2 (Weighting factor is simple)
   The various complexity adjustment values are 4, 1, 0, 3, 3, 5, 4, 4, 3, 3, 2, 2, 4, 5.
5. For a project of 100,000 LOC embedded system, compute the effort and development time using intermediate COCOMO. Assume there are programmers of the low quality but a lot of experience with the programming language with all other attribute values being nominal. Value for low quality=1.17, value for lot of experience=0.95, nominal value=1.
6. Consider a database application project with the following characteristics. The application has 6 screens with 4 views each and 9 data tables for 3servers and 4 clients. The application may generate 5 report of 6 sections each from 5 data tables from 2 server and 3 clients. There is 12% reuse of object points. The developers experience and capability in the similar environment is low. The maturity of organization in terms of capability is nominal. Calculate the object point count, New Object-Point count and effort to develop such a project.
7. Draw the network diagram, find out the critical path and critical activities, and calculate the project duration for the given problems using CPM.
8. Draw the network diagram, find out the critical path and critical activities, and calculate the project duration for the given problems using PERT.
9. Perform load testing on the following websites using the tool JMeter.
   (a) www.google.com, (b) www.irctc.com, (c) www.nitrkl.ac.in
10. Perform mutation testing and find the mutation score of some sample applications using the tool Jumble.
11. Perform functional testing of some sample web applications using the tool Selenium.
12. Consider an office automation system. There are 4 major modules:

    Data Entry 0.6 KLOC
    Data Update 0.6 KLOC
    Query 0.8 KLOC
    Reports 1.0 KLOC
    The various cost driver attributes are of high complexity, high storage, low experience and low programmer capability with all others being nominal. Use intermediate COCOMO to estimate final effort, average staff size and total development time. Value

for high complexity=1.15, value for high storage=1.06, value for low experience=1.13, value for low programmer capability=1.17, nominal value=1.

Web Technology
(MSCS303)

Course Objective:

- Create simple websites based on Node.js features
- Demonstrate database connectivity and operations
- Make applications making use of Angular.js concepts
- Construct Angular.js Forms and Single Page Applications

Course Outcome:

- Build simple websites making use of various Node.js features.
- Design a dynamic web application enabled with database connectivity
- Use the fundamentals of Angular.js Filters, Directives and Controllers to build applications
- Develop Forms and Single page applications (SPA)

Unit - I

Introduction to Node.js: What is Node.js, Advantages of Node.js, Node.js Process Model, Traditional Web Server Model, and Setup Development Environment: Installation of Node.js on Windows, Working in REPL, Node JS Console? Modules, Events &Functions: Standard Callback Pattern, Event Emitter Pattern, Event Types, Event Emitter API, Creating an Event Emitter, Defer Execution of a Function, Cancel Execution of a Function, Schedule/Cancel repetitive execution of a Function, Block/Escape Event Loop.

Unit - II

File Handling& HTTP Web Server: File Paths, fs Module, Opening a file, Reading from a file, writing to a file, closing a file. HTTP request/response object, Headers, Piping, Shutting down the server. Databases: Connect and Communicate with a MySQL Database, Adding data to the database, Reading data.

Unit - III

Angular JS Basics: Introduction to AngularJS, MVC Architecture, Conceptual Overview:Setting up the Environment,First Application, Understanding ng attributes, Expressions: Number and String Expressions, Object Binding and Expressions,Working with Arrays. Filters, Directives : Built-In Filters, Uppercase and Lowercase Filters, Currency and Number Formatting Filters,OrderBy Filter, Introduction to Directives, Directive Lifecycle, Conditional Directives,Styles Directives, Mouse and Keyboar.

Unit - IV

Controllers : Understanding Controllers, Programming Controllers & $scope object, Adding Behavior to a Scope Object, Passing Parameters to the Methods, Having Array as members in Controller Scope.

Unit - V

Forms and SPA (Single Page Application): Working with Simple Angular Forms, Working with Select and Options, Input Validations, Using CSS classes, Form Events, Custom Model update triggers, Custom Validation. Introduction to SPA, Creating HTML Template, Configuring Route Provider, Creating Single Page Application.

Reference Books:

1. Powell TA, Powell TA. HTML & CSS: the complete reference. New York: McGraw-Hill; 2010. ISBN No. 9780071496292
2. Haverbeke M. Eloquent Javascript: A modern introduction to programming. No Starch Press; 2018. ISBN No. 9781593279509
3. Teixeira P. Professional Node.js: Building Javascript based scalable software. John Wiley & Sons; 2012. ISBN No. 9781118185469
4. Brown E. Web development with node and express: leveraging the JavaScript stack. O'Reilly Media; 2014. ISBN No. 9781491949306
5. Karpov V, Netto D. Professional AngularJS. John Wiley & Sons; 2015. ISBN No. 9781118832073
6. Dayley B. Learning AngularJS. Pearson Education; 2014. ISBN No. 9780134034546
7. Seshadri S, Green B. AngularJS: Up and Running: Enhanced Productivity with Structured Web Apps. O'Reilly Media; 2014. ISBN No. 9781548785710.

Web Technology-Lab
(MSCS308P)

List of Experiments

1. Write HTML code to use the tags like caption, title, body etc.
2. Write HTML code to divide the screen into multiple frames.
3. Write HTML code to link the pages and display the images.
4. Write HTML code to create a table
5. Write HTML code for form and place some text boxes, command box, selection box etc on the form.
6. Write a small program using XML.
7. Write a Java Script for displaying message, time and date etc using document write method.
8. Write a Java Script for displaying different buttons (Ex: ok, cancel etc), different icons (ex:
question, critical etc) and different boxes (input box, message box etc)
9. Write a Java Script Script to extract month, year, day from current date.
10. Write a Java Script Script to extract hour, minute and seconds from current time.
11. Write a Java Script to calculate simple interest and compound interest using arithmetic operators.
12. Write programs on string. (Ex: Accepting a string, calculating the position of the character in the string, Length of the string etc)
13. Write programs to work with radio buttons and checkbox.
14. Write ASP code to display current date and time.
15. Write a program to pass the values to the next page using Submit button in ASP.
16. Write a program to establish the connection with the database and populating values in the combo box.
17. Write a program to display all the records in the table.
18. Write a program to insert the record into the table.
19. Write a program to display a registration form.
20. Write a program to store the data in the table.
21. Write PHP code to display date and time.
22. Write PHP code to create a form through which data can be uploaded into automated system.
23. Write PHP code to create a cookie.
24. Write PHP code to create a table and insert records into it.
25. Design your CS and IT website, install it and maintain it.

REFERENCES BOOKS

1. Internet & World Wide Web – Dietel and Dietel Pearson
education Asia.
2. Principles of Web Design Sklar TMH
3. HTML complete reference Powell THH.
4. WWW Design with HTML Xavier (TMH)
5. Basics of Web Site Design NIIT – PHI

Digital Image Processing
(MSCS304)

Course Objectives:

1. Study the fundamental concepts of Digital Image processing and to discuss mathematical transforms.
2. Study image enhancement techniques and explore DCT and DFT techniques
3. Expose students to various image enhancement, restoration methods and morphological operations.
4. Analyze Image Data Compression and morphological Operation
5. Explain various Applications of Image Processing.

Course Outcomes:

1. Explain the fundamental concepts of a digital image processing System
2. Apply techniques for enhancing digital images
3. Examine the use of Fourier transforms for image processing in the frequency domain
4. Compare various Image compression standards and morphological Operation
5. Identify various Applications of Image Processing

Unit - I

Introduction to Image Processing Systems: Image representation, basic relationship between pixels, elements of DIP system, elements of visual perception-simple image formation model Vidicon and Digital Camera working principles Brightness, contrast, hue, saturation, mach band effect, Colour image fundamentals-RGB, CMY, HSImodels 2D sampling,quantization. Image Enhancement in the Spatial domain: Spatial domain methods: point processing-intensity transformations, histogram processing, image subtraction,

Unit - II

image averaging Spatial filtering- smoothing filters, sharpening filters Frequency domain methods: low pass filtering, high pass filtering, homomorphic filter.Discrete Fourier Transform: Introduction , DFT and its properties, FFT algorithms ñ direct, divide and conquer approach, 2-D DFT &FFTImage Transforms : Introduction to Unitary Transform, DFT, Poperties of 2-D DFT, FFT, IFFT, Walsh transform, Hadamard Transform, Discrete Cosine Transform, Discrete Wavelet Transform: Haar Transforms, KL Transform.

Unit - III

Image Restoration and Image Segmentation: Image degradation, Classification of Image restoration Techniques, Image restoration Model, Image Blur, Noise Model : Exponential, Uniform, Salt and Pepper, Image Restoration Techniques : Inverse Filtering, Average Filtering, Median Filtering. The detection of discontinuities - Point, Line and Edge detections: Prewit Filter, Sobel Filter, Fri-Chen Filter Hough Transform, Thresholding Region based segmentation Chain codes, Polygon approximation, Shape numbers.

Unit - IV

Image Data Compression and morphological Operation: Need for compression, redundancy, classification of image compression schemes,

Huffman coding, arithmetic coding, dictionary based compression, transform Based compression, Image compression standards- JPEG &MPEG,vector quantization, wavelet based image compression.Morphological Operation: Introduction, Dilation, Erosion, Opening, Closing.

Unit - V

Applications of Image Processing: Case Study on Digital Watermarking, Biometric Authentication (Face, Finger Print, Signature Recognition), Vehicle Number Plate Detection and Recognition, Object Detection using Correlation Principle, Person Tracking using DWT, Handwritten and Printed Character Recognition, Contend Based Image Retrieval, Text Compression.

Reference Books:

1. R.C.Gonzalez&R.E.Woods, Digital Image Processing, Pearson Education, 3rd edition, ISBN. 13:978-0131687288
2. S. Jayaraman Digital Image Processing TMH (McGraw Hill) publication, ISBN-13:978-0-07- 0144798
3. Gonzalez, Woods & Steven, Digital Image Processing using MATLAB, Pearson Education, ISBN-13:978-0130085191
4. William K. Pratt, "Digital Image Processing", John Wiley, NJ, 4th Edition,200
5. Sid Ahmed M.A., "Image Processing Theory, Algorithm andArchitectures", McGraw-Hill, 1995.Umbaugh, "Computer Vision".
6. Anil K.Jain,Fundamentals of Digital Image Processing,Prentice Hall of India,2nd Edition,2004.

Big Data Analytics
(MSCS305A)

Course Objectives:

1. To explore the fundamental concepts of big data analytics and visualization techniques.
2. To learn to use various techniques for mining data stream.
3. To understand big data analytics technology Hadoop concepts.
4. To understand the Hadoop Framework and various big data enabling Technologies.
5. To understand Open Source Database Concepts.

Course Outcomes:

1. The students will be able to understand the Big Data Analytics fundamental concepts and visualization techniques.
2. The students will be able to understand various techniques used for mining data stream.
3. The students will be able to understand Hadoop Concepts.
4. The students will be able to Know Hadoop frameworks and big data enabling Technologies.
5. The students will be able to understand about concepts of Open Source database such as NOSQL, HBase etc.

UNIT-I INTRODUCTION TO BIG DATA: Introduction to Big Data ,Characteristics of Big Data(5 V's Of Big Data),Sources of Big Data, Challenges of Conventional Systems, Analysisvs Analytics, Types of Data Analytics, Analysis vs Reporting ,Visualizations - Visual data analysis techniques. Case studies of application Big Data.

.

UNIT- II MINING DATA STREAMS: Introduction To Streams Concepts, Stream Data Model and Architecture ,Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments ,Counting Oneness in a Window, Decaying Window.

UNIT-III HADOOP: Components of Hadoop, The Hadoop Distributed File System, Map Reduce, YARN, COMMON, Hadoop Cluster, How Map Reduce Works, Anatomy of a Map Reduce, Job Scheduling, Shuffle and Sort Map Reduce Types and Formats, Map Reduce Features

UNIT-IV HADOOP FRAMEWORKS - Applications on Big Data Using Pig, Hive, Zookeeper Maintenance of Hadoop Cluster, Hadoop benchmarks. Hadoop frameworks. (Cassandra, Apache Mahout, Tez, Hbase, Avro, Chukwa, Spark, Ambari.)

UNIT-V NOSQL: Limitations of SQL Databases, Introduction to NoSQL databases, types of NoSQL Databases, Document Databases, Key Valued Databases, Column based Databases and Graph Databases. Issues of availability and consistency, CAP Theorem, Case studies of MongoDB,Neo4j,HBase,Cassandra, MeMSCSched and Redis.

Text Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Tom White " Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

Simulation & Modeling
(MSCS305B)

Course Objective:

- Simulate and model computer applications
- Understanding various models in simulations
- Working with strategies to simulate

Course Outcome:

- Students completing this course will be able to:
- Developing simulation system to simulate real life scenarios
- Exploring scenarios using 3D visualizations

Unit - I Introduction

Introduction to Simulation, Need of Simulation, Time to simulate, Insidesimulation software: Modeling the progress of Time, Modeling Variability, Conceptual Modeling: Introduction to Conceptual modeling, Defining conceptual model, Requirements of theconceptual model, Communicating the conceptual model, Developing the Conceptual Model: Introduction, A framework for conceptual modeling, methods of modelssimplification.

Unit - II Model Verification and Validation Data Collection and Analysis

Introduction, Data requirements, Obtainingdata, Representing unpredictable variability, Selecting statistical distributions. Obtaining Accurate Results: Introduction, The nature of simulation models and simulation output, Issues in obtaining accurate simulation results, example model, dealing with initialization bias: warmup and initial conditions, Selecting the number of replications and run-length. Searching the Solution Space: Introduction, The nature of simulationexperimentation, Analysis of results from a single scenario, Comparing alternatives,Search experimentation, and Sensitive analysis. Verification, Validation andConfidence: Introduction, Defining Verification and Validation, The difficulties ofverification and validation, Methods of verification and validation, Independent verification and validation.

Unit - III Modeling and simulation modeling

Types of models, Analytical vs Simulation modeling, Application of simulation modeling,Level of abstraction, Simulation Modeling. Methods, System Dynamics, Discrete EventModeling, Agent Based modeling:Introduction toAgent, Agent-based modelling, Time in agent based models, Space in agent based models, Discrete space, Continuous space movement in continuous space, Communication between agents, Dynamic creation and destruction of agents, Statics on agent population, Condition triggered events and transition in agents. Building agents based models: The problem statement, Phases ofmodelling, Assumptions, 3 D animation. Dynamics Systems: Stock and flow diagrams,examples of stock and flow diagrams. Multi-method modelling: Architecture, Technical aspects of combining modelling methods, Examples.

Unit - IV Design and behavior of models

Designing state-based behavior: Statecharts, State transitions, Viewing and debuggingStatecharts at runtime, Statecharts for dynamic objects. Discrete events and Eventmodel object: Discrete event, Event-the simplest low level model object, Dynamicevents, and Exchanging data with external world. Presentation and animation: Workingwith shapes, groups and colors, Designing interactive models: using controls, Dynamic properties of controls, 3D Animation. Randomness in Models: Probability distributions,sources of randomness in the model, randomness in system dynamics model, randomnumber generators,

Model time, date and calendar: Virtual and real time: The modeltime, date and calendar, Virtual and real-time execution modes.

References Books:

1. Agent Based Modeling and Simulation, Taylor S, 2014.
2. Simulation Modeling Handbook: A Practical Approach, Christopher A. Chung,2003.
3. Object Oriented Simulation: A Modeling and Programming Perspective, Garrido,José M, 2009.
4. Simulation, Modeling and Analysis, Averill M Law and W. David Kelton, "TataMcGraw Hill, Third Edition, 2003.
5. Process Control: Modeling, Design and Simulation, Wayne Bequette W, PrenticeHall of India, 2003.

Mini Project & Internship Assessment
(MSCS309P)

(MSCS401A): Privacy and Security in Online Social Media		
Course Outcome (CO)		**Bloom's Knowledge Level**
At the end of course, the student will be able to:		
CO 1	Understand working of online social networks	K2
CO 2	Describe privacy policies of online social media	K2
CO 3	Analyse countermeasures to control information sharing in Online social	K3
CO 4	Apply knowledge of identity management in Online social networks	K3
CO 5	Compare various privacy issues associated with popular social media.	K3
DETAILED		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Online Social Networks:** Introduction to Social Networks, From offline to Online Communities, Online Social Networks, Evolution of Online Social Networks, Analysis and Properties, Security Issues in Online Social Networks, Trust Management in Online Social Networks, Controlled Information Sharing in Online Social Networks, Identity Management in Online Social Networks, data collection from social	**08**
II	**Trust Management in Online Social Networks:** Trust and Policies, Trust and Reputation Systems, Trust in Online Social, Trust Properties, Trust Components, Social Trust and Social Capital, Trust Evaluation Models, Trust, credibility, and reputations in social systems; Online social media and Policing, Information privacy disclosure, revelation, and its effects in	**08**
III	**Controlled Information Sharing in Online Social Networks:** Access Control Models, Access Control in Online Social Networks, Relationship-Based Access Control, Privacy Settings in Commercial Online Social Networks, Existing	**08**
IV	**Identity Management in Online Social Networks:** Identity Management, Digital Identity, Identity Management Models: From Identity 1.0 to Identity 2.0, Identity Management in Online Social Networks, Identity as Self-Presentation,	**08**
V	**Case Study:** Privacy and security issues associated with various social media such	**08**

Textbooks:

1. Security and Privacy-Preserving in Social Networks, Editors: Chbeir, Richard, Al Bouna, Bechara (Eds.), Spinger, 2013.
2. Security and Trust in Online Social Networks, Barbara Carminati, Elena Ferrari, Marco Viviani, Morgan & Claypool publications.
3. Security and Privacy in Social Networks, Editors: Altshuler, Y., Elovici, Y., Cremers, A.B., Aharony, N., Pentland, A. (Eds.), Springer, 2013
4. Security and privacy preserving in social networks, Elie Raad & Richard Chbeir, Richard Chbeir& Bechara Al Bouna, 2013
5. Social Media Security: Leveraging Social Networking While Mitigating Risk, Michael Cross, 2013

(MSCS401B) : Soft Computing		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO 1	Recognize the need of soft computing and study basic concepts and techniques	K_1, K_2
CO 2	Understand the basic concepts of artificial neural network to analyze widely used neural networks.	K_2, K_4
CO 3	Apply fuzzy logic to handle uncertainty in various real-world problems.	K_3
CO 4	Study various paradigms of evolutionary computing and evaluate genetic	K_1, K_5
CO 5	Apply hybrid techniques in applications of soft computing.	K_3
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed**
I	**Introduction to Soft Computing:** Introduction, Comparison with hard computing, Concept of learning and adaptation, Constituents of soft computing, Applications of soft computing. **Artificial Neural Networks:** Basic concepts of neural networks, Human brain, Biological neural network, History of artificial neural networks, Basic building blocks of an artificial neuron, Neural network	**08**
II	**Artificial Neural Networks:** Learning methods - Supervised, Unsupervised, Reinforcement, Hebbian, Gradient descent, Competitive, Stochastic. **Major classes of neural networks:** Perceptron networks, Multilayer perceptron model, Back-propagation network, Radial basis function	**08**
III	**Fuzzy Logic:** Introduction to Fuzzy Logic, Comparison with crisp logic, Properties of classical sets, Operations on classical sets, Properties of fuzzy sets, Operations on fuzzy sets, Classical relations, Fuzzy relations, Features and types of fuzzy membership functions, Fuzzy arithmetic, Fuzzy measures. **Fuzzy Systems:** Crisp logic, Predicate logic, Fuzzy logic, Fuzzy propositions, Inference rules, Fuzzy	**08**
V	**Evolutionary Computing:** Introduction, Evolutionary algorithm, Biological evolutionary process, Paradigms of evolutionary computing – Genetic algorithm and Genetic programming, Evolutionary strategies, Evolutionary programming. **Genetic Algorithm:** Introduction, Traditional optimization and search techniques, Comparison with traditional algorithms, Operations,	**08**
V	**Hybrid Soft Computing Techniques:** Introduction, Classification of hybrid systems, Neuro-fuzzy hybrid systems, Neuro-genetic hybrid systems, Fuzzy- genetic hybrid systems. **Other Soft Computing Techniques:** Tabu Search, Ant colony	**08**

Suggested Readings:

1. Sivanandam S.N. and Deepa S.N., "Principles of Soft Computing", Wiley-India.
2. Rajasekaran S. and Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms- Synthesis and Applications", PHI Learning.
3. Chakraverty S., Sahoo D.M. and Mahato N. R., "Concepts of Soft Computing- Fuzzy and ANN with Programming", Springer.
4. Kaushik S. and Tiwari S., "Soft Computing – Fundamentals, Techniques and Applications', McGrawHill Education.
5. Jang J.-S.R., Sun C.-T. and Mizutani E., "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India.
6. Karray F. O. and Silva C. D., "Soft Computing and Intelligent Systems Design – Theory, Tools and Applications", Pearson Education.
7. Freeman J. A. and Skapura D. M., "Neural Networks: Algorithms, Applications and Programming Techniques", Pearson.
8. Siman H., "Neural Netowrks", Prentice Hall of India.

(MSCS401C): Pattern Recognition		
Course Outcome (CO)	**Bloom's Knowledge Level (KL)**	
At the end of course, the student will be able to understand		
CO 1	Study of basics of Pattern recognition. Understand the designing principles and	K_1, K_2
CO 2	Analysis the Statistical Patten Recognition.	K_3, K_4
CO 3	Understanding the different Parameter estimation methods.	K_1, K_2
CO 4	Understanding the different Nonparametric Techniques.	K_1, K_2,
CO 5	Understand and Make use of unsupervised learning and Clustering in Pattern	K_2 K_3, K_4
DETAILED		**3-0-0**
Unit	**Topic**	**Proposed**
I	**Introduction:** Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution,	**08**
II	**Statistical Patten Recognition:** Bayesian Decision Theory, Classifiers,	**08**
III	**Parameter estimation methods:** Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation- maximization (EM), Hidden Markov Models (HMM),	**08**
IV	**Nonparametric Techniques:** Density Estimation, Parzen Windows, K-	**08**
V	**Unsupervised Learning & Clustering:** Criterion functions for clustering, Clustering Techniques: Iterative square - error partitional clustering – K	**08**

Suggested Readings:

1. Duda R. O., Hart P. E. and Stork D. G., "Pattern Classification", John Wiley.
2. Bishop C. M., "Neural Network for Pattern Recognition", Oxford University Press.
3. Singhal R., "Pattern Recognition: Technologies & Applications", Oxford University Press.
4. Theodoridis S. and Koutroumbas K., "Pattern Recognition", Academic Press.

(MSCS401D): Data Analytics		
Course Outcome (CO)	**Bloom's Knowledge Level (KL)**	
At the end of course, the student will be able to understand		
CO1	Describe the life cycle phases of Data Analytics through discovery, planning and	K_1, K_2
CO2	Understand and apply Data Analysis Techniques.	K_2, K_3
CO3	Implement various Data streams.	K_3
CO4	Understand item sets, Clustering, frame works & Visualizations.	K_2
CO5	Apply R tool for developing and evaluating real time applications.	K_3, K_5, K_6
	DETAILED SYLLABUS	**4-0-0**
Unit	**Topic**	**Proposed**
I	**Introduction to Data Analytics**: Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics. **Data Analytics Lifecycle**: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data	08
II	**Data Analysis:** Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, Neural Networks: Learning and generalisation, competitive learning, principal component analysis and neural networks, fuzzy logic:	08
III	**Mining Data Streams:** Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, Real-time Analytics Platform (RTAP)	08
IV	**Frequent Itemsets and Clustering:** Mining frequent itemsets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets in a stream, Clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based	08
V	**Frame Works and Visualization**: MapReduce, Hadoop, Pig, Hive, HBase, MapR, Sharding, NoSQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications. **Introduction to R** - R graphical user interfaces, data import and export, attribute and data types, descriptive statistics, exploratory data	08

Suggested Readings:

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer.
2. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press.
3. Bill Franks, “Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with advance Analytics” John Wil
4. John Garrett, “Data Analytics for IT Networks : Developing Innovative Use Cases”, Pearson Education.
5. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
6. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Analytics”, EMC Education Series, John Wiley.
7. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series.
8. Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”, Elsevier.
9. Michael Berthold, David J. Hand,” Intelligent Data Analysis”, Springer.
10. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill.
11. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer.
12. Mark Gardner, “Beginning R: The Statistical Programming Language”, Wrox Publication.
13. Pete Warden, “Big Data Glossary”, O’Reilly.
14. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons.
15. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, "Handbook of

(MSCS401E): Software Quality Engineering

Course Outcome (CO)		Bloom's Knowledge Level
At the end of course, the student will be able to:		
CO 1	Understand basic concepts of Software Quality along with its documents and process	K2
CO 2	Apply knowledge of Software Quality in various types of software	K3
CO 3	Compare the various reliability models for different scenarios	K4
CO 4	Illustrate the software Quality Planning and Assurance	K2
CO 5	Make use of various testing techniques in software implementation	K3
DETAILED		**3-1-0**

Unit	Topic	Proposed
I	**Software Quality**: Definition, Software Quality Attributes and Specification, Cost of Quality, Defects, Faults, Failures, Defect Rate and Reliability, Defect Prevention, Reduction, and Containment, Overview of Different Types of Software Review, Introduction to Measurement and Inspection	**08**
II	**Software Quality Metrics Product Quality Metrics**: Defect Density, Customer Problems Metric, Customer Satisfaction Metrics, Function Points, In-Process Quality Metrics: Defect Arrival Pattern, Phase-Based Defect Removal Pattern, Defect Removal Effectiveness, Metrics for Software	**08**
III	**Software Quality Management and Models**: Modeling Process, Software **Reliability Models**: The Rayleigh Model, Exponential Distribution and Software Reliability Growth Models, Software Reliability Allocation Models, Criteria for Model Evaluation, Software Quality Assessment	**08**
IV	**Software Quality Assurance**: Quality Planning and Control, Quality Improvement Process, Evolution of Software Quality Assurance (SQA), Major SQA Activities, Major SQA Issues, Zero Defect Software, SQA Techniques, Statistical	**08**
V	**Software Verification, Validation & Testing:** Verification and Validation, Evolutionary Nature of Verification and Validation, Impracticality of Testing all Data and Paths, Proof of Correctness, Software Testing, Functional, Structural and Error-Oriented Analysis & Testing, Static and Dynamic	**08**

Text books:

1. Jeff Tian, Software Quality Engineering (SQE), Wiley-Interscience, 2005; ISBN 0-471-71345 -7
2. Metrics and Models in Software Quality Engineering, Stephen H. Kan, AddisonWesley (2002), ISBN: 0201729156
3. Norman E. Fenton and Shari Lawrence Pfleeger, "Software Metrics" Thomson, 2003
4. Mordechai Ben – Menachem and Garry S.Marliss, "Software Quality", Thomson Asia Pte Ltd, 2003.

(MSCS402A): Blockchain Architecture		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO1	Study and understand basic concepts of blockchain architecture.	K_1, K_2
CO2	Analyze various requirements for consensus protocols.	K_4
CO3	Apply and evaluate the consensus process.	K_3, K_5
CO4	Understand the concepts of Hyper ledger fabric.	K_1
CO5	Analyze and evaluate various use cases in financial software and supply	K_4, K_5
	DETAILED SYLLABUS	**4-0-0**
Unit	**Topic**	**Proposed**
I	**Introduction to Blockchain:** Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. **Blockchain Architecture and Design:** Basic crypto primitives: Hash, Signature,	**08**
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols, distributed consensus, consensus in Bitcoin. **Permissioned Blockchains:** Design goals, Consensus protocols for	**08**
III	**Hyperledger Fabric:** Decomposing the consensus process, Hyperledger fabric components. **Chaincode Design and Implementation Hyperledger Fabric:**	**08**
IV	**Use case 1:** Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance. **Use case 2:** Blockchain in trade/supply chain: (i) Provenance of goods,	**08**
V	**Use case 3:** Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems, Blockchain Cryptography,	**08**

Suggested Readings:

1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly
2. Melanie Swa, "Blockchain", O'Reilly
3. "Hyperledger Fabric", https://www.hyperledger.org/projects/fabric
4. Bob Dill, David Smits, "Zero to Blockchain - An IBM Redbooks course", https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

(MSCS402B): Neural Networks		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO 1	Study of basic concepts of Neuro Computing, Neuroscience and ANN. Understand the different supervised and unsupervised and neural networks performance.	K_1, K_2
CO 2	Study of basic Models of neural network. Understand the Perception network. and Compare neural networks and their algorithm.	K_2, K_3
CO 3	Study and Demonstrate different types of neural network. Make use of neural networks for specified problem domain.	K_2 K_3, K_4
CO 4	Understand and Identify basic design requirements of recurrent network and Self-organizing feature map.	K_1, K_2
CO 5	Able to understand the some special network. Able to understand the concept of Soft computing.	K_1, K_2 K_3
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Neurocomputing and Neuroscience**: The human brain, biological neurons, neural processing, biological neural network. **Artificial Neural Networks:** Introduction, historical notes, neuron model, knowledge representation, comparison with biological neural network, applications. **Learning process:** Supervised learning, unsupervised learning, error correction learning, competitive learning, adaptation learning, Statistical nature of the learning process.	**08**
II	**Basic Models:** McCulloch-Pitts neuron model, Hebb net, activation functions, aggregation functions. **Perceptron networks:** Perceptron learning, single layer perceptron networks, multilayer perceptron networks. Least mean square algorithm, gradient descent rule, nonlinearly separable problems and bench mark problems in NN.	**08**
III	**Multilayer neural network:** Introduction, comparison with single layer networks. **Back propagation network**: Architecture, back propagation algorithm, local minima and global minima, heuristics for making back propagation algorithm performs better, applications. **Radial basis function network**: Architecture, training algorithm, approximation properties of RBF networks, comparison of radial basis function network and back propagation networks.	**08**
IV	**Recurrent network**: Introduction, architecture and types. **Self-organizing feature map**: Introduction, determining winner, Kohonen Self Organizing feature maps (SOM) architecture, SOM algorithm, properties of feature map; Learning vector quantization-architecture and algorithm. Principal component and independent component analysis.	**08**
V	**Special networks:** Cognitron, Support vector machines. Complex valued NN and complex valued BP. **Soft computing:** Introduction, Overview of techniques, Hybrid soft computing techniques.	**08**

Suggested Readings:

1. Kumar S., "Neural Networks- A Classroom Approach", McGraw Hill.
2. Haykin S., "Neural Networks – A Comprehensive Foundation", Pearson Education.
3. Yegnanarayana B. "Artificial Neural Networks", Prentice Hall of India.
4. Freeman J. A., "Neural Networks", Pearson Education.
5. James F., "Neural Networks – Algorithms, Applications and Programming Techniques", Pearson Education.

(MSCS402C): Internet of Things

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Demonstrate basic concepts, principles and challenges in IoT.	K1,K2
CO 2	Illustrate functioning of hardware devices and sensors used for IoT.	K2
CO 3	Analyze network communication aspects and protocols used in IoT.	K4
CO 4	Apply IoT for developing real life applications using Ardunio programming.	K3
CP 5	To develop IoT infrastructure for popular applications	K_2, K_3

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization,	**08**
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino,	**08**
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment &	**08**
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio,	**08**
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets,	**08**

Text books:

1. Olivier Hersent,DavidBoswarthick, Omar Elloumi"The Internet of Things key applications and protocols", willey
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. ArshdeepBahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014
6. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India

(MSCS402D): Distributed Database Systems		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Understand theoretical and practical aspects of distributed database systems.	K2
CO 2	Study and identify various issues related to the development of distributed database system	K3
CO 3	Understand the design aspects of object-oriented database system and related	K4
CO 4	Equip students with principles and knowledge of distributed reliability.	K3
CO 5	Equip students with principles and knowledge of parallel and object-oriented	K5
DETAILED		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas. Distributed DBMS Architecture: Architectural Models for Distributed DBMS, DDMBS Architecture. Distributed Database Design: Alternative Design Strategies, Distribution	**08**
II	**Query processing and decomposition:** Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data. Distributed query Optimization: Query optimization, centralized query optimization,	**08**
III	Transaction Management: Definition, properties of transaction, types of transactions, distributed concurrency control: Serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic	**08**
IV	**Distributed DBMS Reliability:** Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning. Parallel Database Systems: Parallel database system architectures, parallel	**08**
V	**Distributed object Database Management Systems:** Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing. **Object Oriented Data Model:** Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS	**08**

Text books:

M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001. 2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill. REFERENCE BOOKS: 1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition

(MSCS403A): Mobile Computing		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO 1	Study and aware fundamentals of mobile computing.	K_1, K_2
CO 2	Study and analyze wireless networking protocols, applications and environment.	K_1, K_4
CO 3	Understand various data management issues in mobile computing.	K_2
CO 4	Analyze different type of security issues in mobile computing environment.	K_4
CO 5	Study, analyze, and evaluate various routing protocols used in mobile computing.	K_1, K_4, K_5
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	Introduction, Issues in mobile computing, Overview of wireless telephony, Cellular concept, GSM- air interface, channel structure; Location management- HLR-VLR, hierarchical, handoffs; Channel allocation in cellular systems, CDMA, GPRS, MAC for cellular system.	**08**
II	Wireless Networking, Wireless LAN Overview- MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, Data broadcasting, Mobile IP, WAP-architecture, protocol stack, application environment, applications.	**08**
III	Data management issues in mobile computing, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.	**08**
IV	Mobile Agents computing, Security and fault tolerance, Transaction processing in mobile computing environment.	**08**
V	Adhoc networks, Localization, MAC issues, Routing protocols, Global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Adhoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Adhoc Networks, applications	**08**

Suggested Readings:

1. Schiller J., "Mobile Communications", Pearson
2. Upadhyaya S. and Chaudhury A., "Mobile Computing", Springer
3. Kamal R., "Mobile Computing", Oxford University Press.
4. Talukder A. K. and Ahmed H., "Mobile Computing Technology, Applications and Service Creation", McGraw Hill Education
5. Garg K., "Mobile Computing Theory and Practice", Pearson.
6. Kumar S., "Wireless and Mobile Communication", New Age International Publishers
7. Manvi S. S. and Kakkasageri M. S., "Wireless and Mobile Networks- Concepts and Protocols", Wiley India Pvt. Ltd.

(MSCS403B): Computer Graphics and Animation		
Course Outcome (CO)	**Bloom's Knowledge Level (KL)**	
At the end of course, the student will be able to understand		
CO 1	Understand the graphics hardware used in field of computer graphics.	K_2
CO 2	Understand the concept of graphics primitives such as lines and circle based on	K_2, K_4
CO 3	Apply the 2D graphics transformations, composite transformation and Clipping	K_4
CO 4	Apply the concepts and techniques used in 3D computer graphics, including viewing transformations, projections, curve and hidden	K_2, K_3
CO 5	Perform the concept of multimedia and animation in real life.	K_2, K_3
DETAILED		**3-0-0**
Unit	**Topic**	**Proposed**
I	**Introduction and Line Generation:** Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and	**08**
II	**Transformations:** Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. **Windowing and Clipping:** Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non-rectangular clip windows;	**08**
III	**Three Dimensional:** 3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping. **Curves and Surfaces:** Quadric surfaces, Spheres, Ellipsoid, Blobby	**08**
IV	**Hidden Lines and Surfaces:** Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models– Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation,	**08**
V	**Multimedia Systems:** Design Fundamentals, Back ground of Art, Color theory overview, Sketching & illustration, Storyboarding, different tools for animation. **Animation:** Principles of Animations, Elements of animation and their use, Power of Motion, Animation Techniques, Animation File Format, Making animation for Rolling Ball, making animation for a	**08**

Suggested Readings:

1. Hearn D. and Baker M. P., "Computer Graphics C Version", Pearson Education
2. Foley, Vandam, Feiner, Hughes,"Computer Graphics principle", Pearson Education.
3. Rogers, " Procedural Elements of Computer Graphics", McGraw Hill
4. Newman W. M., Sproull R. F., "Principles of Interactive computer Graphics", McGraw Hill.
5. Sinha A. N. and Udai A. D.," Computer Graphics", McGraw Hill.
6. Mukherjee, "Fundamentals of Computer graphics & Multimedia", PHI Learning Private Limited.
7. Vaughan T., "Multimedia, Making IT Work",Tata McGraw Hill.

(MSCS403C): Natural Language Processing		
Course Outcome (CO)	**Bloom's Knowledge Level (KL)**	
At the end of course, the student will be able to understand		
CO 1	Study and understand basic concepts, background and representations of	K_1, K_2
CO 2	Analyze various real-world applications of NLP.	K_4
CO 3	Apply different parsing techniques in NLP.	K_3
CO 4	Understand grammatical concepts and apply them in NLP.	K_2, K_3
CO 5	Apply various statistical and probabilistic grammar methods to handle and	K_3, K_5
DETAILED		**3-0-0**
Unit	**Topic**	**Proposed**
I	**Introduction to Natural Language Understanding:** The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding	**08**
II	Introduction to semantics and knowledge representation, some applications like machine translation, database interface.	**08**
III	Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English,	**08**
IV	**Grammars for Natural Language:** Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty,	**08**
V	**Ambiguity Resolution:** Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing.	**08**

Suggested Readings:

1. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, "NLP: A Paninian Perspective", Prentice Hall, New Delhi.
2. James Allen, "Natural Language Understanding", Pearson Education.
3. D. Jurafsky, J. H. Martin, "Speech and Language Processing", Pearson Education.
4. L. M. Ivansca, S. C. Shapiro, "Natural Language Processing and Language Representation", AAAI Press, 2000.
5. T. Winograd, Language as a Cognitive Process, Addison-Wesley.

(MSCS403D): Machine Learning Techniques		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able:		
CO 1	To understand the need for machine learning for various problem solving	K_1 , K_2
CO 2	To understand a wide variety of learning algorithms and how to evaluate models generated from data	K_1 , K_3
CO 3	To understand the latest trends in machine learning	K_2 , K_3
CO 4	To design appropriate machine learning algorithms and apply the algorithms to	K_4 , K_6
CO 5	To optimize the models learned and report on the expected accuracy that can	K_4, K_5
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**INTRODUCTION** – Learning, Types of Learning, Well defined learning problems, Designing a Learning System, History of ML, Introduction of Machine Learning Approaches – (Artificial Neural Network, Clustering, Reinforcement Learning, Decision Tree Learning, Bayesian networks, Support Vector Machine, Genetic Algorithm), Issues in Machine	**08**
II	**REGRESSION:** Linear Regression and Logistic Regression **BAYESIAN LEARNING -** Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm. **SUPPORT VECTOR MACHINE:** Introduction, Types of support vector kernel – (Linear kernel, polynomial kernel,and Gaussiankernel), Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM	**08**
III	**DECISION TREE LEARNING -** Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning. **INSTANCE-BASED LEARNING** – k-Nearest Neighbour Learning,	**08**
IV	**ARTIFICIAL NEURAL NETWORKS** – Perceptron's, Multilayer perceptron, Gradient descent and the Delta rule, Multilayer networks, Derivation of Backpropagation Algorithm, Generalization, Unsupervised Learning – SOM Algorithm and its variant; **DEEP LEARNING -** Introduction,concept of convolutional neural network , Types of layers – (Convolutional Layers , Activation function , pooling , fully connected) , Concept of Convolution (1D and 2D) layers, Training of network, Case study of CNN for eg on Diabetic	**08**
V	**REINFORCEMENT LEARNING**–Introduction to Reinforcement Learning , Learning Task,Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process , Q Learning - Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning,Introduction to Deep Q Learning. **GENETIC ALGORITHMS:** Introduction, Components, GA cycle of reproduction, Crossover, Mutation, Genetic Programming,	**08**

Text books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), MIT Press 2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
5. M. Gopal, "Applied Machine Learning", McGraw Hill Education

(MSCS403E): Quantum Computing		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Distinguish problems of different computational complexity and explain why certain problems are rendered tractable by quantum computation with reference to the relevant concepts in quantum theory.	K_1 , K_2
CO 2	Demonstrate an understanding of a quantum computing algorithm by simulating it on a classical computer, and state some of the practical challenges in building a quantum computer.	K_2 , K_3
CO 3	Contribute to a medium-scale application program as part of a co-operative team, making use of appropriate collaborative development tools (such as version control systems).	K_2 , K_3
CO 4	Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.	K_3 , K_4
CO 5	Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.	K_3, K_6
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Fundamental Concepts:** Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	**08**
II	**Quantum Computation**: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	**08**
III	**Quantum Computers:** Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	**08**
IV	**Quantum Information:** Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	**08**
V	**Quantum Error Correction:** Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource .	**08**

Text books:

1. Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation) Paperback – Import,
3 Oct 2014 3. Computing since Democritus by Scott Aaronson
4. Computer Science: An Introduction by N. DavidMermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

Major Project
(MSCS404P)