Uttarakhand Technical University, Dehradun

Evaluation Scheme & Syllabus

as per AICTE FlexibleCurricula

of

Master of Computer Applications(MCA)
(02 Year Programme)

W.E.F. Academic Session 2020-21

Uttarakhand Technical University, Dehradun

MCA Bridge Course(Qualifying Papers)

(Bridge Course must be completed before commencement of MCA I Semester)

S.No.	Sub. Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per			Total Credits
			Theory			Practical			L	T	P	
			End Sem.	Mid Sem.	Quiz / Assignment	End Sem.	Lab Work & Sessional					
1	MBCT 101	Introduction of Information Technology	30	20				50	20			
2	MBCT 102	Programming Fundamentals with 'C'	30	20				50	20			
3	MBCT 103	Fundamental Web Technology	30	20				50	20			

MCA 1st Semester

S. No.	Sub. Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
			Theory			Practical			L	T	P	
			End Sem.	Mid Sem.	Teachers Assessments	End Sem.	Lab Work & Sessional					
1	MCAT 101	Discrete Structure	100	30	20			150	3	1		4
2	MCAT 102 MCAP 102	Database Management System	100	30	20	30	20	200	3	1	2	5
3	MCAT 103 MCAP 103	Operating System	100	30	20	30	20	200	3	1	2	5
5	MCAT 104 MCAP 104	Computer Organization	100	30	20	30	20	200	3	1	2	5
6	MCAT 105	Technical Communication Skills	100	30	20	30	20	200	3	1	2	5
7	MCAP 106	Python Programming / Unix and Shell Programming				30	20	50			2	1
						Total		1000				25

MCA 2nd Semester

S.No.	Sub. Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
			Theory			Practical			L	T	P	
			End Sem.	Mid Sem.	Teachers Assessments	End Sem.	Lab Work & Sessional					
1	MCAT 201	Computer Based Statistical and Numerical Techniques	100	30	20			150	3	1		4
2	MCAT 202 MCAP 202	Data Structure and Analysis of Algorithms	100	30	20	30	20	200	3	1	2	5
3	MCAT 203 MCAP 203	Object Oriented Programming with Java	100	30	20	30	20	200	3	1	2	5
4	MCAT 204 MCAP 204	Computer Networks	100	30	20	30	20	200	3	1	2	5
5	MCAT 205	Microprocessor and Interface	100	30	20	30	20	200	3	1		5
6	MCAT 206 (Non Credit)	Accounting and Financial Management (Non Credit)		30	20			50	3	1		
							Total	1000				24

MCA 3rd Semester

S. No.	Sub. Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours/Week			Total Credits
			Theory			Practical						
			End Sem.	Mid Sem.	Teachers Assessments	End Sem.	Lab Work & Sessional		L	T	P	
1	MCAT 301	Theory of Automata and Formal Language	100	30	20			150	3	1		4
2	MCAT 302 MCAP 302	Software Engineering	100	30	20	30	20	200	3	1	2	5
3	MCAT 303 MCAP 303	Big Data Analysis	100	30	20	30	20	200	3	1	2	5
4	MCAT 304	Artificial Intelligence & Applications	100	30	20			150	3	1		4
5	MCAT 305	Combinatorics and Graph Theory	100	30	20			150	3	1		4
6	MCAT 306	Universal Human Values	70	20	10			100	2			2
7	MCAT 307	Any Online Course specified by AICTE on latest technology Not Credit Course – must be completed (in 2nd Year) to award the MCA Degree										
							Total	1000				25

MCA 4th Semester

S. No.	Sub. Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
			Theory			Practical						
			End Sem.	Mid Sem.	Teachers Assessments	End Sem.	Lab Work & Sessional		L	T	P	
1	MCAT 401 MCAP 401	.Net Technology	100	30	20	30	20	200	3	1	2	5
2	MCAT 402 MCAP 402	Network & Cyber Security	100	30	20	30	20	200	3	1	2	5
3	MCAT 41X	Elective 1	100	30	20			150	3	1		4
4	MCAT 42X	Elective 2	100	30	20			150	3	1		4
5	MCAT 43X	Elective 3	100	30	20			150	3	1		4
6	MCAP 403	Major Project				100	50	150			4	2
							Total	1000				24

List of Electives:

Elective 1:
MCAT 411 Soft Computing
MCAT 412 Distributed System
MCAT 413 Data Science
MCAT 414 Machine Learning
MCAT 415 Simulation & Modeling

Elective 2:
MCAT 421Web Technology and Cloud Computing
MCAT 422 Digital Image Processing
MCAT 423 Computer Graphics & Multimedia
MCAT 424 Software Testing & Quality Assurance
MCAT 425 Compiler Design

Elective 3:
MCAT 431Neural Networks
MCAT 432 Internet of Things
MCAT 433 Blockchain Architecture
MCAT 434 Natural Language Processing
MCAT 435 Advanced Java

Bridge Course(Qualifying papers)

(Bridge Course must be completed before commencement of MCA I Semester)

MBCT 101	**Introduction of Information Technology**		

Course Objectives:

The main objective is to

- Introduce IT in a simple language to all undergraduate students, regardless of their specialization.
- It will help them to pursue specialized programs leading to technical and professional careers and certifications in the IT industry.
- The focus of the subject is on introducing skills relating to IT basics, computer applications, programming, interactive medias, Internet basics etc.

Course Outcomes

1. Understand basic concepts and terminology of information technology.
2. Have a basic understanding of personal computers and their operations.
3. Be able to identify issues related to information security.

Detailed Content

Unit I:

Computers and Its Evolution of Computer, Basic Computer Organization, Input Units, Output Units.

Unit II

Storage Fundamentals, Primary Vs Secondary Storage, Examples of Primary Storage Examples of Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives.

Unit IV

Computer Arithmetic: Binary, Binary Arithmetic, Number System, converting from one number system to another.

Unit V

Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi-Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.

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Suggested reading material:

1. D. P. Curtin, K. Foley, K. Sen, and C. Morin, “Information Technology”, 5th Edition, TMH , 2002.
2. Satcey C. Sawyer, Brain K. Williams Sarah E Hutchinson, “Using Information Technology – Brief version” A practical introduction to computer and communications, 2nd editionMcGraw Hill, 2003.

MBCT 102	Programming Fundamentals with 'C'		

Objectives: This hands-on course provides a comprehensive introduction to programming, and builds a solid foundation of programming skills that can be used to master additional programming languages like C, C++. In this course, student write, compile, and debug programs in C.

Prerequisite: None

UNIT-I
Structure and properties of algorithm, Flow chart, Algorithms for g.c.d., Factorial, Fibonacci series, Prime number generation and other simple problems, searching & sorting techniques

UNIT II
C language fundamentals: Character set, Key words, Identifiers, data types, Constants and variables,Statements, Expressions, Operators, Precedence and Associativity of operators, Side effects, Type conversion,Managing input and output.
Control structures: Decision making, branching and looping.

UNIT -III
Arrays and strings,designing structured programs, Functions in C, User defined and standard functions, Formal vs. actual arguments, Storage classes: Auto, Extern, register and static variables

UNIT IV
Pointers: Pointer variable and its importance, Pointers and arrays, Pointer and character strings, Pointers and functions, Array of pointers, pointers to pointers

UNIT- V
The Pre-processor directives, command line arguments, Macros. Dynamic memory allocation
Structure and union, File Management

Text books:

1. Behrouz A. Forouzan and Richard F. Gilberg. Computer Science: A Structured Approach Using C,Third Edition, 2007, CENGAGE Learning India Pvt. Ltd., New Delhi.
2. E. Balguruswamy, "Programming in ANSI C", 4th edition, 2007, McGraw-Hill Publication, New Delhi.

Reference books;

1. Let us C-Yashwant Kanetkar.
2. K.R. Venugopal, S.R. Prasad, " Mastering C, McGraw-Hill Education India
3. K.N. King,"C Programming-A modern approach'', W.W. Norton
4. S. Prata," C Primer plus", 5th Edition, Pearson Education India

MBCT 103	**Fundamental Web Technology**		

Course Objective

1. To introduce Web & Web World.
2. How to design web sites.
3. To plan & implement real time live web sites.
4. To have basic knowledge of using web templates.

Course Outcome-

1. Select & use of web templates as per user requirement.
2. Basic web designing.
3. Client side validations & enhancements via client-side scripting.
4. Ability to understand the difference between client & server technologies.

Course Content-

Unit 1: Web, web standards &Browser:- Basics of www, Browser, Internet history, Web standards, W3C elements, Domain & Hosting.

Unit 2: HTML 5 Basics: - HTML, Difference between HTML 4, XHTML & HTML 5, HTML elements- doctype, html, head, title, body, Headings, Paragraph, font, table, listing, div, header, footer, article, nav, aside, frames, script, anchor, target attribute, style.

Unit 3: CSS 3 Basics: - CSS 3 basics, Selectors, Inline, Internal & External CSS, Color, Background, Margins, Padding, Text, Alignments, Font, Anchor, Border, RGB, Opacity, list etc.

Unit 4: Java script Basics: - Java script Introduction, Inline, Internal & External Java script, Output, Statements, Variables, Objects, Arithmetic, Data Types, Functions, Events, Arrays etc.

Unit 5: DHTML: -Define DHTML, How and why combine HTML, CSS and Java script, Creation of smallwebsite of minimum 7 to 10 pages represents student profile.

List of Practice Programs:-

1. Create a site named “Mysite” having page index.html.
2. Create a list of courses in your institute with proper headings.
3. Create & design one chapter of any book in HTML using CSS.
4. Create a registration form with minimum 10 form elements.
5. Validate the registration form developed in point 4.

MCA 1st Semester

MCAT 101	**Discrete Structure**	**L3:T 1: 0P**	**4 credits**

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding ofDiscrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

Course Outcomes:

1. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives
2. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference
3. For a given a mathematical problem, classify its algebraic structure
4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
5. Develop the given problem as graph networks and solve with techniques of graph theory.

Unit 1: Sets, relations and functions:
Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.

Unit 2: Propositional Logic:
Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deduction theorem, etc. Decision problems of propositional logic. Introduction to first order logic and first order theory.

Unit 3: Partially ordered sets:
Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices.
Boolean and pseudo Boolean lattices.

Unit 4: Algebraic Structures:
Algebraic structures with one binary operation – semigroup, monoid and group. Cosets, Lagrange's theorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures. Error correcting code. Algebraic structures with two binary operations- ring, integral domain, and field. Boolean algebra and Boolean ring (Definitions and simple examples only).

Unit 5: Introduction to Counting:
Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions.

Textbooks/References:

1. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill,2000.
2. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific,1999.
3. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley,1994.
4. K. H. Rosen, Discrete Mathematics and its Applications, 6th Ed., Tata McGraw-Hill, 2007.
5. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Ed., Jones and Bartlett, 2010.
6. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill,1999.
7. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill,1997.

MCAT 102 &MCAP 102	Data Base Management System	L 3:T 1: P 2	5 Credits

Course Objectives:

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a Database
- To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Outcomes

1. For a given query write relational algebra expressions for that query and optimize the developed expressions
2. For a given specification of the requirement design the databases using ER method and normalization.
3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
4. For a given query optimize its execution using Query optimization algorithms
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling

UNIT-1: **Database system architecture:** Data Abstraction, Data Independence, Data Definition Language(DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object-oriented data models,integrity constraints, data manipulation operations.

UNIT-2: **Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDLand DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. **Relational database design:** Domain and data dependency, Armstrong's axiom, Normal forms,Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Queryequivalence, Join strategies, Query optimization algorithms.

UNIT-3: **Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Lockingand **timestamp**-based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

UNIT-4: **Database Security:** Authentication, Authorization and access control, DAC, MAC and RBACmodels, Intrusion detection, SQL injection.

UNIT-5: **Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases,Distributed databases, Data warehousing and data mining.

List of topics for practical:

1. SQL queries for the creation of tables and insertion of values into tables.
2. SQL queries for viewing all data and specific data corresponding to a particular row or column in a table.
3. SQL queries for the updation, deletion and dropping of tables.
4. SQL queries for aggregation, range finding etc on the tables.
5. SQL queries for renaming, truncating and destroying the tables.
6. SQL queries for the use of not null, group by, having clause.
7. SQL queries for the computation done on the table data.
8. Exercise on nested SQL queries and sub queries.
9. Use of cursors, triggers, functions and writing pl/sql block.
10. A brief idea about oracle report builder.

Text/Reference Books:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, ComputerScience Press.

3. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, PearsonEducation.

4. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley.

MCAT 103&MCAP 103	Operating System	L 3:T 1:P 2	5 Credits

Course Objectives:

- Define, explain, and apply introductory operating systems concepts: process management, inter-process communication, memory management, I/O systems, and file systems.
- Use the UNIX operating system interface to implement a user-level shell in the C language.
- Design and implement a correct concurrent program requiring synchronization.
- Gain experience in implementing and debugging operating system components, including the kernel module, system call, synchronization primitives, and the file system.

Course Learning Outcomes:

1. Understanding fundamental of operating systems and system programming.
2. Apply the process management concept and threads in OS
3. Analyze the performance of various device and resource management techniques for different systems.
4. Examine process synchronization and deadlock problem related to inconsistency and race conditions with shared variables.
5. Analyze the working of IO management and disk scheduling.
6. Analyze and report appropriate OS design choices when building real world systems.

Course Content:

Unit I: Introduction and Historical context of Operating Systems- All components Description, The Evolution of OS: Batch Systems, multi programming systems, Time sharing systems, Parallel systems, Real Time systems, distributed systems. Operating system structure: Micro kernel, Monolithic systems, Layered systems, Virtualization, Client-server model, Mobile Operating System. X86 architecture overview, Booting sequences, Boot loaders and their stages, BIOS and its routines, interrupts.

Unit II: Process Concepts, Threads & Concurrency, Scheduling Concurrency & Synchronizationissues; Process concepts, Threads: Overview, Benefits, User and Kernel threads, Multithreading models. Scheduling, Operations on processes, Cooperative processes, IPC, Scheduling criteria, Scheduling algorithms, multiple processor scheduling, Process synchronization: Critical section problems, Semaphores, Synchronization hardware and monitors. Deadlock; System model, Characterization, Methods for handling deadlocks. Deadlock prevention, Avoidance and detection, Recovery from deadlock.

Unit III: Memory Management; Background, Swapping, Contiguous memory allocation, Paging,Segmentation, Segmentation with Paging, Virtual Memory. File System management and Input output management; File concept, Access models, Directory structure, Protection, File-system Structure, Allocation methods, Free space management. Overview, I/O hardware, Application I/O interface. Secondary Storage Management; Disk structure, Disk scheduling, Disk management, Swapspace management.

Unit IV: Fault and Security Issues; Overview of system security, Security methods and devices,Protection, access, and authentication, Models of protection, Memory protection. Distributed O S; Introduction to distributed operating systems, synchronization and deadlock in distributed systems

Unit V: System Programming; Introduction, Components of a Programming System: Assemblers,Loaders, Macros, Compliers, Formal System. Memory Addressing; Memory Multiplexing, Binding of Instruction and Data to Memory. Address Translation, Multi-Segment, Special Registers, Wait/Exit, Address Translation. Interrupts and Exceptions; Synchronous and asynchronous interrupts, Calling a System Call from User Space, INT, Trap Handling, System call dispatch, arguments and return value, Device Interrupts.

Text / Reference Books:

1. Charles Crowley “Operating System A Design Approach” TMH.
2. Andrew S.Tanenbaum “Operating Systems Design and Implementation”, Third Edition,Prentice Hall Publications 2006.
3. A.S. Tanenbaum, “Modern Operating Systems”, 2nd edition, Prentice Hall India.
4. A.Silberschatz, P.Galvin, G. Gagne, “Operating systems concepts” Willey international company (sixth edition).

Topics for Programs:
Course Goals:
Learn Linux operating system basic principles and components.
Learn and be familiar with the Linux commands.
Understand file permission.
Understand Linux file systems.
Understand Processes.
Learn Vi Editor.
Learn shell scripting.

1. Study of logging/logout details.
2. Study of Unix/Linux general purpose utility command list obtained from (man, who, cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown) commands.
3. Study of grep, find, comm.,cmp anf diff command.
4. Study of sort command with its options.
5. Filters: cat, head, tail, sort, uniq.
6. Process Utilities (ps, kill, wait, sleep).
7. Study of vi editor
8. Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system.
9. Study of Unix/Linux file system (tree structure).
10. Study of .bashrc, /etc/bashrc and Environment variables.
11. Study of file permissions. Chmod with character and octal mode.
12. Shell script program to copy contents of one file to another.
13. Write a shell script program to display list of user currently logged in.
14. Write a shell script program to display “HELLO WORLD”.
15. Write a shell Script program to check whether the given number is even or odd.
16. Shell script Program to search whether element is present is in the list or not.
17. Shell script program to check whether given file is a directory or not.
18. Shell script program to count number of files in a Directory.
19. Write a shell script to change the priority of processes.
20. Write a shell script to change the ownership of processes

MCAT 104 & MCAP 104	Computer Organization	L 3:T 1:P 2	5 Credits

Course Objectives:
The main objective is to
Given the knowledge of digital circuits, and data structures, the student will be able to understand the basic principles on which computers work, analyze their performance and appreciate the issues affecting modern processors.

Course Outcomes
1. Interpret the functional architecture of computing systems.
2. Identify, compare and assess issues related to ISA, memory, control and I/O functions.
3. Design and analyze solutions in the area of computer architecture.

Detailed Content
Unit I:
Basic Structure of Computer, Architecture Milestones, Performance Metrics. ISA Level: Model, Data types, Instruction formats like expanding opcode, Addressing modes, instruction types, procedures, co routines, traps, interrupts etc.

Unit II
I/O organization: Program I/O, Interrupt I/O, DMA Hardware and software. Bus timing and design like synchronous/asynchronous etc. Standard I/O interfaces.

Unit III
Memory system: Addressability, Big and Little endian assignments. RAM organization and design. ROM and its variants. Cache design, mapping and performance of the memory hierarchy. Secondary storage architecture.

Unit IV
Computer Arithmetic: Number Representation, Addition/Subtraction, Fast Adders, Multiplication and Fast Multiplication, Booths algorithm, FP operations, guard bits and truncation, IEEE 754 and implementing an FP unit. Processing Unit: Instruction execution concepts, Single bus and multiple bus data paths, Hardwired control, Micro programmed control.

Unit V
Assembly Language Concepts, Macros, Assembly process, linking and loading. Advanced Concepts like pipelining, hazards, influence on instruction sets, superscalar operation, multi-core and multi-cpu architectures.

MCAP 105: Computer Organization Lab
1. Study and Bread Board Realization of Logic Gates. K-Map, Flip-Flop equation, realization of
1. characteristic and excitation table of various Flip Flops.
2. Implementation of Half Adder, Full Adder and Subtractor.
3. Implementation of Ripple Counters and Registers.
4. Implementation of Decoder and Encoder circuits.
5. Implementation of Multiplexer and D-Multiplexer circuits.

Suggested reading material:
1. Hamacher, Carl V. et al, Computer Organization; 5th edition, McGraw Hill.
2. Heuring, Jordan; Computer Systems Design and Architecture, 2nd edition, Pearson
3. Tanenbaum A.S., Structured Computer Organization; 4th edition, PHI.
4. Patterson D. A., Hennessy J. L.; Computer Organization & Design: The Hardware/ Software Interface, 3rd edition, Elsevier.

MCAT 105	**Technical Communication Skills**	**L 3: T1:P 2**	**5 Credits**

Objectives:
Technical Communication is most essential for students and professionals. Thus there is a drastic need for effective communication. Due to the various phenomenal changes in the business environment, recruiters are now looking for students with good computer knowledge as well as good communication skills. Thus, the objective of this course is to equip the students with the basics of communication skills and technical writing, so that they can put it into use in their dayto-day activities.

UNIT I
Introduction to Communication
What is Communication, Levels of Communication, Importance of Technical Communication, Barriers to Communication, Non-Verbal Communication, Technology-Enabled Communication, Impact of Technology, Selection of Appropriate Communication Technology

UNIT II
Oral Forms of Communication Effective listening, Active vs Passive Listening, Effective Presentation Strategies, Effective Use of Visual Aids, Understanding the Nuances of Delivery, Interviews, Types of Interviews, Group Discussion, Meetings, Conferences.

UNIT III
Introduction to Essential English Grammar
Punctuation and Capitalization, Nouns and Verbs, Pronouns, Adjectives, Prepositions, Conjunctions, Tenses, Active and Passive Voice, Use of Articles, Common Errors in Usage, Words Commonly Misspelt

UNIT IV
Effective Writing Words and Phrases, Guidelines for Effectiveness, Sentence Construction, Paragraph Development, Precis Writing, Reading Comprehension.

UNIT V
Written Forms of Communication
Letter Writing, Memorandums, E-mails, Report Writing, Technical Proposals, Research Paper, Dissertation, Thesis, Instruction Manuals, Technical Description

Text Books:

1. Technical Communication – Principles and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford University Press, Sixteenth Impression 2007.
2. Business Communication by Meenakshi Raman & Prakash Singh, Oxford University Press, Seventh Impression 2008.
3. High School English Grammar and Composition by Wren & Martin

Reference Books:
1. Effective Business Communication by Herta A Murphy, Herbert W. Hilderbrandt & Jane P Thomas, Seventh Edition, Tata McGraw Hill Publication
2. Effective Business Communication by Asha Kaul, Prentice-Hall India Pvt. Ltd., March 2008
3. Technical Writing by B. N. Basu, Prentice-Hall India Pvt. Ltd., 2007

MCAP 106	**Programming in Python**	**L 0 : T 0:P 1**	**1 Credits**

Course Objectives:

The course shows you how to use the free open-source Python to write basic programs and high level applications using concepts such as Class, functions, variables, If Else statements, For loops, While loop etc .This course will be of great interest to all learners who would like to gain a hands on knowledge and understanding of the basic components of computer programming using the Python language

Course Learning Outcomes:

1. To Understand the basic programming structure of Python
2. Using Python Libraries
3. Access database using python programming.
4. Implementing database using SQLite.
5. Create applications using python programming.
6. Write clear and effective python code.
7. Able to apply the principles python programming.

Course Content:

1. Introduction to Python IDE and basic command syntax.
2. Writing simple programs to practice knowledge of variable, data types, strings, control structure.
3. Writing programs to use various libraries related with data manipulation .
4. Wring program of user defined functions, list etc
5. Writing programs related with file I/O using text file, CSV file, Binary file
6. Writing programs to implement Object Oriented programming concepts.

MCA 2nd Sem

MCAT 201	Computer Based Numerical & Statistical Technique	L 3: T 1: P 0	4 Credits

UNIT-I:
Floating point Arithmetic: Representation of floating point numbers, Operations, Normalization,Pitfalls of floating point representation, Errors in numerical computation.
Iterative Methods: Zeros of a single transcendental equation and zeros of polynomial using Bisection Method, Iteration Method, Regula-Falsi method, Newton Raphson method, Secant method, Rate of convergence of iterative methods.

UNIT-II:
Interpolation and approximation: Finite Differences, Difference tables Polynomial Interpolation**:** Newton's forward and backward formula, Central Difference Formulae: Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. Interpolation with unequal intervals**.Langrange's Interpolation, Newton Divided difference formula,** Approximation of function byTaylor's series.

UNIT-III:
Numerical Differentiation and Integration: Introduction, Numerical Differentiation, NumericalIntegration, Trapezoidal rule, Simpson's rules, Boole's Rule, Weddle's Rule.
Solution of differential equations: Picard's Method, Euler's Method, Taylor's Method, Runge-Kutta methods,
Simultaneous Linear Equations: Solutions of system of Linear equations, Gauss Elimination,Gauss Jordan method , Gauss Seidal iterative method, Rate of Convergence.

UNIT-IV:
Curve fitting, Cubic Spline and Approximation: Method of least squares, fitting of straight lines,polynomials, exponential curves etc. Cubic Spline Approximation.
Correlation and Regression analysis: Introduction ,Scatter Diagram ,Types of Correlation ,KarlPearson's Method ,Rank Correlation, Linear and Non-linear regression, Multiple regression.

UNIT-V:
Time series and forecasting: Method of Semi Averages,Method of Moving Averages,Method ofLeast Square, smoothening of curves, forecasting models and methods.
Statistical Quality Controls: Advantages of Q.C, Controls charts,Types of control charts-Meanchart, R- Range chart,Standard Deviation Chart.

Text Books:
1. Rajaraman V., "Computer Oriented Numerical Methods", PHI-2004
2. Gerald & Wheatley, "Applied Numerical Analyses", AW-2003

ReferenceBooks
1. Burden, RichardL.,Fairs,J.DouglasFairs, "NumericalAnalysis",ThomsonAsia.PTE, 7thEdition.
2. Gourdin A., BoumahratM."Applied Numerical Method", PHI.
3. Rajasekaran, S." NumericalMethodinScience& Engineering,A Practical Approach"S.Chand&Co Ltd.,IIEdition.
4. Jain M. K. &IyengerR.K. "NumericalMethods for Scientific&Engg. Computation,"New
5. Age, InternationalPub. 4th Edition.

MCAT 202 **MCAP 202**	**Data Structure & Analysis of Algorithms**	**L 3:T 1: P 2**	**5 Credits**

Course Objectives

1. Introduction to the concept of data structures using lists, stack, queues and trees.
2. Understand and memorize algorithm and its analysis procedural.
3. To design and implement various data structure algorithms.
4. Compute the complexity of various algorithms.
5. To learn some advanced data structure and algorithms of various fields and understand the application of algorithms.

Course Outcomes

1. Select appropriate data structures as applied to specified problem definition.
2. Students will be able to implement linear and Non-Linear data structures.
3. Determine and analyse the complexity of given Algorithms.
4. Ability to choose appropriate algorithm design techniques for solving problems.
5. Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs.

Course Content :-

Unit 1: Introduction to Data Structures

Basic Data organization, Array, Pointer, Structure. *Operations*: insertion, deletion, traversal. *Searching*: Linear & binary searching. *Sorting*: Insertion, bubble, merge, quick, counting, radix, bucket etc. *Dynamic Storage*: Linked lists: Singly, double & circular.

Unit 2: Stack, Queues and Trees

ADT, Stack and its operations, Queue and its operations, Types of queues: Simple, Circular, Priority queues and their operations. Non-Linear Data Structures using array and Linked lists. Binary Search Tree creation and Binary Tree traversal, AVL tree, B Trees and B+ Trees.

Unit 3: Introduction to design and analysis of algorithms

Analysis of Algorithm, Time & space trade-off, Basic asymptotic notations, Divide and conquer approach analysis, Analysis of Binary search, Insertion Sort, Merge Sort, Quick Sort and Heap Sort, RED BLACK Tree and its operations: Insertion and deletion.

Unit 4: Disjoint Sets, Graph and Various Methods

Disjoint Sets operations, Union and find algorithms, Graph, BFS, DFS, Kruskal, Prims, Dijkstra, Floyd-warshall, *Greedy approach:* 0/1 knapsack, Activity Selection Problem, *Backtracking:* n-Queens Problem and *dynamic programming:* Matrix Chaining Multiplication, Rod Cutting.

Unit 5: Branch and Bound and Non-deterministic problems

Branch and Bound, Travelling sales man problem, P, NP, NP-Hard and NP-Complete.

Text Books :-

1. "Fundamentals and Data Structures", Illustrated Edition by Elis Horowitz, Sartaj Sahni, Computer Science Press.
2. Data Structure, Schaum's series.
3. T.H. Coremen, C.E. Leiserson, R.L. Rivest, Introduction to Algorithms, The MIT Press Cambridge, Massachusetts, 3rd Edition.

List of Programs :-

1. Implementation of Array ADT and String ADT.
2. Programs of Stack, Queue, and Circular Queue using Array.
3. Implement Singly Linked List.
4. Implement Doubly Linked List and Circular Linked List.
5. Traversal implementation of Binary Tree (Post order, Pre-order and In-order).
6. Implement Insertion Sort, Counting Sort and Merge Sort.
7. Implement Red-Black Tree Insertion and Deletions.
8. Implement BFS and DFS (Graph).
9. Implement Kruskal and Prims (Graph).

MCAT 203 **MCAP 203**	**Object Oriented Programming with Java**	**L 3 :T 1 : P2**	**5 Credits**

OBJECTIVES:
Java play a predominant role in software development it is felt that the following objectives can be achieved after studying this subject.

i) Understand the concepts of Object oriented Programming.
ii) Write simple applications using Java.
iii) Compare and contrast features Java.

Unit I
Object Modeling: Objects and classes, links and association, generalization and inheritance, aggregation, abstract class, multiple inheritance, meta data, candidate keys, constraints..

Unit II
Dynamic Modeling: Events and states, operations, nested state diagrams and concurrency, advanced dynamic modeling concepts, a sample dynamic model Functional Modeling: Data flow diagram, specifying operations, constraints, a sample functional model.OMT (object modeling techniques) methodologies, examples and case studies to demonstrate methodologies, comparisons of methodologies, SA/SD, JSD.

Unit III
Java Programming: Introduction, Operator, Data types, Variables, Methods & Classes, Multithread Programming, I/O, Java Applet.

Unit IV
Java Library: String Handling, Input/Output exploring Java.io, Networking, Exception Handling, Event Handling, Introduction to AWT, Working with window, Graphics, AWT Controls, Layout Manager and Menus, Images.

Unit V
Software Development using Java: Java Swing, Application of java, JDBC, RMI .

Text Books:

1. Herbert Schieldt, "The Complete Reference: Java", TMH, 7 th Edition.
2. E. Balagurusamy, "Programming in JAVA", TMH, 4 th Edition.
3. James Rumbaugh etal, "Object Oriented Modeling and Design", PHI

References:

1. E. Balagurusamy, "Object Oriented Programming" ,TMH, 2008.

Object Orinted Programming with Java Lab

2. Simple java applicationsfor understanding references to an instant of a class, Inheritence, etc
3. Handling strings in JAVA
4. Simple package creation and developing user defined packages in java
5. Developing user defined interfaces and their implementation.
6. Creation of thread based application in java
7. Illustration of exception handling mechanism in java

MCAT 204 **MCAP 204**	**Computer Network**	**L3 :T 1 :P2**	**5 Credits**

Course Objectives:

The objective of this course is to build basic concepts of Computer network established for the data communication. This course also aims to provide the fundamental concepts in the design and implementation of networks, their protocols and its applications.

Course Learning Outcomes:

- Outline basics to advanced concepts and techniques of Computer networks.
- Describe problem solving approaches as applied in Data communication networking areas.
- Analyse performance of basic communication networks using both analytical and simulation techniques.
- Develop the Computer network design techniques and practical implementation issues.
- Understand the basic properties of internet and data traffic properties.
- Apply verification and validation techniques on a given software project.
- Demonstrate deployment and basic maintenance skills.

Course Content:

Unit I: Introduction: Introduction to computer network, classification of networks WAN, MAN,LAN), distributed systems, digital signals and data rates, bit stream, symbols and band rate, transmission media, modems, structure of computer network, circuit, packet, message switching, Network topological, Network model, ISO-OSI model, TCP/IP model, primitives and services.

Unit II: Physical Layer: Physical Layer Design Issues (Service provided to data link Layer)Introduction Transmission media, RS-232-C and RS-449, Line coding, Switching Techniques.

Unit III: Data Link Layer: Data Link Layer Design Issues (Service Provided to N/w Layer),Framing, error control, flow control, Link Management, Error Detection and Error Correction Coding, Data Link Protocols (Elementary and sliding Window), local and metropolitan area networks. The Medium Access sub layer, Static and Dynamic Channel Allocation in LANs and MANs, ALOHA Protocols (Pure and Slotted), Different Protocols of LAN, IEEE Standard 802 for LAN (802.2, 802.4, 802.5).

Unit IV: Network Layer: Network Layer Design Issues (Service Provided to Transport Layer).Routing, Congestion, Internetworking. Routing Algorithms, Congestion Control Algorithm Internetworking, congestion control. Design issues, buffer management, synchronization. Session and presentation layer synchronization issues, formatting, data compression, data security.

Unit V: Transport Layer: Transport Layer Design Issue. Connection Management, BufferManagement, Quality of Service. Session Layer Design Issues Synchronization issues. Introduction to Presentation Layer. Encryption and decryption. RSA algorithm.

List of Programs: -

1. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Use of crossover and Straight Ethernet cable.
3. Hands on study of following Network Devices in Detail: Repeater ,Hub , Switch , Bridge , Router ,Gate Way.
4. Study of basic network command and Network configuration commands.
5. Performing an Initial Switch Configuration.
6. Performing an Initial Router Configuration.

Text/ Reference Books:

1. A.S. Tennenbaum, Computer Networks, PHI.
2. W. Stallings, Data & Computer Communication, PHI.
3. Forouzen, Behrouz A.Fegan, Sophia Chung Data Communications and Networking, TMH.
4. Carne, E. Bryan Professional's Guide to Data Communication in a TCP/IP World Artech House, London, 2004.
5. Young, Margret Levine Internet: The Complete Reference, Tata McGraw Hill, New Delhi, 2002.

MCAT 205	**Microprocessors & Interface**	**L3 :T 1:P 0**	**4 Credits**

Course Objectives:

- To introduce students with the architecture and operation of typical microprocessors and microcontrollers.
- To familiarize the students with the programming and interfacing of microprocessors and microcontrollers.
- To provide strong foundation for designing real world applications using microprocessors and microcontrollers

Learning Outcomes: At the end of the course students should be able to:

- Assess and solve basic binary math operations using the microprocessor and explain the microprocessor's internal architecture and its operation within the area of manufacturing and performance.
- Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor.
- Compare accepted standards and guidelines to select appropriate Microprocessor (8085 & 8086) to meet specified performance requirements.
- Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor.
- Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.
- Evaluate assembly language programs and download the machine code that will provide solutions real-world control problems.

Course Content:

Unit I: 80x86 Processor Architecture: Introduction, Processor Model, Programmer's model,Designer's Model : 8086 hardware details, Clock generator 8284A, Bus buffering and latching, Processor Read & Write bus cycles, Ready and wait state generation, Minimum versus Maximum mode operation.

Unit II: Memory Interfacing :80x86 processor-Memory interfacing, Address decoding techniques,Memory Devices – ROM, EPROM, SRAM, FLASH, DRAM devices, Memory internal organization, Memory read and write timing diagrams, DRAM Controller.

Unit III: Basic I/O Interfacing :Parallel I/O, Programmed I/O, I/O port address decoding, The 8255AProgrammable Peripheral Interface(PPI), programming 8255, Operation modes, Interface examples – Keyboard matrix, LCD/7-Segment Display, Printer, stepper motor, A/D and D/A converter, Timer Interfacing: The 8254 Programmable Interval Timer(PIT), Timing applications.

Unit IV: Serial I/O Interface: Asynchronous communication, Physical communication standard-EIARS232, Programmable Communication Interface - UART 8251, Interfacing serial I/O devices- mouse, modem, PC Keyboard.

UnitVI: Direct Memory Access: Basic DMA operation, DMA Controlled I/O, The 8237 DMAController, Disk Memory Systems- Floppy disk, Hard disk, optical disk memory systems, video displays. Bus Interfaces: PC bus standards & interfaces – PCI, USB, Firewire, AGP.

Text / Reference Books:

1. Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with 8085, 5th Edition, PIP Publication.
2. A K Ray and K M Bhurchandi, "Advanced Microprocessors & Peripherals", 2nd ed., TMH,2006.
3. Doughlas.V.Hall, Microprocessor and Interfacing : Programming and Hardware", 2nd edition, McGraw Hill, 1991.
4. S K Mandal, Microprocessors and Microcontrollers, WBUT Series by TMH.
5. B. Ram, Fundamentals of Microprocessors and Microcontrollers, Dhanpat Rai Publications.
6. A. P. Godse & D. A. Godse, Microprocessor Systems, Technical Publications Pune, 2nd Revised Edition.

MCAT 206	**Accounting & Financial Management**	**L 3: T 1: P0**	**Non Credit**

Objective: The objective of this course to provide awareness of the underline financial structure andprocedures of the organization so that the interaction of financial system with informationsystems can be understood by the information system designer.

Unit-1
Accounting: Principles, concepts and conventions, double entry system of accounting, Ledger posting andTrial balance.
Final accounts: Trading, profit and loss accounts and balance sheet of sole proprietary concern with normalclosing entries. Introduction to manufacturing account, final account of partnership firms, limited company.

Unit-II
Financial Management: Meaning, role and scope of financial management.
Basic Financial concepts: Time value of Money, present value, future value of a series of cash flows, annuity.Practical applications of compounding and present value techniques.
Long-term sources of finance: Introduction to shares, debentures, preference shares.

Unit-III
Capital Budgeting: Meaning, importance, difficulties. Introduction to evaluation techniques – Traditionaltechniques (ARR Payback method). Discounting cash flow techniques (Present value, NPV, IRR)
Ratio Analysis: Meaning, advantages, limitations of ratio analysis, Types of ratios and their usefulness.

Unit-IV
Costing: Nature, importance and types of cost
Marginal costing: Nature, scope and importance of marginal costing, Break-even analysis, its uses andlimitations, construction of break-even charts. Practical applications of marginal costing.
Inventory control system: The need, cost of inventory, methods of inventory costing.

Unit-V
Introduction to Computerized Accounting System: Coding logic and codes required, master files,transaction files, introduction to documents used for data collection. Processing of different files and outputsobtained.

Text Book
1. Khan & Jain, “Management Accounting”, Tata McGraw Hill Publication
Reference Books:
2. Jawahar Lal, “Financial Accounting”, Wheeler Publishing.
3. S.N. Maheswari & S. K. Maheswari, “Introduction to Financial Accountancy”, Vikas Publication.

MCA 3rd Semester

MCAT 301	**Theory of Automata & Formal Language**	**L 3: T 1: P 0**	**4 Credits**

Course Objectives:

- To give an overview of the theoretical foundations of computer science from the perspective of formal languages.
- To understand the mathematical representation and derivation of formal languages.
- To classify machines by their power to recognize languages.
- To illustrate finite state machines to solve problems in computing and relationship between Finite State Machine and Regular Expression.
- To familiarize Regular grammars, context frees grammar which is crucial to understand how compiler and programming languages are built.
- To the concepts of PDA and the relationship between PDA and Context Free Language and CFG.
- To learn the concepts of Turing machine and its algorithm to solve problems.
- To understand the difference between the solvable and unsolvable problem.

Unit I Basic concepts of Automata Theory:
Introduction to Automata Theory, Alphabets, Strings and Languages, Deterministic Finite Automata (DFA) and Nondeterministic Finite Automata (NFA) – Definition, Representation using Transition Tables and State Diagrams, Equivalence of NFA and DFA, NFA with ε-transitions, Finite Automata with Output: Moore and Mealy Machine, Equivalence of Moore and Mealy Machines, Equivalence and Minimization of DFA, Applications and Limitation of FA.

Unit II Chomsky's Classification of Formal Language, Regular Expression and Languages: Definition of Formal Language, and Grammar, Classification of Grammars, Chomsky's Hierarchy of Formal Language, Regular Expression , Closure properties of regular languages FA and Regular Expressions , Arden Theorem for finding regular expression from FA, Pumping Lemma for regular expressions(Proving languages not to be regular)

Unit III Context-free Grammars and Languages :
Context Free Grammars (CFG) and Context Free Languages (CFL) - Definition, Examples, Derivation trees, Ambiguous Grammars, Simplification of Grammars, Normal forms of CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs, Pumping lemma for CFLs. Push Down Automata (PDA): Definition and Description, Language of PDA and its applications.

Unit IV Turing Machine:
Turing machines (TM): Basic model, definition and representation, Language acceptance by
TM, TM and Type – 0 grammar, Halting problem of TM, Modifications in TM, Universal TM

Unit V Undesirability:
Properties of recursive and recursively enumerable languages, unsolvable decision problem, Undecidable problems about Turing Machines, Rice's Theorem, Post's Correspondence problem (PCP) and Modified PCP. The P and NP Problems.

TEXT BOOK:

1. Introduction to Automata theory, Languages and Computation, J.E.Hopcraft, R.Motwani, and Ullman. 2nd edition, Pearson Education Asia
2. Theory of Computer Science(Automata, Languages and Computation), K.L.P. Mishra and N.Chandrasekaran, PHI, 3rd Edition
3. Introduction to languages and the theory of computation, J Martin, 3rd Edition, Tata McGraw Hill

REFERENCE BOOK:

1. Elements of theory of Computations , C Papadimitrou. and C.L Lewis, PHI
2. Introduction to Computer theory, D. I. A. Cohen, John Wiley & Sons
3. Theory of Automata (Languages and Computation), Rajendra Kumar, PPM

MCAT 302 **MCAP 302**	**Software Engineering**	**L3 :T 1:P 2**	**5 Credits**

Course Objectives:

- To enable the students to apply a systematic application of scientific knowledge in creating and building cost effective software solutions to business and other types of problems.
- To make the students understand project management concepts & their metrics.
- To make the students understand requirement engineering and its models (Information, functional, behavioral).
- Making the students understand to develop quality software, its maintenance & introduce about software reliability.

Course Outcomes: The student will be able to

1. Implement Software life cycle models and have a knowledge of different phases of Software life cycle
2. Identify, formulate, review, estimate and schedule complex software projects using principles of mathematics.
3. Create a bug free software with good design and quality by using appropriate techniques and modern engineering and IT tools.
4. Analyze verification, validation activities, static, dynamic testing, debugging tools and techniques and importance of working in teams.

Detailed Syllabus:

UNIT-1: INTRODUCTION

Evolving role of software, Software Characteristics, Software crisis, Silver bullet, Software myths, Software process, Personal Software Process (PSP), Team Software Process (TSP), emergence of software engineering, Software process, project and product, Software Process Models: Waterfall Model, Prototype Model, Spiral, Model, RAD Model, Iterative Model, Incremental Model, Aspect-oriented Model, Agile Model.

UNIT-2: SOFTWARE PROJECT MANAGEMENT

Project management concepts, Planning the software project, Estimation—LOC based, FP based, Use-case based, empirical estimation COCOMO- A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management.

UNIT-3: REQUIREMENTS, ANALYSIS AND SPECIFICATION

Software Requirements engineering, Requirement engineering process, Requirement Engineering Tasks, Types of requirements, SRS. System Modelling: Data Modelling, Functional Modelling and information flow: Data flow diagrams, Behavioral Modelling, The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the data dictionary.

UNIT-4: SYSTEM DESIGN

Design principles, the design process; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling;

UNIT-5: SOFTWARE TESTING AND MAINTENANCE

Testing terminology- error, bug/defect/fault, failure, Verification and validation, Test case design, Static testing, Dynamic testing--- Black box testing—Boundary value analysis, White box testing-- basis path testing, Unit testing, Integration testing, Acceptance Testing

REFERENCES:

1. Software Engineering – A Practitioner's Approach, Roger S. Pressman, 1996, MGH.
2. Fundamentals of software Engineering, Rajib Mall, PHI
3. Software Engineering by Ian sommerville, Pearson Edu, 5th edition, 1999, AW,
4. Software Engineering – David Gustafson, 2002, T.M.H
5. Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson 1995, JW&S.

6. An Integrated Approach to software engineering by Pankaj Jalote , 1991 Narosa

List of Experiments

1. Phases in software development project, overview, need, coverage of topics
2. To assign the requirement engineering tasks
3. To perform the system analysis : Requirement analysis, SRS
4. To perform the function oriented diagram : DFD and Structured chart
5. To perform the user's view analysis : Use case diagram
6. To draw the structural view diagram : Class diagram, object diagram
7. To draw the behavioral view diagram : Sequence diagram, Collaboration diagram
8. To draw the behavioral view diagram : State-chart diagram, Activity diagram
9. To draw the implementation view diagram: Component diagram
10. To draw the environmental view diagram : Deployment diagram
11. To perform various testing using the testing tool unit testing, integration testing.

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MCAT 303 **MCAP 303**	**Big Data Analysis**	**L 3 : T 1: P 2**	**5 Credits**

UNIT I : Introduction to Big Data: Big Data and its Importance– Four V's of Big Data–Driversfor Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

UNIT II: Big Data Technologies: Hadoop's Parallel World –Data discovery–Open sourcetechnology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans-Firewall Analytics - Information Management.

UNIT III: Processing Big Data: Integrating Disparate Data Stores - Mapping Data To TheProgramming Framework- Connecting And Extracting Data From Storage - Transforming Data For Processing - Subdividing Data In Preparation For Hadoop Map Reduce.

UNIT IV: Hadoop Map reduce: Employing Hadoop Map Reduce - Creating the components ofHadoop Map Reduce jobs - Distributing data processing across server farms -Executing Hadoop Map Reduce jobs - Monitoring the progress of job flows - The Building Blocks of Hadoop Map Reduce - Distinguishing Hadoop daemons - Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

UNIT V: Advanced Analytics Platform: Real-Time Architecture–Orchestration and SynthesisUsing Analytics Engines– Discovery using Data at Rest – Implementation of Big Data Analytics – Big Data Convergence – Analytics Business Maturity Model. Hadoop Eco-System: Pig – Installing and Running , Comparison with Databases – Pig Latin – User-Define Functions – Data Processing Operators – Installing and Running Hive– Hive QL – Tables – Querying Data – User-Defined Functions. Fundamentals of HBase and ZooKeeper - IBM InfoSphereBigInsights and Streams. Visualizations - Visual data analysis techniques, Interaction techniques; Systems and applications.

Text Books:

1. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", 1st Edition, AmbigaDhiraj, WielyCIO Series, 2013.

Reference Books:

1. ArvindSathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st
2. Edition, IBM Corporation, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", 1st Edition, Wiley and SAS BusinessSeries, 2012.
4. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.

MCAT 304	Artificial Intelligence & Applications	L 3 : T 1: P 0	4 Credits

Course Objectives:

The adoption of Artificial Intelligence (AI) technologies is widely expanding in our society. Applications of AI include: self-driving cars, personal assistants, surveillance systems, robotic manufacturing, machine translation, financial services, cyber security, web search, video games, and code analysis and product recommendations. Such applications use AI techniques to interpret information from a wide variety of sources and use it to enable intelligent, goal-directed behaviour.

Course Learning Outcomes:

1. Acquire advanced Data Analysis skills.
2. Stay Industry relevant and grow in your career.
3. Create AI/ML solutions for various business problems. Ÿ Build and deploy production grade AI/ML applications.
4. Apply AI/ML methods, techniques and tools immediately

Course Content:

Unit-1 (Introduction to AI): Definitions, Goals of AI, AI Approaches, AI Techniques, Branches of AI, Applications of AI. Introduction of Intelligent Systems: Agents and Environments, Good Behavior: the concept of Rationality, The Nature of Environments, The structure of Agents, How the components of agent programs work.

Unit-2 (Problems Solving, Search and Control Strategies)

Solving Problems by Searching, Study and analysis of various searching algorithms. Implementation of Depth-first search, Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bi-directional search Informed (Heuristic) Search Strategies: Greedy best-first search A* search: Minimizing the total estimated solution cost, Conditions for optimality: Admissibility and consistency, Optimality of A*, Memory-bounded heuristic search, Heuristic Functions, Generating admissible heuristics from sub problems: Pattern databases, Learning heuristics from experience.

Beyond Classical Search: Local Search Algorithms and Optimization Problems: Hill-climbing search Simulated annealing, Local beam search, Genetic algorithms, Local Search in Continuous Spaces, Searching with Non-deterministic Actions: AND-OR search trees, Searching with Partial Observations.

Unit- 3 (Knowledge Representations Issues, Predicate Logic, Rules)

Knowledge representation, KR using predicate logic, KR using rules. Reasoning System - Symbolic, Statistical: Reasoning, Symbolic reasoning, Statistical reasoning.

Unit-4 (Quantifying Uncertainty, Learning Systems)

Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Bayes' Rule and Its Use, Representing Knowledge in an Uncertain Domain, Other Approaches to Uncertain Reasoning, Rule-based methods for uncertain reasoning, Representing vagueness: Fuzzy sets and fuzzy logic, Study of fuzzy logic and Decision trees, Implementation aspects of Decision trees.

Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, The decision tree representation, Expressiveness of decision trees, inducing decision trees from examples.

Unit-5 (Expert Systems)

Introduction, Knowledge acquisition, Knowledge base, Working memory, Inference engine, Expert system shells, Explanation, Application of expert systems. Fundamentals of Neural Networks

Text/Reference Books:

1. Rich, Elaine Knight, Kevin, Artificial Intelligence, Tata McGraw Hill.
2. Luger, George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education.
3. Nilsson, Nils J, Artificial Intelligence, Morgan Kaufmann.
4. Russell, Stuart J. Norvig, Peter, AI: A Modern Approach, Pearson Education

MCAT 305	Combinatorics& Graph Theory	L 3 : T 1 : P 0	4 Credits

UNIT-I: Rules of sum and products, Permutation, Combination, Permutation groups andapplication, Probability, Ramsey theory, discrete numeric function and generating function, Combinatorial problems, Difference equations.

UNIT-II: Recurrence Relation-Introduction, Linear recurrence relation with constant coefficient,Homogeneous solution, Particular solution, Total solution, Solution by the method of generating function.

UNIT-III: Graphs, sub-graphs, some basic properties, Walks, Path & circuits, Connected graphs,Disconnected graphs and components, Euler and Hamiltonian graphs, Various operation on graphs, Tree and fundamental circuits, Distance diameters, Radius and pendant vertices, Rooted and binary trees, Counting trees, Spanning trees, Finding all spanning trees of a graph and a weighted graph.

UNIT-IV: Cut-sets and cut vertices, some properties, All cut sets in a graph, Fundamental circuitsand cut sets, Connectivity and separatability, Network flows, mincut theorem, Planar graphs, Combinatorial and geometric dual, Kuratowski's to graphs detection of planarity, Geometric dual, Some more criterion of planarity, Thickness and Crossings, Vector space of a graph and vectors, basis vectors, cut set vector, circuit vector, circuit and cut set verses sub spaces, orthogonal vector and sub space.
Incidence matrix of graphs, sub matrices of A(G), circuit matrix, cut set matrix, path matrix and relationship among Af, Bf, Cf, fundamental circuit matrix and rank of Bf adjacency matrix, rank nullity theorem.

UNIT-V: Coloring and covering, partitioning of graph, Chromatic number, Chromaticpartitioning, Chromatic polynomials, Matching, covering, Four color problem, Directed graphs, Types of directed graphs, Directed paths and connectedness, Euler digraphs, Trees with directed edges, Fundamental circuit in digraph, Matrices A, B, C of digraph adjacency matrix of digraph, Enumeration and its types, Counting of labeled and unlabeled trees, Polya's theorem, Graph enumeration with polyas theorem, Graph theoretic algorithm.

Text Books:

1. Deo ,N.: Graph Theory, PHI
2. Harary, F: Graph Theory, Narosa

Reference Books:

1. Bondy and Murthy: Graph Theory and Applications, Adison Wesley
2. Combinatory and Graph Theory",Dr. S.B. Singh, Khanna Book Publishing
3. Joshi K. D., "Fundamental of discrete mathematics", New Age International
4. John Truss, "Discrete mathematics for computer scientist"
5. C. L. Liu, "Discrete mathematics

MCAT 306	Universal Human Values	L 2 : T 0 : P 0	2 Credits

Need, Basic Guidelines, Content And Process For Value Education:
Understanding the need, basic guidelines, Self Exploration-its content and process; 'NaturalAcceptance' and Experiential Validation, Continuous Happiness and Prosperity-Human Aspirations, Right understanding, Relationship and Physical Facilities, UnderstandingHappiness and Prosperity correctly-Acriticalappraisalofthecurrentscenario.Methodtofulfilltheabovhuman aspirations: understand in gland living in harm on yet various levels

Understanding Harmony in the Human Being- Harmony in Myself:
Understanding human being as ace-existence of the sent isn't 'I 'and thematerial'Body'Understanding the needs of Self ('I') and 'Body'-Sukh and Suvidha Understanding the Body as aninstrument of 'I', Understanding the characteristics and activities of 'I'and harmony in 'I'Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal ofPhysical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship:
Understanding harmony in the Family, Understanding values in human-human relationship;meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) andRespect(Samman),meaning of Vishwas; Difference between in tention and competence, meaningof Samman, Difference between respect and differentiation; the other salient value sinrelationship, harmony in the society,Samadhan,Samridhi,Abhay,Sah-astitva as comprehensiveHuman Goals,Visualizing a universal harmonious order in society-Undivided Society(AkhandSamaj),Universal Order(SarvabhaumVyawastha)-from family to world family.

Understanding Harmony in the Nature and Existence- Whole Existence as Coexistence:
Understanding the harmony in the Nature. Inter connectedness and mutual fulfillment among thefour order so fnature-recyclability and self-regulation in nature. Understanding Existenceas Co-existence (Sah-astitva) of mutually in teracting units in all pervasive Space. Holistic perception ofharmony at all levels of existence.

Implications of the Above Holistic Understanding of Harmony on Professional Ethics –Natural Acceptance of Human Values:
Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, HumanisticConstitution and Humanistic Universal Order. Competence in Professional Ethics:

a) Ability toutilize the professional competence for augmenting universal human order,
b) Ability to identifythe scope and characteristics of people-friendly and eco-friendly production systems, technologiesand management models. Strategy for transition from the present state to Universal Human Order:At the level of individual: as socially and ecologically responsible engineers, technologists andmanagers. Case studies related to values in professional life and individual life.

SuggestedReadings:

1. R.R.Gaur, RSangal, GP Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, 2009.ISBN: 978-9-350-62091-5
2. R. Subramanian, Professional Ethics includes Human Values, Oxford Univ. Press.
3. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
4. MGovindrajran, SNatrajan & V.S.Senthil Kumar,Engineering Ethics (includingHuman Values), Eastern Economy Edition, Prentice Hall of India Ltd.
5. BP Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
6. BL Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

MCA 4th Semester

MCAT 401 **MCAP 101**	**.Net Technology**	**L3 :T 1:P 2**	**5 Credits**

Course Objectives:

- The student will use Visual Basic.Net to build Windows applications using structured and object-based programming techniques.
- Students will be exposed to the following concepts and skills.
- Analyze program requirements.
- Design/develop programs with GUI interfaces.
- Code programs and develop interface using Visual Basic .Net.
- Perform tests, resolve defects and revise existing code.

Learning Outcomes:

At the end of the course students should be able to:

1. Students will understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic.
2. Students will describe the basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE).
3. Students will create applications using Microsoft Windows Forms.
4. Students will create applications that use ADO. NET

Course Content:

Unit I:

Introduction to .Net Technology and Visual Basic.Net IDE

Introduction to .Net, Features of .Net, Advantages of .Net, Net Framework, CLR, CTS, CLS, Creating a project, Types of project in .Net, Exploring and coding a project, Solution explorer - toolbox, properties window, Output window, Object Browser.

Unit II:

Programming with VB.Net and Understading Consol Application

Variables, constants, operators, Data types, working with string, Methods, Control statements: Making decisions, If statement, Select case, Loops, MsgBox and Input Box, Classes and Objects, Access Specifiers: Private, Public and Protected, Building Classes, Constructors, Inheritance types, Overloading and Overriding.

Unit III:

GUI Programming

Introduction to Window Applications, Using Form – Properties, Methods and Events, Interacting with controls - Textbox, Label, Button, Listbox, Combobox, Checkbox, Picture Box, Radio Button, GroupBox, Timer, toolbar, Progress Bar, Common Dialog Controls (Save, Open, Font, Color).

Unit IV:

Introduction to ADO.Net

Connected and disconnected Object Model, Creating Connection, Command, Data Adapter, Data Reader and Data Set with OLEDB, Insertion and Updation with table.

UNIT V

ASP.net

Introduction, Architecture, Web forms,Web servers, Server controls, Data connectivity using ASP.net, Introduction of XML, Using XML with ASP.nat

Text Books:

1. VB.Net programming Black Book, by Kogent Learning Solutions,
2. Wiley India VB.Net Step By Step, Michael Halvorson, PHI.
3. Mastering VB.Net, Evangelos Petroutsos,
4. Wiley Publications Beginning VB.Net (Wrox),
5. Matthew Macdonald and Robert Standefer, ASP.NET Complete Reference, TMH

List of Experiments:

1. Write a program to check whether empty query string is entered in Asp .net
2. Write a program to change color of Label text control programmatically in Asp .Net
3. Write a program to Enable-Disable Textbox and change width of TextBox programmatically in Asp .Net
4. Write a program to increase and decrease font size programmatically.
5. Write C# code to display the asterisk pattern as shown below:

   *****
   *****
   *****
   *****
   *****

6. Write C# code to prompt a user to input his/her name and country name and then the output will be shown as an example below:

   Hello Ram from country India!
7. Write C# code to do the following
   - Convert binary to decimal
   - Convert decimal to hexadecimal
   - Convert decimal to binary
   - Convert decimal to octal
8. Write C# code to convert infix notation to postfix notation.
9. Write a C# code to convert digits to words
10. Write a C# code to Convert following currency conversion. Rupees to dollar, frank, euro.
11. Write a C# code to Perform Celsius to Fahrenheit Conversion and Fahrenheit to Celsius conversion.
12. Write ASP.Net program to Store Objects in Session State and Storing Session State in SQL Server.

MCAT 402 &MCAP 402	**Network and Cyber Security**	**L 3:T 1:P2**	**5 Credits**

Course Objectives:
The objective of the course is to provide a basic understanding of the various issues related to information systems security (esecurity). The course will present an overview of the risks encountered in information systems security, and the tools used for resolving these risks.

Course Learning Outcomes:
1. Provide security of the data over the network.
2. Do research in the emerging areas of cryptography and network security.
3. Implement various networking protocols.
4. Protect any network from the threats in the world.

Course Content:

UNIT I: INTRODUCTION & NUMBER THEORY
Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid‟s algorithm-Finite fields-Polynomial Arithmetic –Prime numbers-Fermat‟s and Euler‟s theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

UNIT II: BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY
Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management – Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT III: HASH FUNCTIONS AND DIGITAL SIGNATURES
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols
– DSS – EI Gamal – Schnorr.

UNIT IV: SECURITY PRACTICE & SYSTEM SECURITY
Authentication applications – Kerberos – X.509 Authentication services – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

UNIT V: E-MAIL, IP & WEB SECURITY
E-mail Security: Security Services for E-mail-attacks possible through E-mail – establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-
S/MIME. IPSecurity: Overview of IPSec – IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET)

List of Programs:-

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts: o Caesar Cipher
   - Playfair Cipher o Hill Cipher
   - Vigenere Cipher
   - Rail fence–row & Column Transformation
2. Implement the following algorithms
   - DES
   - RSA Algorithm o Diffiee-Hellman o MD5
   - SHA-1
3. Implement the Signature Scheme - Digital Signature Standard.
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
5. Setup a honey pot and monitor the honeypot on network (KF Sensor).
6. Installation of rootkits and study about the variety of options.
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA. (Net Stumbler).
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w).

Books:

1. William Stallings, Cryptography and network security, Pearson Education.
2. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone , Handbook of Applied Cryptography, CRC Press.
3. Margaret Cozzens, Steven J Miller, The mathematics of encryption, American Mathematical Society.

Elective 1:

MCAT 411	**Soft Computing**	**L 3 : T 0: P 0**	**3 Credits**

Course Objectives:
This course aims to develop students' abilities in using some contemporary approaches in solving problems in automation.

Learning Outcomes:
1. Appreciate the advantages and limitations of fuzzy systems and their potential impacts and applications in intelligent control and automation;
2. Appreciate the advantages and limitations of neural networks and their potential impacts and applications in intelligent automation; and
3. Develop an understanding of generic algorithms and their potential applications.

Course Content:
Unit-1: Basics of Soft Computing - Introduction, Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Applications. Fundamental of Neural Networks- Introduction, Model of Artificial Neuron, Architectures, Learning Methods, Taxonomy of NN Systems, Single-Layer NN System, Applications.

Unit-2: Back-propagation Networks - Background, Back-Propagation Learning, Back-PropagationAlgorithm. Associative Memory - Description, Auto-associative Memory, Bi-directional Hetero-associative Memory.

Unit-3: Adaptive Resonance Theory -Recap supervised, unsupervised, backprop algorithms;Competitive Learning; Stability-Plasticity Dilemma (SPD), ART Networks, Iterative Clustering, Unsupervised ART Clustering. Fuzzy Set Theory – Introduction, Fuzzy set : Membership, Operations, Properties; Fuzzy Relations.

Unit-4: Fuzzy Systems–Introduction, Fuzzy Logic, Fuzzification, Fuzzy Inference, Fuzzy RuleBased System, Defuzzification. Genetic algorithms & Modeling- Introduction, Encoding, Operators of Genetic Algorithm, Basic Genetic Algorithm.

Unit-5: Integration of Neural Networks, Fuzzy Logic and Genetic Algorithms - GA Based BackPropagation Networks, Fuzzy Back Propagation Networks, Fuzzy Associative Memories, Simplified Fuzzy ARTMAP.

Text Book
1. Rajasekaran, G.A. Vijayalakshmi Pai , Neural Networks, Fuzzy Logic, and Genetic Algorithms, Prentice-Hall of India Private Ltd.
2. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro-Fuzzy And Soft Computing, Pearson Education.
3. Horia-Nicolai Teodorescu, Abraham Kandel, Lakhmi C. Jain , Soft Computing in Human-Related Science, CRC Press.
4. David E. Goldberg, Genetic Algorithms, Pearson Education.

MCAT 412	Distributed Systems	L 3 : T 0: P 0	3 Credits

Course Objectives:
- To explain the evolving computer model called cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.

Learning Outcomes:
1. use public and private cloud solutions for computational science and engineering applications
2. discuss key concepts of cloud computing services, such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS);
3. asses the suitability of cloud computing infrastructures for different scientific applications;
4. implement software for cloud-based distributed computing using the technology presented in the course;
5. Critically analyze and present solutions and implementations in writing and orally.

Course Content:

UNIT- I : Systems Modeling, Clustering and Virtualization: Distributed System Models andEnabling Technologies, Computer Clusters for Scalable Parallel Computing, Virtual Machines and Virtualization of Clusters and Data centers.

UNIT- II : Foundations: Introduction to Cloud Computing, Migrating into a Cloud, Enrichingthe 'Integration as a Service' Paradigm for the Cloud Era, The Enterprise Cloud Computing Paradigm.

UNIT- III : Infrastructure as a Service (IAAS) & Platform and Software as a Service (PAAS / SAAS): Virtual machines provisioning and Migration services, On the Management of Virtualmachines for Cloud Infrastructures, Enhancing Cloud Computing Environments using a cluster as a Service, Secure Distributed Data Storage in Cloud Computing. Aneka, Comet Cloud, T-Systems', Workflow Engine for Clouds, Understanding Scientific Applications for Cloud Environments.

UNIT- IV : Monitoring, Management and Applications: An Architecture for Federated CloudComputing, SLA Management in Cloud Computing, Performance Prediction for HPC on Clouds, Best Practices in Architecting Cloud Applications in the AWS cloud, Building Content Delivery networks using Clouds, Resource Cloud Mashups.

UNIT – V : Governance and Case Studies: Organizational Readiness and Change managementin the Cloud age, Data Security in the Cloud, Legal Issues in Cloud computing, Achieving Production Readiness for Cloud Services.

Text Book

1. K. Hwang, G.Fox and J. Dongarra, "Distributed and Cloud Computing", MorganKaufmann Publishers, 2012.
2. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2011.

MCAT 413	Data Science	L 3 : T 0: P 0	3 Credits

Course Objectives:

This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset. Students will learn concepts, techniques and tools they need to deal with various facets of data

Science practice, including data collection and integration, exploratory data analysis, predictive modelling, descriptive modelling, data product creation, evaluation, and effective communication.

Learning Outcomes:

At the end of the course students should be able to:

1. Students will develop relevant programming abilities.
2. Students will demonstrate proficiency with statistical analysis of data.
3. Students will develop the ability to build and assess data-based models.
4. Students will execute statistical analyses with professional statistical software.
5. Students will demonstrate skill in data management.
6. Students will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

Course Content:

Unit I: Introduction and Data Pre-processing

Data Science Introduction

Big Data and Data Science

Current landscape of perspectives

Unit II: Data Analysis and Correlations: Basic Concepts and Methods Populations and samples

Statistical modelling, probability distributions, Regression, fitting a model Dimensionality Reduction: PCA & DWT, Correlation and regression analysis.

Chi square t and F distributions (definitions only) Confidence interval Single mean and difference known and unknown variances.

Unit III: Introduction to machine learning and Cluster Analysis: Basic Concept and Methods Supervised and unsupervised learning, Training and testing data, Over fitting and under fitting. Distance measures: - Manhattan, Chebyshev, Mahala Nobis Distance

Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering, Clustering High-Dimensional Data, Clustering Graph and Network Data

Unit IV: Classification Algorithms

Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Support Vector Machines, Lazy Learners (or Learning from Your Neighbours)

Unit V: Introduction to Web Search and Social Media Analytics

Data Wrangling: APIs and other tools for scrapping the Web

Mining Complex Data Types, Other Methodologies of Data, Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends

Social Media Analytics is the science of analyzing data to convert information to useful knowledge. This knowledge could help us understand our world better and, in many contexts, enable us to make better decisions.

Text Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from the Frontline,O'Reilly. 2014.
2. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

Reference Books:

1. Jure Leskovek, Anand Rajaraman and Je_rey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014.
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009.

MCAT 414	Machine Learning	L 3 : T 0: P 0	3 Credits

Course Objectives:
In this course we will study the basic component of an intelligence system i.e. machine learning, their functions, mechanisms, policies and techniques used in their implementation and examples.

Course Learning Outcomes:
1. List various approaches of Machine Learning.
2. Describe machine learning algorithms to solve the real world problems
3. Develop Hypothesis and machine learning models
4. Identify appropriate models for solving machine learning problems.
5. Apply learning techniques to solve real world machine learning problems.
6. Evaluate and interpret the results of the algorithms.

Course Content:

Unit I: Introduction: What Is Machine Learning?, Why Use Machine Learning? ,Types of MachineLearning Systems, Supervised/Unsupervised Learning, Batch and Online Learning, Instance-Based Versus Model-Based Learning, Hypothesis generation, Main Challenges of Machine Learning, Data sets and Testing and Validating.

Unit II: Concept Learning: Introduction to Concept Learning, Concept Learning Task, Notation,Inductive Learning Hypotheses, Concept Learning as Search: Generic-to-Specific Ordering of Hypotheses, Finding a Maximally Specific Hypotheses, Version Spaces, Candidate-Elimination Algorithms.

Unit III: Classification: MNIST Training a Binary Classifier, Performance Measures, MeasuringAccuracy Using Cross-Validation, Confusion Matrix, Precision and Recall Precision/Recall Tradeoff, The ROC Curve, Multiclass Classification, Error Analysis, Multi label and Multi output classification.

Unit IV: Training Models: Linear Regression, The Normal Equation, Computational Complexity,Gradient Descent, Polynomial Regression, Learning Curves, Regularized Linear Models, Logistic Regression, Estimating Probabilities, Training and Cost Function, and Decision Boundaries.

Unit V: Support Vector Machines Linear SVM Classification, Soft Margin Classification, NonlinearSVM Classification, Polynomial Kernel, Adding Similarity Features, Gaussian RBF Kernel, Computational Complexity, SVM Regression, Decision Function and Predictions, and The Dual Problem.

Unit VI: Decision Trees Training and Visualizing a Decision Tree, Making Predictions, EstimatingClass Probabilities, The CART Training Algorithm, Computational Complexity, Gini Impurity or Entropy, Regularization of hyper parameters, and Random Forests.

Unit VII: Dimensionality Reduction: The Curse of Dimensionality, Main Approaches forDimensionality Reduction, Projection, Manifold Learning, PCA, Preserving the Variance, Principal Components, Choosing the Right Number of Dimensions.

Unit VIII: Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Usingclustering for image segmentation, Using Clustering for Pre-processing and for Semi-Supervised Learning.**Unit IX:** Introduction to Neural Networks: From Biological to Artificial Neurons, BiologicalNeurons, Logical Computations with Neurons, The Perceptron, Multi-Layer Perceptron and Backpropagation.

Text/Reference Books:
1. Machine Learning, TOM M MITCHELL, TMH
2. Introduction to Machine Learning, 2nd Ed, Ethem Alpaydin, The MIT Press Cambridge, Massachusetts,London, England.
3. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Ed, AurelienGeron, O'RIELLY.

MCAT 415	Simulation & Modelling	L 3 : T 0: P 0	3 Credits

UNIT-I: Introduction to Modeling and Simulation Nature of Simulation. Systems , Models andSimulation, Continuous and Discrete Systems, system modeling, concept of simulation, Components of a simulation study, Principles used in modeling ,Static and Dynamic physical models, Static and Dynamic Mathematical models Introduction to Static and Dynamic System simulation , Advantages ,Disadvantages and pitfalls of Simulation.

UNIT-II: System Simulation and Continuous System Simulation Types of System Simulation,Monte Carlo Method, Comparison of analytical and Simulation methods, Numerical Computation techniques for Continuous and Discrete Models, Distributed Lag Models, Cobweb Model. Continuous System models, Analog and Hybrid computers, Digital- Analog Simulators, Continuous system simulation languages,Hybrid simulation ,Real Time simulations.

UNIT–III: System Dynamics & Probability concepts in Simulation Exponential growth and decaymodels, logistic curves,Generalization of growth models, System dynamics diagrams, Multi segment models, Representation of Time Delays. Discrete and Continuous probability functions, Continuous Uniformly Distributed Random Numbers, Generation of a Random numbers, Generating Discrete distributions, Non-Uniform Continuous Distributed Random Numbers, Rejection Method.

UNIT-IV: Simulation of Queueing Systems and Discrete System Simulation Poisson arrivalpatterns, Exponential distribution, Service times, Normal Distribution Queuing Disciplines, Simulation of single and two server queue. Application of queuing theory in computer system. Discrete Events,Generation of arrival patterns,Simulation programming tasks, Gathering statistics, Measuring occupancy and Utilization, Recording Distributions and Transit times.

UNIT-V: Introduction to Simulation languages and Analysis of Simulation output GPSS: Actiontimes, Succession of events, Choice of paths, Conditional transfers,program control statements. SIMSCRIPT: Organization of SIMSCRIPT Program, Names & Labels, SIMSCRIPT statements. Estimation methods, Relication of Runs , Batch Means, Regenerative techniques, Time Series Analysis, Spectral Analysis and Autoregressive Processes.

Text Books:

1. Seila, Simulation Modeling, Cengage Learning
2. Deo, System Simulation with Digital Computer, PHI

Reference Books:

1. Law .,Simulation Modeling And Analysis, McGraw Hill
2. Severance, " System Modeling & Simulation, Willey Pub

Elective 2:

MCAT 421	Web Technologies and Cloud Computing	L 3 : T 0: P 0	3 Credits

Course Objective:The main objectives are

- To provide students a comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications.
- Learning about state-of-the-art in Cloud Computing fundamental issues, technologies, applications and implementations.
- Exposer to the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.
- This subject will offer learning about latest computational resources such as large storage capacity, high network bandwidth, and vast processing power via a computer network and delivers flexible, scalable, and on-demand services to the end-users.

Course Outcomes :

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
2. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Explain the core issues of cloud computing such as security, privacy, and interoperability.
4. Choose the appropriate technologies, algorithms, and approaches for the related issues.
5. Identify problems, and explain, analyze, and evaluate various cloud computing solutions.
6. Provide the appropriate cloud computing solutions and recommendations according to the applications used.
7. Attempt to generate new ideas and innovations in cloud computing.

Detailed Contents

Unit – 1

Introduction- Objectives, From Internet to the Cloud – A short history of Client – Server Computing, Peer-to-Peer Computing, Distributed Computing, Collaborative Computing, Virtual Computing, Cloud Computing platforms , Cloud based operating systems , Cloud based Storage network , Web as Services, Industrial Applications of cloud computing .

Unit–2

Inside Cloud Computing- Introduction- Objectives, Feeling Sensational about Organization, Making Strategy Decisions- Governance Issues- Monitoring Business Processes- IT Cost Management, Business Values, Introduction-Objectives, Service Modeling, Infrastructure Services, Platform Services, Software Services - Software as service modes- Massively scaled software as a service- Scale of Economy, Management and Administration.

Unit–3:

Cloud Service Administration- Service Level Agreements and Monitoring-Support Services- Accounting Services, Resource Management- IT Security- Performance Management- Provisioning- Service Management, Untangling Software Dependencies, Cloud Computing Technology- Introduction-Objectives, Clients – Mobile – Thin – Thick, Security - Data Linkage - Offloading Work - Logging - Forensics - Development – Auditing, Network- Basic Public Internet- The Accelerated Internet- Optimised Internet Overlay- Site-to-Site VPN- Cloud Providers- Cloud Consumers - Pipe Size- Redundancy, Services- Identity- Integration- Mapping- Payments- Search.

Unit–4

Accessing the Cloud- Introduction-Objectives, Platforms- Web Application Framework- Web Hosting Services- Proprietary Methods, Web Applications- API's in Cloud Computing, Browsers for Cloud Computing- Internet Explorer- Mozilla Firefox- Safari- Chrome.,Data Management- Introduction- Objectives, Data Security- Data Location- Data Control- Securing data for transport, Scalability and Cloud Services- Large Scale Data Processing- Databases and Data Stores- Data Archival.

Unit–5

Information Storage in Cloud Computing- Introduction- Objectives, Storage as a Service, Storage Providers- Amazon Simple Storage Service- Nirvanix- Google Bigtable Datastore- MobileMe- Live Mesh, Storage Security, Merits and Demerits of Storage., Desktop and Device Management- Introduction- Objectives, Desktop

Virtualization- Across Industries- Client Desktops, Desktop placement in the cloud- Merits- Desktop as a Service (DaaS), Desktop Management- Watching the four areas- Asset Management.

Unit–6

Migrating to the Cloud- Introduction- Objectives, Cloud Services for individuals- Available Services - Skytap Solution, Cloud Services Aimed at the mid – market, Enterprise Class Cloud Offerings- MS Exchange - VMotion- VMWare vCenter Converter- Hyper – V Live Migration, Migration- Applications needed for migration - Moving existing data to cloud- Using the Wave approach. Migrating to the Cloud- Introduction- Objectives, Analyzing the Services- Establishing a Baseline and Metrics- Tools, Best Practices- Finding the Right vendor- Phased-in Vs Flash-cut Approaches- Bringing in Creativity, How Cloud computing might evolve- Researcher Predictions- Responding to Changes- Getting ready.

Suggested reading material:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

MCAT 422	Digital Image Processing	L 3 : T 0: P 0	3 Credits

Course Objectives:

- Develop a theoretical foundation of fundamental Digital Image Processing concepts.
- Provide mathematical foundations for digital manipulation of images; image acquisition; pre-processing; segmentation; Fourier domain processing; and compression.
- Gain experience and practical techniques to write programs using MATLAB language fordigital manipulation of images; image acquisition; pre-processing; segmentation; Fourier domain processing; and compression.

Course Outcome:

1. Have a good understanding of the mathematical foundations for digital manipulation of images.
2. Be able to write programs for digital manipulation of images.
3. Learn and understand the Image Enhancement in the Spatial Domain.
4. Be able to use different digital image processing algorithms.
5. Be able to design, code and test digital image processing applications.
6. Analyze a wide range of problems and provide solutions related to the design of image processing systems through suitable algorithms, structures, diagrams, and other appropriate methods.

Course Content:

UNIT I : Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital ImageProcessing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

UNIT II: Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing,Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

UNIT III: Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of TwoVariables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.

Unit IV: Restoration: Noise models, Restoration in the Presence of Noise Only using SpatialFiltering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.

UNIT V: Color Image Processing: Color Fundamentals, Color Models, Pseudo color ImageProcessing. **Wavelets:** Background, Multiresolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.

UNIT V: Segmentation: Point, Line, and Edge Detection, Thresholding, Region-BasedSegmentation, Segmentation Using Morphological Watersheds. **Representation andDescription:** Representation, Boundary descriptors.

Text Book

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Third Edit on, Pearson-Prentice-Hall, 2008.
2. R. C. Gonzalez, R. E. Woods, S. L. Eddins, "Digital Image Processing using Matlab", Second Edit on, Pearson-Prentice-Hall, 2004.
3. Al Bovik (ed.), "Handbook of Image and Video Processing", Academic Press, 2000.
4. A.K. Jain, "Fundamentals of Digital Image Processing", Prentice-Hall, Addison-Wesley, 1989.
5. M. Petrou, P. Bosdogianni, "Image Processing, The Fundamentals", Wiley, 1999.
6. P.Ramesh Babu, Digital Image Processing. Scitech Publications., 2003.
7. Bernd Jähne, Digital Image Processing, Springer-Verlag Berlin Heidelberg 2005.
8. B. Jähne, "Practical Handbook on Image Processing for Scientific Applications", CRCPress, 1997.

MCAT 423	**Computer Graphics & Multimedia**	**L 3 : T 0: P 0**	**3 Credits**

Course Objective

- To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
- To learn the basic principles of 3- dimensional computer graphics.
- Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
- Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.
- To be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.
- To comprehend and analyze the fundamentals of multimedia, underlying technologies, principles, and applications.

Syllabus

UNIT –I Overview of Graphics Systems, Video display devices, raster-scan systems, Random scan system, Graphics monitors and workstations, Input devices, Hardcopy devices, Graphicssoftware
Output primitives: Line drawing algorithms, Circle generation algorithms, ellipse generating algorithms, pixel addressing, Filled area primitives, Fill area functions, cell array, character generations.

UNIT –II Attributes of output primitives: Line attributes, curve attributes color and Gray-scale level, Area fill attributes, character attributes, and Bundled attributes Enquiry functions.
Two dimensional Geometric transformations: Basic transformations, Homogenous co-ordinates, affine transformations, Transformation functions, Raster methods for transformations.

UNIT – III Two dimensional viewing: Viewing pipeline, viewing transformation, viewing functions, line clipping – Cohen Sutherland line clipping, Liang Barsky line clipping, polygon clipping, Sutherland – Hodgman polygon clipping, WilerAthertion polygon clipping.

UNIT – IV Structures and Hierarchical Modeling: Structure concepts, editing structures,Basic modeling concepts, hierarchical modeling with structures.Graphical user interfaces and Interactive input methods: The user Dialogue, logical classification of input devices, Input functions and Models Interactive picture construction techniques

UNIT V - Multimedia basics, Multimedia applications, Multimedia system architecture, Evolving technologies for multimedia, Defining objects for multimedia systems, Multimedia data interface standards, Multimedia I/O technologies, Digital voice and audio, Video image and animation, Full motion video, Storage and retrieval technologies Multimedia databases, Compression and decompression, Data and file format standards,.

Text Books:

1. Heanry Donald, Pauline Baker M: Computer Graphics, PIH 2nd edn, 1995.
2. Harrington S: Computer Graphics A Programming Approach 2nd Edn. McGraw Hill,1987.
3. Tay Vaughan (2001) *Multimedia Making it Work*, 8th edn : Mcgraw Hill.

Reference Books:

1. L. Ammeraal and K. Zhang (2007). Computer Graphics for Java Programmers, Second Edition, John-Wiley & Sons.
2. David Rogers (1998). Procedural Elements for Computer Graphics. McGraw-Hill.
3. James D. Foley, Andries Van Dam, Steven K. Feiner and John F. Hughes (1995). Computer Graphics: Principles and Practice. Addison-Wesley.
4. Donald Hearn and M. Pauline Baker (1994). Computer Graphics. Prentice-Hall. 5. Francis S. Hill (2001). Computer Graphics. Prentice Hall.

MCAT 424	Software Testing & Quality Assurance	L 3	3 Credits

UNIT-I

Introduction: Software Quality, Role of testing, v & v, objectives and issues of testing, Testing activities and levels, Sources of Information for Test Case Selection, White-Box and Black-Box Testing , Test Planning and Design, Monitoring and Measuring Test Execution, Test Tools and Automation, Test Team Organization and Management. UNIT Testing: Concept, Static UNIT Testing, Defect Prevention, Dynamic UNIT Testing, Mutation Testing, Debugging.

UNIT-II

Control Flow & Data Flow Testing: Outline of CFT, CF Graph, Paths in a Control Flow Graph, Path Selection Criteria,Generating Test Input, Examples of Test Data Selection. Overview of Dynamic Data Flow Testing, Data Flow Graph, Data Flow Testing Criteria, Comparison of Testing Techniques.

UNIT-III

System Integration Testing & Test Design: Concept of Integration Testing, Different Types of Interfaces and Interface Errors, Granularity of System Integration Testing, System Integration Techniques, Test Plan for System Integration,Off-the-Shelf Component Testing, System Test Categories.

UNIT-IV

System Test Planning, Automation & Execution: Structure of a System Test Plan, Test Approach, Test Suite Structure, Test Environment, Test Execution Strategy, Test Effort Estimation, Scheduling and Test Milestones, System Test Automation, Selection of Test Automation Tools, Test Selection Guidelines for Automation, Structure of an AutomatedTest Case, Test Automation Infrastructure Metrics for Tracking System Test, Metrics for Monitoring Test Execution, Beta Testing, System Test Report, Measuring Test Effectiveness. Acceptance Testing.

UNIT-V

Software Quality: Five Views of Software Quality, McCall's Quality Factors and Criteria, Quality Factors Quality Criteria, Relationship between Quality Factors and Criteria, Quality Metrics, ISO 9126 Quality Characteristics, ISO 9000:2000 Software Quality Standard ISO 9000:2000 Fundamentals, ISO 9001:2000 Requirements.

Text Books:

- Software Testing and Quality Assurance theory and practice byKshiraSagarNaik and PriyadarshiTripathy

Reference Books:

1. Stephen H.Khan ,Metrics and Models in Software Quality Engineering Pearson Education,India
2. Shari Lawrence Pfleeger,"Software Engineering Theory and Practice Pearson

MCAT 425	Compiler Design	L 3 : T 0: P 0	3 Credits

Course Objectives:

- This course is designed to provide a comprehensive knowledge of Compiler Construction.
- To learn how to construct compiler to translate High Level Languages to Machine Language.
- To learn different phases of compiler and how to implement them.
- To learn efficient machine Language Code Generation using the techniques of Optimization.

Course Learning Outcomes:

1. Understands compiler and various phases in compilation.
2. Understands Lexical Analysis and implement it using LEX tool.
3. Understands LL, LR, and SLR parsing techniques.
4. Implement parsing using YACC tool.
5. Understands Syntax Directed Translation, Symbol Tables and their applications.
6. Understands Intermediate Code Generation and Code Optimization.

Course Content:

Unit I: Introduction to Compiler: Phases and passes, Bootstrapping, Finite state machines and regularexpressions and their applications to lexical analysis, implementation of lexical analyzers, LEX-compiler, Formal grammars and their application to syntax analysis,, ambiguity, The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.

Unit II: Basic Parsing Techniques: Parsers, Shift reduce parsing, operator precedence parsing, topdown parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, YACC tool.

Unit III: Syntax-directed Translation: Syntax-directed Translation schemes, Intermediate code,postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, Translation of simple statements and control flow statements, Type checking, Type conversions, Equivalence of type expressions, Overloading of functions and operations.

Unit IV: Symbol Tables: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.

Unit V: Code Generation and Code Optimization: Code Generation: Design Issues, the TargetLanguage. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.

Text / Reference Books:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ulman; Compilers: Principles, Techniques
2. and Tools: 2nd Edition, 2nd Edition, Pearson Education.
3. W. Appel, Modern Compiler Implementation in Java, Prentice Hall, 2002.
4. Watt, Brown, Programming Language Processors in Java: Compilers and Interpreters, Prentice hall, 2000.

Elective 3:

MCAT 431	**Neural Networks**	**L 3: T 0: P 0**	**3 Credits**

Objectives

- To understand the abstract simulation of real nervous system
- To learn the origin and ideological basics of artificial neural networks
- To understand different structure of ANN
- To learn and understand various basic methods of learning
- Perceptron and dynamical theories of recurrent networks including amplifiers, attractors, and hybrid computation would be studied.

Introduction to ANN Features , structure and working of Biological Neural Network , Trends in Computing Comparison of BNN and ANN , characteristics of neural networks terminology, models of neuron Mc Culloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture

Backpropagation networks : (BPN) Architecture of feed forward network, single layer ANN, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning

Activation & Synaptic Dynamics : Introduction, Activation Dynamics models, synaptic Dynamics models, stability and convergence, recall in neural networks.
Feedforward neural networks Linear responsibility X-OR problem and solution. - Analysis of pattern mapping networks summary of basic gradient search methods.

Feed back neural networks Pattern storage networks, stochastic networks and simulated annealing, Boltzmann machine and Boltzmann learning & Competitive learning.

References:

1. B. Yegnanarayana - Artificial neural network PHI Publication.
2. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
3. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005 4. Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press ,1995
4. Nelson Morgan – Artificial neural network: Electronic Implementations – IEEE Press, 1990

MCAT 432	Internet of Things	L 3: T 0: P 0	3 Credits

UNIT I: Introduction to Internet of Things–Definition and Characteristics of IoT, Physical Designof IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoTenabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates. Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

UNIT II: IoT and M2M–Software defined networks, network function virtualization,difference between SDN and NFV for IoT.Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNITIII: Introduction to Python - Language features of Python, Data types, data structures, Controlof flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

UNIT IV: IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI,I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT V: IoT Physical Servers and Cloud Offerings–Introduction to Cloud Storage models andcommunication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

Text Books:

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015

Reference Books:

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014

MCAT 433	Block Chain Architecture	L 3: T 0: P 0	3 Credits

Course Objective: The main objectives are

- Students will familiar with The widespread popularity of digital crypto currencies that is required for foundation of Blockchain, knowledge about public digital ledger to share information in a trustworthy and secure way.
- The concept and applications of Blockchain have now spread from crypto currencies to various other domains, including business process management, smart contracts, IoT and so on.
- This course is a joint venture from academia and industry, where the target is to cover both the conceptual as well as application aspects of Blockchain.
- This includes the fundamental design and architectural primitives of Blockchain, the system and the security aspects, along with various use cases from different application domains

Outcomes: Student will develop clear understanding about Blockchain technology landscape

1. Applications and implementation strategies
2. State-of-the-art, open research challenges, and future directions
3. Working with digital crypto currencies

Unit 1
Introduction to Blockchain: Digital Money to Distributed Ledgers , Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hashchain to Blockchain, Basic consensus mechanisms.

Unit 2 :
Consensus: Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains:Design goals, Consensus protocols for Permissioned Blockchains

Unit 3 :
Hyperledger Fabric (A): Decomposing the consensus process , Hyperledger fabric components, Chaincode Design and Implementation Hyperledger Fabric (B): Beyond Chaincode: fabric SDK and Front End (b) Hyperledger composer tool.

Unit 4:
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, visibility, trade/supply chain finance, invoice management discounting, etc.

Unit 5:
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, Privacy and Security on Blockchain

Suggested reading material:

1. Mstering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
2. Blockchain by Melanie Swa, O'Reilly
3. Blockchain Applications: A Hands-on Approach by Arshdeep Bahga and Vijay K. Madisetti, ISBN: 9780996025560
4. Mastering Bitcoin: Programming The Open Blockchain, Andreas M. Antonopoulos, O'Reilly, ISBN: 9789352135745

MCAT 434	**Natural Language Processing**	**L 3: T 0: P 0**	**3 Credits**

Regular expressions and automata, Morphology and Finite State transducers, N – grams.

Word classes and part of speech tagging, Context free grammars for English, Parsing with context free grammars.
Features and Unifications, Lexicalized and Probabilistic parsing.
Semantics: Representing meaning, Semantic analysis, Lexical semantics, Word Scene Disambiguation and Information retrieval.

Pragmatics: Discourse, Dialog and Conversational Agents, Natural Language Generation, Machine Translation.

References:
1. Daniel, Jurafsky and Martin, Speech and Language Processing, Pearson, 2003

MCAT 435	**Advanced JAVA**	**L 3**	**3 Credits**

UNIT-I
Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script. XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX Review of Applets, Class, Event Handling, AWT programming.

UNIT-II
Introduction to Swing: JApplet, Handling Swing Controls like Icons – Labels – Buttons – Text Boxes – Combo – Boxes – Tabbed Pains – Scroll Pains – Trees – Tables Differences between AWT Controls & Swing Controls Developing a Home page using Applet & Swing. Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizers, Java Beans API.

UNIT-III
Introduction to Servlets: Lifecycle of a Servlet, JSDK The Servlet API, The javax.servlet Package, Reading Servlet parameters, Reading Initialization parameters. The javax.servlet HTTP package, Handling Http Request & Responses, Using Cookies- Session Tracking, Security Issues Introduction to JSP, The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat.

UNIT-IV
JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods, Error Handling and Debugging, Sharing Data between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations.

UNIT-V
Database Access, Database Programming using JDBC, Studying Javax.sql.* package, accessing a Database from a JSP Page, Application – Specific Database, Actions Deploying JAVA Beans in a JSP Page. Introduction to struts framework.

Text Books:
1. Patrick Naughton and Herbert Schildt: The Complete Reference Java, Latest Edition, Tata McGraw-Hill.

Reference Books:
1. Hans Bergstan: Java Server Pages.
2. Bill Siggelkow, S P D O'Reilly: Jakarta Struts, Cookbook.
3. Murach: Murach's beginning JAVA JDK 5, SPD.