

**Revised Syllabus
along with Rules and Regulations
as per CBCS Rules**

w.e.f. 2019 onwards

Master of Computer Applications (MCA)



**Centre of Computer Education
Institute of Professional Studies
University of Allahabad
Allahabad**

Regulations and Courses of Studies for the Master of Computer Applications (MCA) Programme

1. There shall be a Master's Degree Programme in Computer Applications in the Centre of Computer Education, Institute of Professional Studies, leading to the degree of Master of Computer Applications (MCA).
2. The Master of Computer Applications (MCA) Programme shall be open to graduates of all streams. The admission Rules and process shall be prescribed by the competent body of the Institute of Professional Studies and shall be reported for endorsement to the Admissions Committee of the University, but there will be no provision for readmission.
3. The examination for MCA shall be by means of theory papers, practicals and project work, as specified in the Regulations. Candidates shall be required to pass separately in theory and practicals.
4. The Regulations shall be guided by Choice Based Credit System (CBCS) Rules framed under Clauses 1(a)(i) and 3(a)(x) of Ordinance LX: The Organisation and Conduct of Examinations.
5. The duration of the programme shall be three academic years consisting of six semesters, as follows:

SEMESTER I:

1. Discrete Mathematical Structures (MCA501)
 2. Financial & Organizational Management (MCA502)
 3. Digital Electronics & Computer Organization (MCA503)
 4. Operating Systems (MCA504)
 5. Programming in C (MCA505)
 6. Linux & Shell Programming (MCA506)
- Lab I: Programming in C in Linux environment (MCA631)
Lab II: Digital Electronics & Assembly Language (MCA632)

SEMESTER II:

1. Numerical Methods (MCA507)
 2. Data & File Structure using C (MCA508)
 3. Database Management System (MCA509)
 4. Advanced Computer Organization (MCA510)
 5. Object Oriented Methodology using C++ (MCA511)
 6. Theory of Computation (MCA512)
- Lab I: Programming in Data Structures and C++ (MCA633)
Lab II: DBMS Programming (MCA634)

SEMESTER III:

1. Software Engineering & Case Tools (MCA513)
 2. Design & Analysis of Algorithms (MCA514)
 3. Web Technologies using JAVA (MCA515)
 4. Embedded Systems (MCA516)
 5. Computer Graphics (MCA517)
 6. System Programming (MCA518)
- Lab I: Programming in JAVA (MCA635)
Lab II: Software Engineering/Graphics (MCA636)

SEMESTER IV:

1. .NET Framework & C# (MCA519)
 2. Image Processing (MCA520)
 3. Multimedia System (MCA521)
 4. Operation Research (MCA522)
 5. Data & Communication Networks (MCA 523)
 6. Information Retrieval & Web Mining (MCA524)
- Lab I: Programming in C# (MCA637)
Lab II: Image Processing/DCN Lab (MCA638)

SEMESTER V:

1. Machine Learning Techniques (MCA525)
 2. Secure Computing (MCA526)
 3. Robotics & AI (MCA527)
 4. Digital Communication (MCA528)
 5. Elective: Network Analysis; Data Science & Python/R; NLP; HCI (MCA529)
- MINI Project (MCA639)

SEMESTER VI:

- Mobile Computing & applications (MCA530)
Elective: Application Development on Hand-held devices; Distributed Computing; E-Commerce & Cyber Laws; High Performance Computing; Computer Vision; Artificial Neural Networks; Fuzzy Systems; Big Data Analysis; Cloud Computing; Computer Animation (MCA531)
MAIN PROJECT (MCA640)
Comprehensive Viva (MCA641)

6. The Structure of the Course shall be as follows:

CREDIT STRUCTURE of Master of Computer Applications (MCA) (w.e.f. 2019)

SEMESTER-I

S. No.	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	MCA501	Discrete Mathematical Structures	2	1	0	3	40	60
2	MCA502	Financial & Organizational Management	2	1	0	3	40	60
3	MCA503	Digital Electronics & Computer Organization	2	1	0	3	40	60
4	MCA504	Operating Systems	2	1	0	3	40	60
5	MCA505	Programming in C	2	1	0	3	40	60
6	MCA506	Linux & Shell Programming	2	1	0	3	40	60
7	MCA631	Programming in C in Linux environment	0	1	3	4	40	60
	MCA632	Digital Electronics & Assembly Language	0	1	3	4	40	60
TOTAL			12	08	06	26	320	480

SEMESTER-II

S.No	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	MCA507	Numerical Methods (MCA507)	2	1	0	3	40	60
2	MCA508	Data & File Structure using C (MCA508)	2	1	0	3	40	60
3	MCA509	Database Management System (MCA509)	2	1	0	3	40	60
4	MCA510	Advanced Computer Organization (MCA510)	2	1	0	3	40	60
5	MCA511	Object Oriented Methodology using C++	2	1	0	3	40	60
6	MCA512	Theory of Computation	2	1	0	3	40	60
7	MCA633	Programming in Data Structures and C++	0	1	3	4	40	60
	MCA634	DBMS Programming	0	1	3	4	40	60
TOTAL			12	08	06	26	320	480

SEMESTER-III

S.No	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	MCA513	Software Engineering & Case Tools	2	1	0	3	40	60
2	MCA514	Design & Analysis of Algorithms	2	1	0	3	40	60
3	MCA515	Web Technologies using JAVA	2	1	0	3	40	60
4	MCA516	Embedded Systems	2	1	0	3	40	60
5	MCA517	Computer Graphics	2	1	0	3	40	60
6	MCA518	System Programming	2	1	0	3	40	60
7	MCA635	Programming in JAVA	0	1	3	4	40	60
	MCA636	Software Engineering/Graphics	0	1	3	4	40	60
TOTAL			12	08	06	26	320	480

SEMESTER-IV

S.No	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	MCA519	NET Framework & C#	2	1	0	3	40	60
2	MCA520	Image Processing	2	1	0	3	40	60
3	MCA521	Multimedia System	2	1	0	3	40	60
4	MCA522	Operation Research	2	1	0	3	40	60
5	MCA523	Data & Communication Networks	2	1	0	3	40	60
6	MCA524	Information Retrieval & Web Mining	2	1	0	3	40	60
7	MCA637	Programming in C#	0	1	3	4	40	60
	MCA638	Image Processing/DCN Lab	0	1	3	4	40	60
TOTAL			12	08	06	26	320	480

SEMESTER-V

S.No	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	MCA525	Machine Learning Techniques	2	1	0	3	40	60
2	MCA526	Secure Computing	2	1	0	3	40	60
3	MCA527	Robotics & AI	2	1	0	3	40	60
4	MCA528	Digital Communication	2	1	0	3	40	60
5	MCA529	Elective: Network Analysis; Data Science & Python/R; NLP; HCI	2	1	0	3	40	60
6	MCA639	Mini Project	0	0	12	12	160	240
TOTAL			10	5	12	27	360	540

SEMESTER-VI

S.No	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	MCA530	Mobile Computing & applications	3	1	0	4	40	60
2	MCA531	Elective: Application Development on Hand-held devices; Distributed Computing; E-Commerce & Cyber Laws; High Performance Computing; Computer Vision; Artificial Neural Networks; Fuzzy Systems; Big Data Analysis; Cloud Computing; Computer Animation	3	1	0	4	40	60
3	MCA640	Main Project	0	0	12	12	160	240
4	MCA641	Comprehensive Viva	0	4	0	4	0	100
TOTAL			6	6	12	24	240	460

7. The medium of instruction and examination shall be English.
8. Scheme of examination and courses of studies:
 - (i) The students shall register for the courses as defined in the Regulations.
 - (ii) The performance of the students will be evaluated on a comprehensive system of continuous evaluation.
 - (iii) The awards along with answer sheets shall be submitted to the Controller of Examinations for consolidation and publication of results.
 - (iv) There shall be 40% sessional marks and 60% for the end-Semester examination in each theory paper.
 - (v) Evaluation of continuous assessment for each course shall be made on the basis of the student's performance in the best of the two tests/ assignments/ presentations/ group discussion / quiz (carrying 20% marks of the course) organized by the course Instructor and one Mid Semester Examination (carrying 20% marks of the course).
 - (vi) The schedule for the continuous assessment and the grading system shall be made known to the students at the beginning of the semester. The tests/ assignments/ quiz / group discussions / presentations shall be evenly spaced out throughout the semester.
 - (vii) The marks awarded for continuous assessment shall be made known to the students ordinarily within ten days of the conduct of the test etc. Students may seek clarifications, if any, about their performance from the teacher concerned within a week of the declaration of marks/grades. If there is any problem, then the student can refer the matter to the Board of Examiners.
 - (viii) No special tests will be arranged for any individual student. However, if course teacher feels it necessary he/she may arrange it in his/her course after seeking permission from the head/coordinator of the department/centre.
 - (ix) For Practicals, 40% of the total marks shall be allotted to the Sessional work and the remaining 60% for the end-Semester Practical Examination. The Sessional marks shall be distributed as under:

Viva-Voce/Attendance: Weightage of 40% of the total Sessional marks (16/40)

Programming Tests (2 Nos): Weightage of 60% of the total Sessional Marks (24/40)
 - (x) The aggregate Sessional marks of each candidate in each paper (total marks obtained by the candidate out of 40) shall be communicated to the Controller of Examinations by the Course Coordinator.
 - (xi) For the conduct of the Practical Examination, there shall be a Board comprising of one external examiner and two internal examiners.
 - (xii) For the Project Evaluation there shall be a Board comprising of two external examiners and two internal examiners, in which presence at least one external is essential.
 - (xiii) The end-Semester Examination shall be of three hours duration.
 - (xiv) The implementation of the evaluation process shall be monitored by a Committee to be constituted by the Institute at the beginning of each academic year.
 - (xv) The project in sixth Semester shall carry 400 marks as follows:

For the Project, 40% of the total marks shall be allotted to the Sessional work and the remaining 60% to the end-Semester Viva-Voce. The Sessional marks shall be awarded on the basis of the following:

Two presentations during the Project Work: Weightage of 60% of the total Sessional Marks (96/160).

Project Submission: Weightage of 40% of the total Sessional marks (64/160)

End semester evaluation of 240 marks will be carried out by a board of four members – two internal and two external examiners.

A learner shall have to obtain minimum of grade 'C' (or its equivalent marks) in project/thesis. The number of credits for the project/thesis shall be decided by the board of studies of the concerned academic unit.

A learner who passes in all the theory papers but does not secure minimum grade 'C' in project/thesis as applicable has to resubmit a fresh project/thesis till he/she secures a minimum grade 'C'. His/her marks and/or grades in the theory papers that the learner has passed will be carried forward.
 - (xvi) Each student shall carry out the project in such entities (Department/Organisation/ Institution) as approved by the Institute, under the supervision of a teacher assigned by the Institute. The concerned entity may also appoint a supervisor for the student in consultation with the Institute.
9. Candidates shall be required to pass separately in the theory and practicals.

10. End-Semester Examination:

- i. Each semester shall have normally 90 teaching days excluding examination. A student shall be eligible to appear in end-semester examination only if he/she has at least 75% of attendance in respect of classes delivered in each paper/course separately. In case if a student failed to fulfil this condition due to some unavoidable circumstances beyond control like illness etc., attendance up to 20% can be condoned by the Dean/HOD on production of medical certificate/supporting documents on justified grounds.
- ii. If a student represents his/ her institution, University, State or Nation in Sports, NCC, NSS or Cultural or any other officially sponsored activities, he/ she shall be eligible for relaxation of attendance up to 20% in a paper based on the specific recommendations of the Dean/Head of the Department.
- iii. The question paper for the end-semester examinations for each course shall be set by the course instructor. It shall be the responsibility of the paper setter to ensure that the syllabus for the course is adequately covered in the question paper.
- iv. The answer scripts for End-Semester Examination shall be evaluated preferably by the respective paper-setters.
- v. Duration of end-semester examination for each course will be 3 Hours. The End-Semester examination paper will contain questions from all units.
- vi. The marks will be given for all examinations and they will be converted into grade (quality) points either based on absolute or relative grading system. The semester-end, final grade sheets and transcripts will have only Credits, Grades, Grade Points, SGPA and CGPA.
- vii. The end-semester Practical Examination shall be conducted by an internal examiner.
- viii. For conduct of B.Voc. Practical Examination, there shall be a Board comprising of one external examiner and one internal examiner.

11. Moderation of Question Papers:

The end semester question paper for each program shall be moderated by a Board of Moderators consisting of (a) Head / Coordinator of the concerned Department/Centre who shall be its chairman and (b) Two to Four senior teachers nominated by the Head/coordinator of the concerned Department/Centre.

12. Departmental Examination Committee:

- i. Each Departmental Committee / Course Advisory Committee of the Department / Centre shall constitute a Departmental Examination Committee of three members with at least one external member to oversee all work connected with evaluation of Sessional work and end semester examination. The senior most internal member of the Committee shall be the ex-officio Chairman of this Committee.
- ii. It shall be the responsibility of the Departmental Examination Committee to maintain the standard of evaluation. The Committee will ensure fairness of evaluation by going through the evaluated scripts/assignment reports for internal/continuous assessment and the end semester examination. The Committee will also address complaints, if any from the students taking a particular course. The Committee will also verify and evaluate the grading method (Absolute or Relative) used by the Course instructor and make suitable modifications, if necessary.
- iii. The evaluation/grades approved by the Departmental Examination Committee will be final.

13. Grades and Grade Points:

Percentage of Marks	Grade Point	Letter Grade	Classification
Marks above 80	10	O	Outstanding
Marks > 73 & ≤ 80	9	A+	Excellent
Marks > 66 & ≤ 73	8	A	Very good
Marks > 59 & ≤ 66	7	B+	Good
Marks > 52 & ≤ 59	6	B	Above Average
Marks > 45 & ≤ 52	5	C	Average
Marks > 40 & ≤ 45	4	P	Pass
Marks < 40	0	F	Fail
ABSENT	0	Ab	Absent

14. PROMOTION TO NEXT SEMESTER AND ADDITIONAL EXAMINATION:

- i. A Student shall be declared as 'Passed' and promoted to the next semester when s/he earns 'C' Grade or above in the last concluded semester examination and has not got below 'P' grade in more than two courses in the previous semester.

- ii. A student who has earned an average of 'C' grade or above in the last concluded semester examination but has got below 'P' grade in not more than two courses in the previous semester shall be promoted to the next semester with the condition that the student shall appear in the additional examination for the courses in which the student has got below 'P' grade.
- iii. A Student shall be deemed as 'Failed' in a semester when s/he gets below 'P' Grade in more than two courses offered in the previous semester, or does not appear in the examination in more than two courses. Such students will repeat the semester on payment of semester fees.
- iv. Additional examination (except for the last two semesters of the programme) for the courses in which students have failed or were absent will be held along with the corresponding semester examination for those courses of the succeeding academic years, provided that the student does not carry more than four papers of the previous semesters at any time during the course of study.
- v. In case, a student has failed in less than three papers in the final semester, the student will be permitted to appear in the additional examination in those papers that would be conducted around forty days after the declaration of the final semester result. In case, a student fails in the thesis/project, the student has to complete the thesis/project and appear in the examination in the corresponding semester of the succeeding academic year.
- vi. A student who has passed all the papers in a semester but has failed to get an overall grade of 'C' shall be promoted to the next semester and shall appear in the additional examination for two of the courses of his/her choice from the previous semester.
- vii. The backlog course(s) additional examination shall be held for the semester end examination paper only. The points scored by the candidate in the Continuous Assessment shall be carried forward.
- viii. The (provisional) results of the additional examination shall be announced within two weeks (subject to the ratification by the Departmental Examination Committee when it meets next).
- ix. A student who fails to pass in any semester or carries over more than four papers would not be allowed to be Promoted to the subsequent semester and has to repeat the semester in which he fails or accumulates fail grade in more than four papers.
- x. A candidate may get chance to clear all the courses within double the duration of the course of study.
 - i. e. for 2 year course within four years, for 3 year courses within six years, for 4 year courses within eight years and for 5 year courses within ten years and so on. However, the student shall be allowed only once to repeat the first semester. If s/he fails again in the first semester, s/he be required to withdraw from the programme.

15. RESULTS PREPARATION:

Grade Card / Mark sheet: The Grade card issued at the end of each semester to each student will contain the following: i) Name, ii) Roll Number, iii) Enrolment Number, (iv) Course code, (v) Course title (vi) Grade point (Gi) (10 point scale), (vii) Credits earned for each course (Ci), (viii) SGPA for a semester and CGPA after final semester which will resemble consolidated results. The following procedure shall be used to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

- i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e. $SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$ where C_i is the number of credits of the i th course and G_i is the grade point scored by the student in the i th course.
- ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e. $CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$ where S_i is the SGPA of the i th semester and C_i is the total number of credits in that semester.

16. Miscellaneous

The University may from time to time revise, amend and change the Regulations.

DETAILED STRUCTURE OF MCA CURRICULUM

SEMESTER I

Paper-1: Discrete Mathematical Structures (MCA501)

- Mathematical Logic:** Introduction, Statements and notation, Connectives, Statement formula and truth tables, Well-formed formula, duality law, Tautological implications, Functionally complete set of connectives
Normal forms: conjunctive and disjunctive normal forms, Principal conjunctive and disjunctive normal forms, Ordering & uniqueness of normal forms.
Predicate Calculus: Predicates, Statement function, Variables & quantifiers, Predicate formulas, Theory of inference for the predicate calculus
8 Lectures
- Set Theory, Relations and Functions:** Basic concepts of set theory, Finite & Infinite sets, Equality of sets, the power set, Venn Diagrams, Cartesian Products, Cardinality of sets.
Definition and properties of relations & functions, Matrix & Graph representation of relations, Covering of set equivalence relations, Composition of relation & functions, Inverse function, Characteristic function of a set
8 Lectures
- Principle of inclusion & exclusion:** First principle, Inclusion & Exclusion principle in general & their applications
8 Lectures
- Algebraic structures:** Overview of Group theory, Semi group, Monoid, Groupoid, Finite & Infinite group, Abelian group and their examples
8 Lectures
- Lattices and Boolean Algebra:** Poset, Hasse diagram, Elements of Poset, Bounds, Lattices, Join, Meet, Different types of lattices and their examples
8 Lectures

Reference:

- Logic for CS by Gallier
- Discrete Maths by Tremblay Manohar
- Discrete Maths by Stanat
- Laws of Logical Calculi by Morgan

Paper-2: Financial & Organizational Management (MCA502)

- Accounting:** Principles, concepts and conventions, double entry system of accounting, Ledger posting and Trial balance. Final accounts: Trading, profit and loss accounts and balance sheet of sole proprietary concern with normal closing entries. Introduction to manufacturing account, final account of partnership firms, limited company; Basic Financial management concepts; Introduction to shares, debentures, preference shares.
8 Lectures
- Capital Budgeting and Analysis:** Meaning, importance, difficulties. Introduction to evaluation techniques; Meaning, advantages, limitations of ratio analysis, Types of ratios and their usefulness.
Costing: Nature, importance and types of cost. Marginal costing: Nature, scope and importance of marginal costing, Break-even analysis, its uses and limitations
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 outputs obtained.
10 Lectures
- Organization Structure:** Classical theories of Management: Scientific management theory, Fayol's 14 principles of Management, Weber's bureaucratic theory. Definition of organization and organization Structure. Line and Staff authority, Centralization and Decentralization, Span of control, Formal and Informal Organization. Function based, Product based, Geography based, Project based (Matrix). Organization Design: Mechanistic and Organic Structure, Virtual and Network organization Structure
Motivation and Information Systems: Definition of Motivation, Importance of Motivation, Motivation and behavior, Theories of Motivation – Maslows need Hierarchy, Two- Factor Theory, McClelland 's Need Theory, Introduction to information system in business, Types of information systems, Effectiveness and efficiency criteria in information system.
10 Lectures

4. **Management Information Systems:** Definition of a management information system, MIS versus Data processing, MIS & Decision Support Systems, MIS & Information Resources Management, End user computing, Concept of an MIS, Structure of a Management information system. Concepts of planning & control: Concept of organizational planning, The Planning Process, Computational support for planning, Characteristics of control process, The nature of control in an organization.

6 Lectures

5. **Business applications of information technology and its management:** Internet & electronic commerce, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information System for Managerial Decision Support, **Information** System for Strategic Advantage. Enterprise & global management, Security & Ethical challenges, Planning & Implementing changes.

Advanced Concepts in Information Systems: Enterprise Resource Planning, Supply Chain Management, Customer Relationship Management, and Procurement Management.

6 Lectures

References:

1. S.N. Maheswari & S. K. Maheswari, "Introduction to Financial Accountancy", Vikas Publication.
2. S.N. Maheswari & S. K. Maheswari, "Advanced Accountancy", Vikas Publication.
3. S.N. Maheswari & S. K. Maheswari, "Financial Management", Viaks Publication.
4. O Brian, "Introduction to Information System", MCGRAW HILL.
5. Murdick, "Information System for Modern Management", PHI.
6. Jawadekar, " Management Information System", TMH.
7. Jain Sarika, "Information System", PPM
8. Davis, "Information System", Palgrave Macmillan
9. L. M. Prasad, "Organizational Behavior", S. Chand.
10. Koontz, Weihrich, "Essentials of Management", TMH
11. K. Aswathappa, "Human Resource and Personnel Management", TMH
12. L. M. Prasad, "Human Resource Management", S. Chand

Paper-3: Digital Electronics & Computer Organization (MCA503)

1. **Representation of Information and Basic Building Blocks:** Introduction to Computer- Basic building blocks, Computer hardware and Software; Types of Computers; Number System: Binary, Octal, Hexadecimal, Gray code; Character Codes (BCD, ASCII, EBCDIC, UNICODE), Logic gates, Boolean Algebra; Logic expression – SOP & POS form; K-map simplification; Design of Combinatorial circuits: Half Adder, Full Adder, Subtractor, Decoder, Encoders, Multiplexer, Demultiplexer, Carry lookahead adder, Parity bit Generator & Checker; Design of Sequential circuits: Latches; Flip-Flops; Registers; Counters (synchronous & asynchronous); State reduction; ALU, Micro-Operations.

8 Lectures

2. **Basic Organization:** Stored Program concept (Von Neumann Machine); Operational flow chart (Fetch, Execute), Instruction Cycle, Organization of Central Processing Unit, Hardwired & micro programmed control unit, General Register Organization, Stack Organization, Addressing modes, Instruction formats, data transfer & Manipulation, I/O Organization, Bus Architecture, Programming Registers. ALU- chip, Faster Algorithm and Implementation (multiplication & Division).

8 Lectures

3. **Memory Organization:** Memory Hierarchy, Main memory (RAM/ROM chips), Types of memory; Auxiliary memory - magnetic disk and its performance, magnetic Tape, Optical memory; Associative memory, Cache memory, Virtual Memory, Memory Management Hardware, hit/miss ratio; Memory interleaving

8 Lectures

4. **I/O Organization:** Peripheral devices, I/O interface methods, Interrupts and its usage; Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor, and Serial Communication. I/O Controllers, Asynchronous data transfer, Strobe Control, Handshaking.

8 Lectures

5. **Process Organization:** Basic functional block diagram of a computer; Introduction to microprocessor – Essential & Non-essential components; Basic Concept of 8-bit micro Processor (8085) and 16-bit Micro Processor (8086), Instruction Set, Assembly language program of (8085): Addition of two numbers, Subtraction, Block Transfer, Finding greatest number, Table search, Numeric Manipulation, Introductory Concept of pipeline, Coprocessors; Flynn's and Feng's Classification, Parallel Architectural classification.

8 Lectures

References:

1. William Stalling, "Computer Organization & Architecture", Pearson education Asia
2. Mano Morris, "Computer System Architecture", PHI
3. Zaky & Hamacher, "Computer Organization", McGraw Hill
4. Ram, "Computer Fundamental Architecture & Organization", New Age
5. Tannenbaum, " Structured Computer Organization", PHI.

Paper-4: Operating Systems (MCA504)

1. **Introduction:** Definition and types of operating systems, Batch Systems, multi programming, time-sharing parallel, distributed and real-time systems, Operating system structure, Operating system components and services, System calls, system programs, Virtual machines.
8 Lectures
2. **Process Management:** Process concept, Process scheduling, Cooperating processes, Threads, Inter-process communication, **CPU** scheduling criteria; Long term, Short Term & Medium Term scheduling; Scheduling algorithms, Multiple-processor scheduling, Real-time scheduling and Algorithm evaluation.
8 Lectures
3. **Process Synchronization and Deadlocks:** The Critical-Section problem, Synchronization hardware, Semaphores, Classical problems of synchronization, Critical regions, Monitors; Deadlocks-System model, Characterization, Deadlock prevention, Avoidance and Detection, Recovery from deadlock, Combined approach to deadlock handling.
8 Lectures
4. **Storage management:** Memory Management-Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation with paging in MULTICS and Intel 386, Virtual Memory, Demand paging and its performance, Page replacement algorithms, Allocation of frames, Thrashing, Page Size and other considerations, Demand segmentation, File systems, secondary Storage Structure, File concept, access methods, directory implementation, Efficiency and performance, recovery, Disk structure, Disk scheduling methods, Disk management, Recovery, Disk structure, disk scheduling methods, Disk management, Swap-Space management, Disk reliability.
8 Lectures
5. **Security & Case Study:** Protection and Security-Goals of protection, Domain of protection, Access matrix, Implementation of access Matrix, Revocation of Access Rights, language based protection, The Security problem, Authentication, One Time passwords, Program threats, System threats, Threat Monitoring, Encryption. Windows XP-Design principles, System components, Environmental subsystems, File system, Networking and program interface, Linux system-design principles, Kernel Modules, Process Management, Scheduling, Memory management, File Systems, Input and Output, Interprocess communication, Network structure, security
8 Lectures

References:

1. Abraham Siberschatz and Peter Baer Galvin, "Operating System Concepts", Fifth Edition, Addison-Wesley
2. Milan Milankovic, "Operating Systems, Concepts and Design", McGraw-Hill.
3. Harvey M Deital, "Operating Systems", Addison Wesley
4. Richard Peterson, "Linux: The Complete Reference", Osborne McGraw-Hill.

Paper-5: Programming in 'C' (MCA505)

1. **Programming in C:** Algorithm & Algorithmic language; Flowcharts, Basic constructs; Introduction to C, Structure of C programs, Compilation & execution of C programs, Debugging techniques, Data types & sizes, Declaration of variables, Modifiers, Identifiers & keywords, Symbolic constants; Operators: Unary operators, Arithmetic & Logical operators, Bit-wise operators, Assignment operators and expressions, Conditional expressions, Precedence & order of evaluation; Storage classes: Automatic, External, Register & Static, Enumerations.
8 Lectures
2. **Control statements:** If-else, Switch, Break, Continue, Comma operator, Go-to statement; **Loops:** For, While, Do-while; **Functions:** Built-in & User-defined, Function declaration, Definition & function call, Parameter passing: Call by value, Call by reference, Recursive functions, Multi-file programs.
8 Lectures
3. **Arrays:** Linear arrays, Multi-dimensional arrays, Passing arrays to functions, Arrays & Strings; **Structures & Union:** Definition and differences, Self-referential structure; **Pointers:** Value at (*) and address of (&) operator, Pointer to pointer, Dynamic memory allocation, Calloc & Malloc functions, Array of pointers, Function of pointers, Structures and Union, C Directives: Macros, C pre-processor.
8 Lectures
4. **Linked list:** Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.
8 Lectures

8 Lectures

Page 9 of 31

5. **File Handling in C:** Opening, Closing and creating a data file, Read and Write functions, Unformatted data files; Make Utility; Command line parameters; Insertion Sort, Bubble Sorting, Quick Sort, Counting Sort, Radix sort.

8 Lectures

References:

1. Peter Norton's, DOS Guide, PHI
2. Gottfried, Programming in C, Schaum series, TMH
3. Yashwant Kanitkar, Let us C, BPB

Paper-6: Linux And Shell Programming (MCA506)

1. **Introduction:** Introduction to LINUX, LINUX system organization (the kernel and the shell), Files and directories, Library functions and system calls, Editors (vi and ed).

8 Lectures

2. **LINUX Shell programming:** Types of Shells, Shell Meta characters, Shell variables, Shell scripts, Shell commands, the environment, Integer arithmetic and string Manipulation, Special command line characters, Decision making and Loop control, controlling terminal input, trapping signals, arrays.

8 Lectures

3. **Portability with C:** Command line Argument, Background processes, process synchronization, Sharing of data, user-id, group-id, pipes, fifos, message queues.

8 Lectures

4. **LINUX System Administration:** File System, mounting and unmounting file system, System booting, shutting down, handling user account, backup, recovery, security, creating files, storage of Files, Disk related commands.

8 Lectures

5. **Different tools and Debugger:** System development tools: lint, make, SCCS (source code control system), Language development tools: YACC, LEX, M4, Text formatting tools: nroff, troff, tbl, eqn, pic, Debugger tools: Dbx and Adb.

8 Lectures

References:

1. Linux Networking & System Administration, Terry Collings and Kurt Wall (Wiley)
2. Red Hat Linux 9, Bill Ball and Hoyt Duff (Pearson Education)

SEMESTER II

Paper-1: Numerical Methods (MCA507)

1. **Floating point Arithmetic:** Numeric computation and error analysis; Representation of floating point numbers, Operations, Normalization, Pitfalls of floating point representation; 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.

8 Lectures

2. **Simultaneous Linear Equations:** Solutions of system of Linear equations, Gauss Elimination direct method and pivoting, Ill Conditioned system of equations, Refinement of solution; Gauss Seidal iterative method, Rate of Convergence.

8 Lectures

3. **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, Hermite's Interpolation Approximation of function by Taylor's series and Chebyshev polynomial.

8 Lectures

4. **Numerical Differentiation and Integration:** Introduction, Numerical Differentiation, Numerical Integration, Trapezoidal rule, Simpson's rules, Boole's Rule, Weddle's Rule Euler- Maclaurin Formula; Solution of differential equations: Picard's Method, Euler's Method, Taylor's Method, Runge-Kutta methods, Predictor-corrector method, Automatic error monitoring, stability of solution.

8 Lectures

5. **Curve fitting, Cubic Spline and Approximation:** Method of least squares, fitting of straight lines, polynomials, exponential curves etc; Frequency Chart: Different frequency chart like Histogram, Frequency curve, Pi-chart; Regression analysis: Linear and Non-linear regression, Multiple regression; Time series and forecasting: Moving averages, smoothening of curves, forecasting models and methods; Statistical Quality Controls methods.

8 Lectures

References :

1. Hopcroft, Sethi and Ullman, Compiler Principles, AddisonWesley
2. John Levine, Linkers and Loaders, <http://www.iecc.com>
3. info lex and info bison on GNU/Linux Systems
4. H. Abelson and G. Sussmann, Structure and Interpretation of Computer Programs, MIT Press
5. Hopcroft and Ullman, Introduction to Automata theory, Languages and Computation, Narosa Pub.
6. Systems Programming & Operating Systems- D M Dhamdhare THM

Paper-2: Data & File Structure Using 'C' (MCA508)

1. **Introduction and Basic Data Structures:** Basic Terminology, Elementary Data Organization, Data Structure operations, Algorithm Complexity and Time-Space trade-off. **Arrays:** Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered List, Sparse Matrices, and Vectors.

8 Lectures

2. **Stack and Queues:** Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array representation of Stack, Linked representation of Stack, Operations associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Queues: Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty. Circular queue, D-queue, and Priority Queue.

8 Lectures

3. **Trees:** Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree. Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees. Traversing Threaded Binary trees, Huffman algorithm. Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-Trees, Red Black Trees, Augmenting Data Structure.

8 Lectures

4. **Searching and Sorting:** Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision resolution Strategies, Hash Table Implementation. Sorting: Insertion sort, Selection Sort; Bubble Sort; Shell Sort; Quick sort; Two Way Merge Sort, Heap Sort, Binomial Heap, Fibonacci Heap, Mergeable heaps. Sorting on Different Keys.

8 Lectures

5. **File Structures:** Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B+ Tree index Files, B Tree index Files, Inverted files; Indexing and Hashing Comparisons

8 Lectures

References:

1. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia
2. R. Kruse etal, "Data Structures and Program Design in C" Pearson Education
3. A M Tenenbaum etal, "Data Structures using C & C++", PHI
4. Lipschutz, "Data Structure", TMH
5. K Loudon, "Mastering Algorithms With C", Shroff Publisher & Distributors
6. Bruno R Preiss, "Data Structures and Algorithms with Object Oriented Design Pattern in C++", Jhon Wiley & Sons, Inc.
7. Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Asia
8. Pal G. Sorenson, "An Introduction to Data Structures with Application", TMH.

Paper-3: Data Base Management System (MCA509)

1. **Introduction and ER Modeling:** An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure. Data Modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.
8 Lectures
2. **Relational data Model and Language:** Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus.
8 Lectures
3. **Introduction to SQL:** Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes, Queries and sub queries, Aggregate functions, Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors in SQL. PL/SQL, Triggers and clusters.
8 Lectures
4. **Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependencies, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.
8 Lectures
5. **Transaction Processing:** Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling. Concurrency Control Techniques: Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi-version schemes, Recovery with concurrent transaction. Transaction processing in Distributed system, data fragmentation. Replication and allocation techniques for distributed system, overview of concurrency control and recovery in distrusted database.
8 Lectures

References:

- 1 Date C J, "An Introduction To Database System", Addison Wesley
- 2 Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
- 3 Elmasri, Navathe, "Fundamentals Of Database Systems", Addison Wesley
- 4 Paul Beynon Davies, "Database Systems", Palgrave Macmillan

Paper-4: Advanced Computer Architecture (MCA510)

1. **Introduction to computer architecture:** Difference between scalar, scalar pipeline, scalar superpipeline and superscalar architecture; Pipeline Processing: An overlapped parallelism, Instruction and Arithmetic pipelines; Pipeline hazards; Comparative study of 16 bit and 32 bit processor families; Basics of Pentium Processors; Comparative study of Microcontrollers; Future Trends
8 Lectures
2. **Introduction to Parallel computing:** Parallelism in Uni-processor Systems, Parallel computer Structures, Architectural Classification schemes, Parallel processing applications. Case studies of vector processors, Array processors, Cube, Hypercube, Parallel algorithms on hyper cubes, Multiprocessor system, Multiprocessor interfacing schemes, Tightly & loosely coupled systems
8 Lectures
3. **Principles of design:** Designing pipelined processors, Internal forwarding and register tagging, Hazard detection and resolution, Job sequencing and collision prevention, Concept of Array and Vector processing, Masking and Data routing: Concurrency in Pipelining and Vector Processing; Cache Coherence
8 Lectures
4. **Other architectures:** Concept of RISC systems; Data flow architectures; Comparison with control flow systems Shuffle exchange and Omega Network, VLIW Architecture; EPIC Architecture
8 Lectures
5. **Introduction to Parallel Algorithms:** Addition on Tree, Cube, Mesh, Linear Array, PSN, etc. Matrix multiplication on Mesh, Cube, Torus, etc.; Parallel Sorting; Associative Processing
8 Lectures

References:

1. Computer Architecture & Parallel processing – Hwang & Briggs
2. Computer Architecture – Jean Loop Bear
3. Introduction to Distributed and Parallel computing- Crichlow
4. Designing Efficient Algorithms for parallel Computers- M.J.Quinn
5. Introduction to Parallel Algorithms- Joseph JA
6. The Design and Analysis of Parallel Algorithms- S.G.Akl
7. Computer Architecture & Organization – B Govindrajalu TMH

Paper-5: Object Oriented Methodology Using C++ (MCA511)

1. **Object Modeling** Object & classes, Links and Associations, Generalization and Inheritance, Aggregation, Abstract classes, A sample object model, Multiple Inheritance, Meta data, candidate keys, constraints.
8 Lectures
2. **Dynamic Modeling** Events and States, Operations and Methods, Nested state Diagrams, Concurrency, Relation of Object and Dynamic Models, advanced dynamic model concepts, a sample dynamic model.
8 Lectures
3. **Functional Modeling** Functional Models, Data flow Diagrams, Specifying Operations, Constraints, a sample functional model.
8 Lectures
4. **Programming in C++:** Classes and objects in C++, Functions, Constructors, Destructors, Inheritance, Functions overloading, Operator Overloading, I/O Operations. Real life applications, Extended Classes, Pointer, Virtual functions, Polymorphisms, Working with files, Class templates, Function templates. Translating object oriented design into an implementation.
8 Lectures
5. **Object Oriented Methodologies:** Methodologies, examples and case studies to demonstrate methodology, comparison of Methodology, SA/SD, and JSD.
8 Lectures

References:

1. Rambaugh James et al, "Object Oriented Design and Modeling", PHI-1997
2. Bjarne Stroustrup, "C++ Programming Language", Addison Wesley
3. Balagurusamy E, "Object Oriented Programming with C++", TMH, 2001
4. Booch Grady, "Object Oriented Analysis and Design with application 3/e", Pearson
5. Lipman, Stanley B, Jonsce Lajole, " C++ Primer Reading", AWL, 1999
6. Dillon and Lee, "Object Oriented Conceptual Modeling", New Delhi PHI-1993
7. Stephen R. Shah, "Introduction to Object Oriented Analysis and Design", TMH
8. Berzin Joseph, "Data Abstraction: the object oriented approach using C++", McGraw Hill
9. Mercer, "Computing Fundamental with C++", Palgrave Macmillan

Paper-6: Theory of Computation (MCA512)

1. **Recursive Functions & Formal Languages:** Partial & total functions; Recursive functions; Bounded minimization; Ackermann's function; Strings; Free semi-group; Languages; Generative grammars and their languages; Chomsky classification of grammars and languages
8 Lectures
2. **Finite Automata:** Deterministic & Non-deterministic finite automata; Machines with moves on empty strings, regular expressions, Regular sets, Relationship with regular grammars, Pumping lemma for regular sets and its usage, Closure property of regular sets, Decision algorithm for regular sets, Minimization of Finite Automata
8 Lectures
3. **Context Free Grammars:** Derivation Trees, Simplification of context free grammars, Chomsky normal form, Greibach normal form, Decision algorithm
8 Lectures
4. **Pushdown Automata:** Instantaneous description, languages accepted by final states and empty stacks, deterministic pushdown automata, relationship with context free language.
8 Lectures
5. **Turing Machines and Undecidability:** Instantaneous description, Languages, String manipulation, Turing computability of functions, Equivalence between Turing Computability and partial recursiveness.
Undecidability: Recursively enumerable and recursively decidable languages, Undecidability of decision algorithm for Type 0 grammar, Church Turing thesis, Halting problem of machine.
8 Lectures

References:

1. Automata, Languages & Computation Hopcraft & Ullman
2. Theory of computability Hennie
3. Formal languages Revesz
4. Theory of Computer Science K L P Mishra & Chandrashekharan

SEMESTER III

Paper-1: Software Engineering And Case Tools (MCA513)

1. **Introduction and SRS:** Introduction to software engineering, Importance of software, The evolving role of software, Software Characteristics, Software Components, Software Applications, Software Crisis, Software engineering problems, Software Development Life Cycle, Software Process. Requirement Analysis and Specification: Analysis Principles, Water Fall Model, The Incremental Model, Prototyping, Spiral Model, Role of management in software development, Role of matrices and Measurement, Problem Analysis, Requirement specification, Monitoring and Control.
8 Lectures
2. **Software-Design:** Design principles, problem partitioning, abstraction, top down and bottom up-design, Structured approach, functional versus object oriented approach, design specifications and verification, Monitoring and control, Cohesiveness, coupling, Forth generation techniques, Functional independence, Software Architecture, Transaction and Transform Mapping, Component – level Design, Forth Generation Techniques
8 Lectures
3. **Coding and Testing:** Top-Down and Bottom –Up programming, structured programming, information hiding, programming style and internal documentation. **Testing:** Testing principles, Levels of testing, functional testing, structural testing, test plane, test case specification, reliability assessment, software testing strategies, Verification & validation, Unit testing, Integration Testing, Alpha & Beta testing, system testing and debugging.
8 Lectures
4. **Software Project Management:** The Management spectrum- (The people, the product, the process, the project), cost estimation, project scheduling, staffing, software configuration management, Structured Vs. Unstructured maintenance, quality assurance, project monitoring, risk management.
8 Lectures
5. **Software Reliability & Quality Assurance:** Reliability issues, Reliability metrics, Reliability growth modeling, Software quality, ISO 9000 certification for software industry, SEI capability maturity model, comparison between ISO & SEI CMM. **CASE (Computer Aided Software Engineering):** CASE and its Scope, CASE support in software life cycle, documentation, project management, internal interface, Reverse Software Engineering, Architecture of CASE environment.
8 Lectures

References:

1. Pressman, Roger S., "Software Engineering: A Practitioner's Approach Ed. Boston: McGraw Hill, 2001
2. Jalote, Pankaj, "Software Engineering Ed.2", New Delhi: Narosa 2002
3. Schaum's Series, "Software Engineering", TMH
4. Ghezzi, Carlo and Others, "Fundamentals of Software Engineering", PHI
5. Alexis, Leon and Mathews Leon, "Fundamental of Software Engineering", Vikas
6. Sommerville, Ian, "Software Engineering", AWL, 2000
7. Fairly, "Software Engineering", New Delhi: TMH
8. Pfleerger, S, "Software Engineering", Macmillan, 1987

Paper-2: Design And Analysis Of Algorithms (MCA514)

1. **Introduction:** Algorithms, Analysis of Algorithms, Design of Algorithms, and Complexity of Algorithms, Asymptotic Notations, Growth of function, Recurrences Sorting in polynomial Time: Insertion sort, Merge sort, Heap sort, and Quick sort Sorting in Linear Time: Counting sort, Radix Sort, Bucket Sort.
8 Lectures
2. **Divide and Conquer:** Binary search, Strassen's matrix multiplication, Greedy Algorithm: General Approach, Knapsack Problem, Huffman Code; Number Theoretic Algorithms: Factorization, GCD, Modular Arithmetic; String Matching: Naïve, Rabin-Karp, KMP Algorithms
8 Lectures
3. **Advanced Design and Analysis Techniques: Dynamic programming:** General approach, Multistage graph, Matrix- chain multiplication, Longest common subsequence, 0/1 Knapsack problem; **Backtracking:** N-queen problem, Sum of subsets, Knapsack problem, Travelling salesperson problem; **Branch-and-Bound:** Assignment problem, 0/1 knapsack problem; Amortized Analysis.
8 Lectures
4. **Graph Algorithms:** Breadth first search, depth first search, **Application of BFS, DFS:** Connected component, Topological sort, **Minimum Spanning Tree:** Kruskal's Algorithms, Prim's Algorithms, **Shortest Path: Single Source:** Dijkstra, Bellman Ford; **All pair shortest Path:** Floyd's Algorithms, **Maximum flow:** Flow networks and Ford Fulkerson algorithms

8 Lectures

5. **Theory of NP-Completeness:** P, NP, NP-Complete, NP Hard, **Randomized Algorithms:** Randomized Quick-Sort, Randomized algorithms for n-queens, randomized min cut; **Approximation Algorithms:** Travelling Salesman Problem, Bin packing, Set cover, max cut; **Computational Geometry:** Convex Hull; **Parallel Algorithms.**

8 Lectures

References:

1. Horowitz Sahani, "Fundamentals of Computer Algorithms", Golgotia
2. Cormen Leiserson et al, "Introduction to Algorithms", PHI
3. Brassard Bratley, "Fundamental of Algorithms", PHI
4. M T Goodrich et al, "Algorithms Design", John Wiley
5. A V Aho et al, "The Design and analysis of Algorithms", Pearson Education

Paper-3: Web Technologies Using Java (MCA515)

1. **Introduction to object oriented programming:** Features of Java; constants, variables and data types, Operators and expressions; decision making, branching and looping; Classes, objects and Methods; arrays, strings and vectors; Java Applet, String handling, Networking, Event handling, Introduction to AWT, AWT controls, Layout managers, Menus, Images, Graphics.

8 Lectures

2. **Inheritance & File Handling:** Interfaces; Managing Input/ Output Files in Java; Packages, Exception Handling, Multithreaded Programming; Utility Classes; String Handling; Generics, Generic Class, Generic methods.

8 Lectures

3. **JDBC Overview:** JDBC implementation; Connection class; Statements; Catching Database Results, handling database Queries. Networking; InetAddress class; URL class; TCP sockets; UDP sockets.

8 Lectures

4. **Web Page Design:** Web page Designing using HTML, Scripting basics: Client side and server side scripting; Java Script-Object, names, literals, operators and expressions, statements and features, events, windows-documents, frames, data types, built-in functions, Browser object model, Verifying forms; Servlet: life cycle of a servlet; The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking; Introduction to JSP.

8 Lectures

5. **XML:** Introduction, Displaying an XML Document, Data Interchange with an XML document, Document type definitions, Parsers using XML, Client-side usage, Server Side usage; Common Gateway Interface (CGI), PERL, RMI, COM/DCOM, VBScript, Active Server Pages (ASP).

8 Lectures

References:

1. Burdman, "Collaborative Web Development", Addison Wesley.
2. Sharma & Sharma, "Developing E-Commerce Sites", Addison Wesley
3. Ivan Bayross, "Web Technologies Part II", BPB Publications.
4. Margaret Levine Young, "The Complete Reference Internet", TMH
5. Naughton, Schildt, "The Complete Reference JAVA2", TMH
6. Balagurusamy E, "Programming in JAVA", TMH
7. Shishir Gundavarma, "CGI Programming on the World Wide Web", O'Reilly & Associate.
8. DON Box, "Essential COM", Addison Wesley.
9. Greg Buczek, "ASP Developer's Guide", TMH

Paper-4: Embedded Systems (MCA516)

1. **Classification of systems:** Real-time design issues; Typical Real-time applications; Hard vs Soft real-time systems; A reference model for real-time systems; Design of data acquisition System; Language issues; Exception handling; Characteristics of real-time OS, Real-time kernels; Introduction to iRMX III+, TRON; Inter-task communication & synchronization; Real-time memory management; System performance issues & optimization

Real-time specification & design techniques : Mathematical specification; Structure charts; Pseudo-code and programming design languages; DFDs, Petri Nets, State charts, Usage of Graphical Techniques

8 Lectures

2. **Commonly used approaches to real-time scheduling:** Clock driven, priority driven; Priority driven scheduling of periodic tasks, Scheduling a-periodic and sporadic jobs in priority driven systems; Resources and resource access control; Multiprocessor scheduling, resource access control & synchronization

Real-time kernels: Polled loop systems; State driven code; Co-routines; Interrupt driven systems- Context Switching, Round Robin systems, Pre-emptive priority systems; Major & Minor processing; Foreground/Background systems; Full featured real-time OS

- 8 Lectures**
3. **Inter-task communication & Synchronization:** Buffering data- Time-relative buffering, Ring Buffers; Mailboxes & their implementation, Other operation on Mailboxes; Queues; Critical regions; Semaphores- Counting Semaphores, Problems with semaphores; Deadlock- Detection & Recover, Avoidance
Real-Time Memory Management: Process Stack Management; Dynamic Allocation; Static schemes
8 Lectures
 4. **System performance analysis & optimization:** response-time calculation; Interrupt Latency; Time loading and its measurement; Reducing response times and time loading; Analysis of Memory requirements; Reducing Memory loading
8 Lectures
 5. **Comparative study of real-time programming languages; Design of Embedded Systems** – Techniques & issues involved
8 Lectures

References:

1. Automatic Control Systems by Kuo, B.C.
2. Real-time Computer Control by Linkens & Bennett
3. Real-time software for small systems by Leigh, A.W.
4. Programming embedded microprocessors by Fowler, R.J.
5. Real-time systems Design & Analysis by Laplante P.A.

Paper-5: Computer Graphics (MCA517)

1. **Introduction to Graphic Display Devices:** LED & LCD Display; Flat Panel Displays; Raster Scan Graphics; Line, Circle & Ellipse Generation Techniques; Scan Conversion; Frame Buffer; Filling algorithms: Flood fill, boundary filling.
8 Lectures
2. **Geometrical Transformations:** Two dimensional transformations; Clipping & Windowing methods for 2D images - Simple boundary method, End point code method, Cohen-Sutherland clipping, Polygon clipping. Three Dimensional transformations; Parallel and Perspective Projections
8 Lectures
3. **Plane Curves and Surfaces:** Parametric and Non-parametric curves and their representations; Cubic Splines; Bezier and B Splines. B Spline and Bezier Surfaces; Visible line and surfaces detection algorithms: ZBuffer Algorithm; A Buffer Algorithm; Rendering; Phong reflection model, Incremental shading techniques; Gourard and Phong Shading; Illumination models; Shadows and Texture.
8 Lectures
4. **Graphs,** sub-graphs, Connected graphs, Disconnected graphs, Bipartite Graphs, Walks and path - Euler Circuits and Walks, Hamilton Cycles and Paths, Various operation on graphs, Tree and fundamental circuits, Rooted and binary trees, Counting trees, Spanning trees.
8 Lectures
5. **Fundamental cut sets and fundamental circuits,** Directed graphs, Network flows, Max-Flow Min-Cut theorem, Planar graphs- Kuratowski's two graph, Detection of planarity, Combinatorial and Geometric dual, Thickness and Crossings, Vector space of a graph: vectors, basis vectors, cut set vector, circuit vector, circuit and cut set sub spaces, orthogonal vector and sub spaces.
8 Lectures

References:

1. Computer Graphics: Principles and Practice: Foley et al.
2. Computer Graphics: Hern and Baker
3. Procedural elements in Computer Graphics: David F. Rogers
4. Mathematical Elements for Computer Graphics: David F. Rogers and J.A.Adams
5. Graph Theory with applications to engineering & computer science: Deo Narsing

Paper-6: System Programming (MCA518)

1. **Language Processors:** Introduction; Language Processing Activities; Fundamentals of Language Processing; Fundamentals of Language Specifications; Data Structures for Language Processing; Scanning & Parsing
8 Lectures
2. **Assemblers:** Elements of Assembly Language Programming; A Simple Assembly Scheme; Pass Structure of Assemblers; Types of Assemblers; Assembler Directives; Design of a Two Pass Assembler; Macros and Macro Processors; Nested Macro Calls; Advanced Macro Facilities; Design of a Macro Preprocessor
8 Lectures
3. **Lexical and Syntax Analysis:** Aspects of Compilation; Memory Allocation; Lexical analysis – DFA diagrams; Syntactic analysis- Bottom up & Top Down Parsing; Symbol Tables – Hash & Tree Structures, Parse trees
8 Lectures
4. **Semantic analysis and Code Optimization:** Syntax Directed Translation; Compilation of Expressions; Compilation of Control Structures; Code generation & Optimization; Register utilization
8 Lectures
5. **Linkers:** Relocation & Linking concepts; Design of a Linker; Self relocating Programs; A Linker for MS-DOS; Linking for overlays; Loaders; Types of Loaders & Linkers
8 Lectures

References :

1. Hopcroft, Sethi and Ullman, Compiler Principles, AddisonWesley
2. John Levine, Linkers and Loaders, <http://www.iecc.com>
3. info lex and info bison on GNU/Linux Systems
4. H. Abelson and G. Sussmann, Structure and Interpretation of Computer Programs, MIT Press
5. Hopcroft and Ullman, Introduction to Automata theory, Languages and Computation, Narosa Pub.
6. Systems Programming & Operating Systems- D M Dhamdhare THM

SEMESTER IV

Paper-1: .Net Frame Work and C# (MCA519)

1. **The .NET framework:** Introduction, Common Language Runtime, Common Type System, Common Language Specification, The Base Class Library, The .NET class library Intermediate language, Just-in-Time compilation, garbage collection, Application installation & Assemblies, Web Services, Unified classes.
8 Lectures
2. **C# Basics:** Introduction, Data Types, Identifiers, variables & constants, C# statements, Object Oriented Concept, Object and Classes, Arrays and Strings, System Collections, Delegates and Events, Indexes Attributes, versioning.
8 Lectures
3. **C# Using Libraries:** Namespace-System, Input Output, Multi-Threading, Networking and Sockets, Data Handling, Windows Forms
8 Lectures
4. **C# in Web application:** Error Handling.
8 Lectures
5. **Advanced Features Using C#:** Web Services, Windows services, messaging, Reflection, COM and C#, Localization. Advanced Features Using C#: Distributed Application in C#, XML and C#, Unsafe Mode, Graphical Device Interface with C#, Case Study (Messenger Application)
8 Lectures

References:

1. Jeffrey Richter, "Applied Microsoft .Net Framework Programming", (Microsoft)
2. Fergal Grimes, "Microsoft .Net for Programmers", (SPD)
3. TonyBaer, Jan D. Narkiewicz, Kent Tegels, Chandu Thota, Neil Whitlow, "Understanding the .Net Framework", (SPD)
4. Balagurusamy, "Programming with C#", TMH

Paper-2: Image Processing (MCA520)

1. **Introduction:** Image representation and modeling, 2-D linear system, Luminance, Contrast and Brightness, Color representation, Visibility functions, Monochrome and color vision model.
8 Lectures
2. **Image Quantization and Image Transforms:** Sampling theorem, Anti-aliasing, image quantization, Orthogonal and unitary transforms, DFT, Cosine transform, Hadamard transform, Haar transform, KL transform.
8 Lectures
3. **Image Enhancement:** Point operation, Histogram modeling, Filtering and spatial operations, Transform operations, Multi-spectral Image Enhancement
8 Lectures
4. **Image Restoration:** Image formation models, Noise models, Inverse and Wiener filtering, Least square filters, Recursive filters, Maximum entropy method, Blind de-convolution, Bayesian method of noise removal, Image reconstruction, Tomography, Radan transform, Back-projection, Reconstruction algorithm, Algebraic method of reconstruction, Fan-beam reconstruction.
8 Lectures
5. **Data Compression:** Data compression vs. Bandwidth, Pixel coding, Predictive coding, Transform coding, Coding of two-tone images.
8 Lectures

References:

1. Fundamentals of Digital Image Processing: Anil K. Jain
2. Digital Image Processing: R. Chellappa
3. Image Processing for Scientific Applications: Bernd Jahne
4. Digital Image Processing: R.C. Gonzalez & R.E. Woods
5. The Image Processing Handbook: J.C. Russ
6. Digital Image Processing: W.K. Pratt
7. Digital Image Restoration: Andrews & Hunt

Paper-3: Multimedia Systems (MCA521)

1. **Multimedia Technology:** Meaning & scope of Multimedia; Elements of Multimedia; Creating multimedia applications; Multimedia file & I/O functions; Multimedia data structures; Multimedia file formats; Multimedia Protocols
8 Lectures
2. **Multimedia Audio:** Digital sound; Audio compression & decompression; Companding; ADPCM compression; MPEG audio compression; True Speech; Special effects and Digital Signal Processing; Audio synthesis; FM synthesis; Sound blaster card; Special effect processors on sound cards; Wave table synthesis; MIDI functions; Speech synthesis & Recognition
8 Lectures
3. **Multimedia Video:** Representation of Digital video; Video capture; Frame grabbing; Full motion video; Live video in a window; Video processor; Video compression & decompression; Standards for video compression & decompression; Playback acceleration methods
8 Lectures
4. **Creating Multimedia Animation and Authoring Tools:** Icon animation; Bit-map animation; Real-time vs Frame by Frame animation; Object modeling in 3D animation; Motion control in 3D animation; Transparency; Texture, Shadows, Anti-aliasing; Human modeling & Animation; Automatic motion control. Multimedia Authoring tools: Project editor; Topic editor; Hot-spot editor; Developing a multimedia title; Multimedia text authoring systems; Usage of authoring tools
8 Lectures
5. **Multimedia communication systems:** Multimedia DBMS; Documents, Hypertext and MHEG; User Interfaces; Synchronization, A reference model for multimedia synchronization. Multimedia on LANs & Internet: Fast modems & Digital networks for multimedia; High speed digital networks; Video conferencing techniques; Multimedia interactive applications on internet; Future Directions
8 Lectures

References:

1. Multimedia: Computing, Communications & Applications – Nahrstedt & Steinmetz
2. Computer Speech Processing – Fallside F.
3. Speech Analysis, Synthesis & Perception – Flanagan, J.L.
4. Hypertext & Hypermedia- Nielsen J.
5. Digital Processing of Speech Signals- Rabiner L.R. & Schafer L.W.

Paper-4: Operation Research (MCA522)

1. **Network Analysis:** Terminology of network, Shortest route problem, minimal spanning tree problem, max-flow problem.
8 Lectures
2. **PERT & CPM:** Project Scheduling by PERT, CPM: Diagram, representation, Critical path calculation, Construction of time chart and resource labeling, Probability and cost consideration in project scheduling, project control.
8 Lectures
3. **Linear and Nonlinear Programming:** Simplex Method, Revised simplex method, Duality in Linear programming, Application of Linear Programming to Economic and Industrial Problems. Nonlinear Programming: The Kuhn-Tucker conditions, Quadratic programming, Convex programming.
8 Lectures
4. **Replacement Models:** Introduction, Replacement policies for items whose efficiency deteriorates with time, Replacement policies for items that fail completely.
8 Lectures
5. **Sequencing Model:** Classification of self problems, processing of n jobs through two machines, three machines, processing of two jobs through m machines.
8 Lectures

References:

1. Taha, Operations Research, Macmillan.
2. B.E. Gillet, Introduction to Operations Research, McGraw-Hill.
3. S.S.Rao, Optimization Theory and Applications, Wiley Eastern.
4. G.Hadley, Linear programming, Addison-Wesley.

Paper-5: Data Communication And Networks (MCA523)

1. **Data Communication:** History of Data Communication; Importance of Modulation & Multiplexing: Types of Modulation; Multiplexing techniques; The electrical interface-transmission media, attenuation and distortion sources, Signal types and signal propagation delay, Public carrier service
6 Lectures
2. **Data Transmission basics :** Synchronous/asynchronous transmission; Error detection & Error correction methods; Data compression; Transmission control circuits; Communication control devices; Protocol basics; data link control protocol, Broad band multi service networks- networking requirement, FDDI II, Cell based networks, ATM Lans, DQDB, ATMR, CRMA II,
6 Lectures
3. **Computer Networks:** Advantages & Disadvantages; Classification of networks; Wired/Wireless networks; protocols, CSMA/CD & CSMA/CA; Ethernet switching – Thinnet & Thicknet; Fast Ethernet; FDDI; Network devices- Active & Passive; WAN-characteristic of public data networks; packet switched; circuit switched; ISDN; private networks; Layered approach to network design: ISO/OSI & TCP/IP models; TCP & UDP; Protocols at each layer; Classful and Classless addressing; Subnetting concept; DNS; Introduction to NAT; IPv4 vs IPv6
12 Lectures
4. **Internetworking:** Inter network architecture issues, IP standards, Routing – Basics, Link State & Distance Vector; ISO routing protocols, Transport Protocols, Application support protocols, application specific protocols
8 Lectures
5. **System aspects**-Layer interactions, implementation issues, related standards, Design of Campus-wide LAN; Design of WAN
8 Lectures

References:

1. Data and Computer Communication- W.Stallings,
2. Computer Networks- A.S.Tanenbaum
3. Computer Network and Distributed Data Processing- J. Martin
4. Local Networks - W.Stallings
5. Computer Communication Network Design and Analysis- M.Schwartz
6. Data Communications and Networking- B. A. Forouzan
7. TCP/IP fundamentals-Vol I & II - Comer

Paper-6: Information Retrieval and Web mining (MCA524)

- 1. Introduction and Information Retrieval Models:** Introduction to information storage and retrieval, IR models, functional view of paradigm IR system, IR and other types of information systems.
IR evaluation: Measuring effectiveness of IR system; Precision and recall, User centered evaluation. Boolean model, Vector space model, Probabilistic model, non-classical models of IR – Information logic model, cluster model, LSI model; AI in IR – ANN model, genetic algorithm model, Knowledge-bases, Natural language processing; Query expansion.
8 Lectures
- 2. Data structures and algorithms related to IR:** Data structures -inverted files and its implementation, B-trees and tries, signature files; algorithms – indexing and retrieval algorithms.
8 Lectures
- 3. Term and query operation:** Tokenization, stop lists, stemming, different types of stemmers; thesaurus construction; query modification.
8 Lectures
- 4. Vector space model:** Indexing - document and query representation; Term weighting; Similarity measures, ranking algorithms; Query expansion- Relevance feedback methodology Rocchio's and Ide's method, Evaluation of relevance feedback; clustering algorithms and its application.
8 Lectures
- 5. Further topics:** Web information indexing; Web Information categorization and ranking; Web IR evaluation; Data fusion, Text mining; Semantic Web; Intelligent agents in IR.
8 Lectures

References:

1. Modern Information Retrieval, Ricardo – Baeza Yates, B. Ribeiro-Neto (Addison Wesley Longman)
2. C. J. van Rijsbergen "Information Retrieval", Second Edition
3. G. Salton, and M. J. McGill, "Introduction to modern information retrieval". New York: McGraw-Hill
4. Information Retrieval: Data Structures and algorithms. W. Frakes and R. Baeza-Yates (Eds.). Prentice Hall
5. D. Jufrasky, and J. H. Martin. "Speech and language processing: an introduction to natural language processing, computational linguistics, and speech recognition". *Pearson education, Asia*, 2000.
6. Introduction to Information Retrieval, by C. Manning, P. Raghavan, and H. Schütze

SEMESTER V

Paper-1: Machine Learning Techniques (MCA525)

- 1. Introduction:** Difference between human learning and machine learning; Types of Machine learning- Supervised, Unsupervised, Reinforced and their comparison; Applications of Machine learning; Tools for Machine learning; Issues in Machine learning; Basic types of data in Machine learning; Data Pre-processing; Other types of learning – Representation learning, Active learning, Memory based learning, Associative rule learning algorithms, Ensemble learning algorithm
10 Lectures
- 2. Modelling & Evaluation:** Selecting a model – Predictive and Descriptive models; Training a model for supervised learning; Model representation and Interpretability; Evaluating the performance of a model – Classification, Regression & Clustering; Improving the performance of a model; Basics of Feature Engineering- Feature transformation, Feature Subset selection; Brief overview of Probability – Random variables, Introduction to Discrete distributions and continuous distribution, Central limit theorem, Sampling distributions
10 Lectures
- 3. Different learning methods:** Bayesian method – Baye's theorem, Brute force Bayesian algorithm, Baye's optimal classifier, Bayesian belief network; Supervised learning – Classification, Common classification algorithms – kNN, Decision tree, Random Forest, Support vector machine; Regression – Common regression algorithms, Logistic regression, Maximum likelihood estimation
6 Lectures
- 4. Unsupervised learning:** Unsupervised vs Supervised learning; Applications of Unsupervised learning; Clustering – Different types of clustering techniques, Partitioning methods, K medoids, Hierarchical clustering, Density based methods; Finding pattern using association rule; The apriori algorithm for association based learning
6 Lectures

5. **Basics of Neural Networks:** Understanding the biological neuron; Exploring the artificial neuron; Types of activation functions – Identity function, Threshold function, ReLU function, Sigmoid function, Hyperbolic tangent function; Implementations of ANN; Architectures of Neural Network – Single layer & Multi layer feed forward network, Competitive network, Recurrent network; Learning Process in ANN – Number of layers, Direction of Signal flow, Number of nodes in layers, Weight of interconnection between neurons; Back propagation; Introduction to Deep Learning

8 Lectures

References:

1. Miroslav Kubat: An introduction to machine Learning, Springer
2. John Slavic: Machine Learning for Beginners
3. Rajiv Chopra: Machine Learning, Khanna Publications
4. Gareth Witten, James Daniela et al: An introduction to Statistical Learning with applications in R
5. Ethen Alpaydin: Introduction to Machine Learning, PHI
6. Tom M Mitchell: Machine Learning

Paper-2: Secure Computing (MCA526)

1. **Basics of computer security:** Kinds of security branches, Security goals and vulnerabilities, Methods of Defence

8 Lectures

2. **Program Security:** Viruses and other malicious codes, Targeted malicious codes, Controls against program threats; Protection in General purpose operating systems, Protecting memory and addressing, Protecting access to general objects, File protection mechanisms, User authentication

8 Lectures

3. **Security in Networks and Distributed Systems:** Threats in Network, Network security control, Administering Security

8 Lectures

4. **Encryption and Decryption:** Mono alphabetic substitution ciphers, Poly alphabetic substitution ciphers, Transpositions, Stream and block ciphers, Secure encryption system: Public key Encryption, Merkel Hellman, knapsacks, RSA Encryption, EL Gamel algorithm, Hash Algorithms, Digital Signature algorithm, Symmetric system, DES algorithm, Enhancing cryptographic security.

8 Lectures

5. **Legal and Ethical issues in Computer Security:** Protecting programs and data, computer crime, Ethical issues, Electronic privacy

8 Lectures

References:

1. Security in Computing by Charles P. Pfleeger (Prentice Hall)
2. Computer Security Handbook Vol. 1 & 2 by Bosworth, Kabay & Whyne (Wiley)
3. Applied Cryptograph by Schneier, Bruce (Wiley)
4. Practical Cryptography by Schneier & Ferguson (Wiley)
5. Introduction to cryptography: Principles and applications by Delfs & Knebl (Springer)

Paper-3: Robotics & AI (MCA527)

1. **Introduction:** Scope of AI: Games, theorem proving, Natural language processing, Vision and speech processing, Robotics & Expert systems, AI techniques, Introduction to intelligent agents.

Search Techniques: State space search, control strategies: Depth first search, Breadth first search and Production systems; Use of heuristics: Hill climbing, Best first search, A* algorithm- admissibility, AND/OR graph – AO*, Constraint satisfaction; Game playing: Minimax and Alpha-Beta searching, Genetic algorithms.

12 Lectures

2. **Knowledge Representation:** Propositional logic: its syntax and semantics; Reasoning patterns in propositional logic: Resolution, forward and backward reasoning. First order logic: Syntax and semantics; Inference in first order logic: Unification, Forward & backward chaining, Resolution. Structured knowledge representation: Semantic Net, Frames, and Conceptual graphs; Uncertain knowledge and reasoning: Introduction to probabilistic reasoning; representing vagueness- fuzzy sets and fuzzy logic.

Learning: Different forms of learning; Concept learning system; Inductive learning; Learning decision trees; Neural network: single layer feed forward network.

10 Lectures

3. **Introduction to Robotics:** Classification; Robot manipulator kinematics, Arm control & Wrist control equations; Trajectory generation & control; Task planning & compliance; Linear & Non-linear control of manipulators; Robot vision

8 Lectures

4. **Robot Motion:** Translational & Rotational motion; Motion conversion; Lagrangian analysis of manipulator; Control of actuators; Robot sensory devices

5 Lectures

5. **Computer Vision & Robot Programming:** Imaging components; Object recognition & categorization; Need for vision training & adaptation; Robot Programming; Robot design & Process specifications

5 Lectures

References:

1. Artificial Intelligence: Rich and Knight
2. Artificial Intelligence: A Modern Approach: Stuart Russell and Peter Norvig
3. Introduction to Artificial Intelligence: Partick Winston
4. Artificial Intelligence: Nilsson
5. Introduction to Robotics: Fu, Lee & Gonzalez
6. Introduction to Robotics- Mechanics & Control: Craig, John J
7. Robot Motion: Brady
8. Robot Manipulators, Mathematics, Programming & Control: Paul R.
9. Robot Modelling: Ho C Y

Paper-4: Digital Communication (MCA528)

1. **Pulse Code Modulation:** Modulation basics: Analog & Digital; Concept of various modulation techniques; Basic elements of a PCM System, Electrical representation of binary digits. Companding. Multiplexing of PCM signals, Digital Hierarchy, Pulse stuffing, Differential PCM. Delta Modulation. Adaptive delta modulation, Comparison of ADM & DM.

10 Lectures

2. **Digital Modulation Techniques:** Power density of digital data BPSK, OOK, BFSK, DPSK, M-ary ASK, Quadrature phase shift keying, Duo binary encoding.

10 Lectures

3. **Modulation and Demodulation in Presence of Additive White Gaussian Noise:** A baseband receiver, optimum filter, matched filter, Different representation of narrow band signals and systems. Spectrum of digital modulated signals, Calculation of probability of error for binary & M-ary signals, digital signaling schemes for coherent and non-coherent demodulation. Comparison of different modulation schemes, Symbol synchronization and carrier recovery circuits.

10 Lectures

4. **Digital Signaling in Presence of ISI & A WGN:** Design of band limited channels for no ISI, Design of band limited signals for controlled .ISI (partial response signals), Optimum demodulator in presence of ISI & A WGN noise.

10 Lectures

Reference:

1. Principles of Communication Taube Schilling (TMH)
2. Digital Communication J.G. Proakis (TMH)
3. Digital Communication S.Haykin (Wiley)

Paper-5: ELECTIVE: Network Analysis; Data Science & Python/R; NLP; HCI (MCA529)

Network Analysis

1. **Introduction:** Aspects of networks, Behavior and dynamics, Technological networks: The Internet, The telephone network, Power grids, Transportation networks, Delivery and distribution networks; Social networks: The empirical study of social networks, Affiliation networks, The small-world experiment, Snow ball sampling, contact tracing, and random walks; Networks of information: The World Wide Web, Citation networks, Other information networks; Biological networks, Neural networks, Ecological networks.

8 Lectures

2. **Fundamentals of network theory:** Mathematics of networks, Network representations, Web as a graph, Measures and metrics: Degree centrality, Katz centrality, PageRank, Closeness centrality, Betweenness centrality, Signed edges and structural balance, Homophily and assortative mixing; Key network properties: Degree distribution, Path length, Clustering coefficient.

8 Lectures

- 3. The Small-World Phenomenon:** Six degrees of separation, Structure and randomness, Decentralized search, Modeling the process of decentralized search, Empirical analysis and generalized models, Core-periphery structures and difficulties in decentralized search, Analysis of decentralized search.

8 Lectures

- 4. Community Structure in Networks:** Network communities, Community detection: Graph partitioning-based community detection, Clustering-based community detection, Genetic algorithms-based community detection; Overlapping communities.

8 Lectures

- 5. Epidemics:** Diseases and the networks that transmit them, Branching processes, The SI epidemic model, The SIR epidemic model, The SIS epidemic model, Synchronization, Transient contacts and the dangers of concurrency; Genealogy, Genetic inheritance, and mitochondrial eve.

8 Lectures

References:

1. Mark Newman, "Networks: An Introduction", Oxford University Press.
2. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press.

Data Science & Python/R

- 1. Introduction to Data Science with Python/R:** What is analytics & Data Science, Common Terms in Analytics, Analytics vs. Data warehousing, OLAP, MIS Reporting, Relevance in industry and need of the hour, Types of problems and business objectives in various industries, How leading companies are harnessing the power of analytics, Critical success drivers, Overview of analytics tools & their popularity, Analytics Methodology & problem solving framework, List of steps in Analytics projects, Identify the most appropriate solution design for the given problem statement, Project plan for Analytics project & key milestones based on effort estimates, Build Resource plan for analytics project, Why Python for data science, Overview of Python- Starting with Python.

8 Lectures

- 2. Python Essentials:** Introduction to installation of Python, Introduction to Python Editors & IDE's(Canopy, pycharm, Jupyter, Rodeo, Ipython etc), Understand Jupyter notebook & Customize Settings, Concept of Packages/Libraries - Important packages (NumPy, SciPy, scikit-learn, Pandas, Matplotlib, etc),Installing & loading Packages & Name Spaces, Data Types & Data objects/structures (strings, Tuples, Lists, Dictionaries),List and Dictionary Comprehensions, Variable & Value Labels – Date & Time Values, Basic Operations - Mathematical - string – date, Reading and writing data, Simple plotting, Control flow & conditional statements, Debugging & Code profiling, How to create class and modules and how to call them, Importing Data from various sources (Csv, txt, excel, access etc).

8 Lectures

- 3. Accessing/Importing and Exporting Data using Python Modules:** Database Input (Connecting to database),Viewing Data objects - subsetting, methods, Exporting Data to various formats, Important python modules: Pandas, beautiful soup, Cleansing Data with Python, Data Manipulation steps(Sorting, filtering, duplicates, merging, appending, subsetting, derived variables, sampling, Data type conversions, renaming, formatting etc),Data manipulation tools(Operators, Functions, Packages, control structures, Loops, arrays etc),Python Built-in Functions (Text, numeric, date, utility functions),Python User Defined Functions, Stripping out extraneous information, Normalizing data, Formatting data, Important Python modules for data manipulation (Pandas, Numpy, re, math, string, datetime etc).

8 Lectures

- 4. Data Analysis:** Visualization using Python/R-introduction exploratory data analysis; Descriptive statistics, Frequency Tables and summarization, Univariate Analysis (Distribution of data & Graphical Analysis), Bivariate Analysis(Cross Tabs, Distributions & Relationships, Graphical Analysis),Creating Graphs- Bar/pie/line chart/histogram/ boxplot/ scatter/ density etc),Important Packages for Exploratory Analysis (NumPy Arrays, Matplotlib, seaborn, Pandas and scipy.stats etc),Basic Statistics - Measures of Central Tendencies and Variance, Building blocks - Probability Distributions - Normal distribution - Central Limit Theorem, Inferential Statistics - Sampling - Concept of Hypothesis Testing, Statistical Methods - Z/t-tests(One sample, independent, paired), Anova, Correlations and Chi-square, Important modules for statistical methods: Numpy, Scipy, Pandas.

8 Lectures

5. **Text Mining and Analytics:** Sentiment Analysis using Python, Text Analytics – Word cloud analysis using Python, Text Analytics - Segmentation using K-Means/Hierarchical Clustering, Text Analytics - Classification (Spam/Not spam), Applications of Social Media Analytics, Metrics(Measures Actions) in social media analytics, Examples & Actionable Insights using Social Media Analytics, Important python modules for Machine Learning (SciKit Learn, stats models, scipy, nltk etc), Fine tuning the models using Hyper parameters, grid search, piping etc.

8 Lectures

References:

1. Getting started with Data Science: Making sense of Data with Analytics Paper back 2016 by Murtaza Haider Kindle edition (2015) Ibm Press.
2. Statistics for Data Science Paperback 2017 by James .D.Miller Kindle edition.
3. Data Science from Scratch Paperback –i January 2015 by Joel Grus (OREILLY)
4. Pandas for Everyone: Python Data Analysis 1e Paperback-15 April 2018 BY Daniel.Y.Chen.
5. Hands on Data Analysis with Numpy and Pandas Paperback -29 June 2018 by Curtis Miller–Kindle edition.
6. Python for Data Analysis: Data Wrangling with Pandas, Numpy and Python paper back 27 October 2017 by Willima Mckinney, Kindle Edition.

Natural Language Processing

1. **Introduction to Natural Language Understanding:** The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language, Understanding Systems, Linguistic Background: An outline of English syntax.

8 Lectures

2. **Introduction to semantics and knowledge representation, Applications:** Machine translation, database interface. **Web 2.0 Applications:** Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR).

8 Lectures

3. **Grammars and Parsing:** Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks. Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing.

8 Lectures

4. **Grammars for Natural Language:** Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.

8 Lectures

5. **Ambiguity Resolution:** Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

8 Lectures

References:

1. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, NLP: A Paninian Perspective, Prentice Hall, New Delhi.
2. James Allen, Natural Language Understanding, 2/e, Pearson Education, 2003.
3. D. Jurafsky, J. H. Martin, Speech and Language Processing, Pearson Education, 2002.
4. L.M. Ivasca, S. C. Shapiro, Natural Language Processing and Language Representation
5. T. Winograd, Language as a Cognitive Process, Addison-Wesley

Human Computing Interface

1. **Introduction:** Importance of user Interface: definition, importance of good design. The Human: Input-output channels; Human Memory; Thinking: emotions; Psychology & design of interactive systems; Computer: Text entry devices- Positioning, Pointing & drawing: Display devices for Virtual reality, 3D; Interaction models; Frameworks & HCI, Ergonomics: Interaction styles, WIMP Interfaces: context; paradigms for Interaction.

8 Lectures

2. **Software Process & Design Rules:** Human interaction with computers, Interaction design basics, user focus, scenarios, navigation, screen design & layout; HCI in software process: life cycle. Usability engineering: Interactive design & prototyping; Design rules: Principles for usability, standards, guidelines, golden rules, HCI patterns.

8 Lectures

3. **Implementation & User Support:** Implementation support : Windowing system elements, using tool kits, user interface management ; Evaluation techniques: goals, expert analysis, choosing a method; Universal design principles: multimodal interaction; User support : requirements; Approaches: adaptive help systems, designing user support system
8 Lectures
4. **Cognitive, Communication & Collaborative Models:** Cognitive models: Goal & task hierarchies; Linguistic models: Physical & device models, architectures; communication & collaboration models: Face-to-face communication, conversation, text based, group working; Task analysis: difference between other techniques, task decomposition; Knowledge based analysis: ER based techniques, uses.
8 Lectures
5. **Ubiquitous Computing:** Ubiquitous computing application research; virtual & augmented reality; information & data visualization; understanding hypertext. Web Technology & issues; Static Web content; Dynamic Web content; Groupware systems; Computer mediated communication; DSS: Frameworks for groupware. Interaction Devices: Keyboard and function keys; pointing devices; speech recognition; digitization and generation; image and video displays drivers.
8 Lectures

References:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition Prentice Hall, 2004.
2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in HumanComputer Interaction, Wiley, 2010.
3. Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition, pp. 672, ISBN 0-321-53735-1, March 2009), Reading, MA: Addison-Wesley Publishing Co.

SEMESTER VI

Paper-1: Mobile Computing And Applications (MCA-601)

1. **Introduction:** Evolution and fundamentals of Mobile communication, Terminal mobility, Personal Mobility and Service Portability, The Cellular concept, A basic cellular system, Multiple access technologies of cellular systems, Analog & Digital cellular systems, Generations of systems, Cellular system operation and planning, System architecture, Location updating and call setup, Handoff & power control
8 Lectures
2. **Digital cellular systems:** Evolution of Mobile System, GSM, GSM standardization and service aspects, GSM reference architecture and function partitioning, GSM radio aspects, GSM security aspects, GSM protocol model, GSM call flow sequences, gprs, edge; (Wireless) Medium Access Control: Motivation for a specialized MAC(Hidden and exposed terminals, Near and Far terminals), SDMA, FDMA, TDMA, CDMA
8 Lectures
3. **Mobile network and transport layer:** Mobile IP: goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations, Dynamic Host Configuration Protocol (DHCP). Mobile Transport Layer: Traditional TCP ,Indirect TCP ,Snooping TCP ,Mobile TCP, Fast retransmit/fast recovery ,Transmission /time-out freezing ,Selective retransmission, Transaction oriented TCP
8 Lectures
4. **Database issues:** Hoarding techniques, caching invalidation mechanisms. client server computing with adapt ion , power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues
8 Lectures
5. **Mobile Ad hoc Networks (MANETs):** Overview, Properties of a MANET, spectrum of MANET, applications, routing and various routing algorithms, security in MANET's.
8 Lectures

References:

1. Mobile and Personal communication systems and Services – Raj Pandya
2. Mobile Communications – Schiller J.
3. Mobile Cellular Telecommunications – Lee William C.Y.
4. Wireless Communications & Networks – Stallings, William

Paper-2: Elective: Application Development on Hand-held devices; Distributed Computing; E-Commerce & Cyber Laws; High Performance Computing; Computer Vision; Artificial Neural Networks; Fuzzy Systems; Big Data Analysis; Cloud Computing; Computer Animation (MCA531)

Application Development on Hand Held Device

1. **Introduction To Application Development for Handheld:** Features, Device Types, Device Limitations, Technology & marketing trends, Mobile Applications and its Types, Mobile web sites, Apps, Web apps and Native Apps, Introduction to Mobile Web design, Design Time and Runtime Considerations
8 Lectures
2. **Website Design For Smart Devices:** HTML5, Javascript, JQuery Programming, JQuery Selectors, Event Binding, Animation, Ajax, CSS3 Features for web, border-radius, gradients, box-sizing, min-width, max-width, box-shadow, text-shadow, text-overflow, multiple-backgrounds, Understanding CSS Animations, Using CSS Transitions, Css Media Queries, Role of Modernizer. Js, Responsive Website Design and Development, Firebug Extension, Layout Frameworks, Using Skeleton.js
8 Lectures
3. **Web Apps:** JQuery Mobile, Introduction, Data Attributes, Pages, Dialog, Toolbars, Navbars, Theming, Transitions, Ajax, Events, Touch, Swap, Tap, Slide, Offline Cache, Customizing Themes, Deployment
8 Lectures
4. **Development of WebApp:** Web App as Native ... Android Introduction, Developer Tools, Platform Tools, ADB, AVD, Phonegap/Cordova Introduction, Development Environment, CLI and Build, Conversion to Native for platforms (android/windows/ios etc.), Deployment, Geolocation, Device Rotation, Device Orientation, Touch gestures, Offline Apps, Client Side storage, Testing and Deployment on virtual and physical devices.
8 Lectures
5. **Development of Native App:** Native App..., Android Studio, Getting Started with IDE, Development, Debugging and Deployment, Programming Model and Structure, APIs and Packages, Accessing native services of OS, Testing and Deployment on virtual and physical device
8 Lectures

Reference:

1. Build Mobile Websites And Apps for Smart Devices by E. Castledine
2. Jump Start Responsive Web Design by Craig Sharkie & Andrew Fisher
3. O'REILLY Building Android Apps with HTML, CSS and Javascript
4. Building Windows 8 Application Development – XAML edition by Kyle Burns
5. Beginning Android 4 Application Development by Wei-Meng Lee
6. O'REILLY Building iPhone Apps with HTML, CSS and Javascript by Jonathan Stark

Distributed Computing

1. **Introduction to Distributed Systems:** Goals and advantages of distributed systems, Distributed Computing System Models, Network operating systems, True distributed systems, Design issues – Transparency, Reliability, Performance and Scalability. Message Passing, Group communication.
8 Lectures
2. **RPCs and Distributed Shared Memory:** Remote procedure call (RPC), Light Weight RPC, Client Server Communication. Introduction to shared memory, Comparison of shared memory systems, Consistency models, Page-based distributed shared memory.
8 Lectures
3. **Synchronization in Distributed Systems:** Clock synchronization, Logical and physical clocks, Vector clock, Clock synchronization algorithms, Mutual exclusion – Centralized, Distributed, Token Ring and Maekawa's Algorithm, Election Algorithms, Atomic transactions, Deadlocks in distributed systems.
8 Lectures
4. **Processes and Processors in Distributed Systems:** Process Migration, Threads – Usage, Design issues and implementation, Scheduling in distributed systems, Load balancing and Load sharing, Fault tolerance.
8 Lectures

5. **Distributed File Systems and Security:** File Models, File Accessing Models, File Sharing Semantics, File Caching Schemes, File Replication. Security in Distributed System: Potential Attacks to Computer Systems, Introduction to Cryptography, Authentication, Access Contro. Case Studies: V -Systems, Amoeba.

8 Lectures

References:

1. Distributed Operating Systems: A.S.Tanenbaum
2. Distributed Systems Concepts and Design: G.F.Coulouris, J.Dollimore and T.Kindberg
3. Distributed Operating Systems: Pradeep K. Sinha

E-Commerce & Cyber Laws

1. **Introduction:** Electronic Commerce - Technology and Prospects, Definition of E- Commerce, Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, Impact of E-commerce on business.

Network Infrastructure for E-Commerce: Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY).

10 Lectures

2. **Mobile Commerce:** Introduction, Wireless Application Protocol, WAP technology, Mobile Information device, Mobile Computing Applications.

6 Lectures

3. **Web Security:** Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.

Encryption: Encryption techniques, Symmetric Encryption- Keys and data encryption standard, Triple encryption, Asymmetric encryption- Secret key encryption, public and private pair key encryption, Digital Signatures, Virtual Private Network.

14 Lectures

4. **Electronic Payments:** Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda.

5 Lectures

5. **Cyber Laws**

5 Lectures

References:

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.
2. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH
3. P. Loshin, John Vacca, "Electronic commerce", Firewall Media, New Delhi

High Performance Computing

1. **Introduction:** Motivation for high performance and parallelism application areas, Technologies, Abstraction levels, Models of Computation; Overheads, Multiple program counters, Multi-threaded execution models; Parallel languages and compilers, Task Parallel and Data parallel Programming models; Memory architecture; Memory access times and associated overheads; Performance timing; Restructuring for parallel performance; Parallelising compilers; Load & Data transformation; State of the art research & future direction

5 Lectures

2. **Microprocessor and system architecture:** Pipelining, superscalar designs; SIMD, multithreading; caches; memory, busses; Asynchronous microprocessors for high performance processing and low power applications

5 Lectures

3. **Multi processor architectures:** Classification; programming models; application examples; interconnection networks

5 Lectures

4. **Tightly coupled systems:** Cache coherence, consistency, synchronization; SMP, ccNUMA, COMA; performance evaluations

5 Lectures

5. **Other architectures and extensions:** Distributed memory systems; vector systems; clusters, grids Supercomputer Architecture; Vector Machines; Parallel Processors; Data Parallel Processors. Single-Instruction-Multiple-Data; Multiple-Instruction-Multiple-Data; Pipelining; Vectorization; Parallelization; Superscalar execution – VLIW computation; PRAMs – parallelism issues Comparison of Serial, Parallel and Vector Architectures. Performance Measures and Models; Speed-up limitations; Theoretical Timings; Efficiencies; Amdahl's Law and Extensions; Scaled Speed-up; Pipeline Speed-up. Data Dependency Reduction. Data flow; Loop reordering. Parallelization of Algorithms; Parallel linear algebra routines; Loop optimizations; Implementation; Principle of Locality; Caches and Buffers.

20 Lectures

References:

1. J. J. Dongarra, I. B. Duff, D. C. Sorensen and H. A. van der Vorst: Solving Linear Systems on Vector and Shared Memory Computers, SIAM, 1991.
2. K. Hwang: Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill
3. D. A. Patterson and J. L. Hennessy, Computer Architecture: A Quantitative Approach, Morgan Kaufmann
4. D. Kuck: The Structure of Computers and Computations, Wiley
5. Levesque and Williamson: A Guidebook to FORTRAN on Supercomputers, Academic Press
6. Metcalf: FORTRAN Optimization, Academic Press
7. J. M. Ortega: Introduction to Parallel and Vector Solution of Linear Systems, Plenum
8. Quinn: Designing Efficient Algorithms for Parallel Computers, McGraw-Hill
9. P. J. Hatcher and M. J. Quinn: Data-Parallel Programming on MIMD Computers, MIT Press
10. Parallel processor architecture & VLSI Hardware: Decegama A.L.
11. Introduction to Parallel Algorithms & Architectures – Arrays, Trees and Hypercubes: Leighton F. Thomson

Computer Vision

1. **Images:** Sources of imagery, The physics of imaging, Representing, acquiring, and displaying images, Grayscale, color, noise, lens distortion, and filtering
5 Lectures
2. **Image processing:** Preprocessing, and image correction, Enhancing features and correcting imperfections, Addressing noise, lens distortion, and blurring.
5 Lectures
3. **Computer Vision Paradigms:** Bottom-up, top-down, neural net, feedback, Pixels, lines, boundaries, regions, and object representations, "Low-level", "intermediate-level", and "high-level" vision, Historical and illustrative examples.
5 Lectures
4. **Finding Edges and Lines:** Finding edges (low-level), Gradients, zero crossing detectors, line models, Roberts, Sobel, Canny, Finding and grouping lines (intermediate-level), Boundary tracing, line fitting, Hough transform.
5 Lectures
5. **Finding and Processing Regions:** Finding "elementary regions" (low-level), Merging, splitting, and grouping regions (intermediate-level). Grouping and analyzing lines and regions (high-level), Guzman, Clowes and Huffman, Waltz. Stereo, and Motion, Optical Flow and FOE, Motion Understanding Texture, Fourier transform Representing the environment and Matching, Clouds, generalized cylinders, semantic nets, Matching line and region groups to object representations (high-level).
Applications: Using computer vision, Applications in Medicine, Industry, and Surveillance
20 Lectures

References:

1. Digital Image Processing - R.C.Gonzalez & P.Wintz
2. Computer Vision - D.H.Ballard & C.M.Brown
3. Syntactic Pattern Recognition: An introduction -R.C.Gonzalez and M.G.Thomason
4. Pattern Recognition - A Statistical Approach - P.A. Devijver and J. Kittler
5. Digital Image Processing - W. K. Pratt
6. Fundamentals of Digital Image Processing - A.K. Jain
7. Digital Picture Processing - A. Rosenfeld and A.C. Kak
8. Vision in Man and Machine - M.D. Levine

Artificial Neural Networks

- 1. Introduction:** Real and artificial neural networks, Neurons as Processing elements, Activation and Signals, Threshold functions, Connection topologies.
5 Lectures
- 2. Network Models:** Dynamical Systems viewpoint, Additive dynamics, Additive neuronal feedback, Bivalent additive associative memory, Stability of BAMs, Lyapunov functions, Bivalent BAM theorem, BAM connection matrices, Linear associative memory, Optimal linear associative memory, Memory capacity, Hopfield model, Additive dynamics and Noise-Saturation dilemma, Grossberg's saturation theorem, Multiplicative dynamics, Shunting inhibition, Adaptive resonance theory of Grossberg, ART1 and ART2 networks.
15 Lectures
- 3. Network Learning Methods:** Unsupervised learning, Learning laws, Signal Hebbian, Competitive, Differential Hebbian and differential competitive learning laws, Deterministic and stochastic learning, Stochastic equilibrium, Asymptotic centroid estimation, Kohonen's self-organizing map, Reinforcement learning.
10 Lectures
- 4. Network Learning Methods:** Supervised learning, Stochastic approximation, Perceptron learning theorem, LMS algorithm, Back-propagation algorithm, Multilayer feed-forward networks, Enhancements in Back-propagation algorithm., Recurrent back-propagation. Adaptive vector quantization, AVQ algorithms, Convergence theorem, Adaptive bi-directional associative memory.
10 Lectures

References:

1. Neural Networks and Fuzzy Systems: Bart Kosko
2. Neural Computing: Theory and Practice: P.D.Wasserman
3. Artificial Neural systems: P.K.Simpson
4. Neurocomputing: Robert Hecht-Nielson
5. Neural Networks: J.A.Freeman

Fuzzy Systems

- 1. Fuzzy Set Concepts:** Fuzzy and crisp sets, Operations on Fuzzy sets, Extended Fuzzy sets, Fuzzy quantifiers and its relation to linguistic variables, members function and its estimation, binary and n-ary fuzzy relations, fuzzy graphs and matrices.
8 Lectures
- 2. Fuzzy Measure:** Belief and plausibility measures, probability measure, possibility measures
8 Lectures
- 3. Theory of Approximate reasoning and uncertainty measurement:** Multivalent logic and fuzzy valued logic, fuzzy model logic, approximate reasoning, fuzzy algebra and uncertainty, classical and fuzzy measures of uncertainty
8 Lectures
- 4. Fuzzy Systems:** General fuzzy systems and its design, fuzzy control systems with applications, fuzzy optimization, fuzzy expert and decision Making systems, probabilistic search trees, fuzzy pattern analysis, fuzzy database search, some applications
8 Lectures
- 5. Fuzzy Programming and Tools:** Fuzzy Programming environments, efficiency and accuracy, fuzzy tools, learning fuzzy rules in neural networks, fuzzy associative mapping, introduction to neuro-fuzzy and fuzzy genetic approaches.
8 Lectures

Reference:

1. Fuzzy mathematical techniques with application: Abraham Kandel
2. Fuzzy Sets, Uncertainty and information: G.J. Klir and T.A. Folger
3. Fuzzy Systems: C.v. Negotia
4. Neural Networks and Fuzzy Systems: B. Kosko

Big Data Analysis

1. **Introduction:** Big Data Overview, characteristics, architecture, technologies, applications. Cloud Computing- Concept. Comparative study of working of various cloud services platforms – Amazon Web Services, Microsoft Azure, Google Cloud Platform. Different types of cloud computing services.
8 Lectures
2. **Data Analysis and Visualization:** Analysis - The process of data analysis-requirement, collection, processing, cleaning, exploratory data analysis, modeling and algorithms, data product, communication. Visualization - Characteristics of effective graphical displays.
8 Lectures
3. **Statistical Concepts in Big Data Analysis:** Probability theory, probability distribution, statistical significance, hypothesis testing and regression.
8 Lectures
4. **Overview of Hadoop and its Ecosystem:** HDFS, MapReduce, Pig, Hive, HBase, Spark, Sqoop, Oozie.
8 Lectures
5. **NoSQL Databases:** Column oriented databases (Cassandra, HBase), Document oriented database (MongoDB), Key-Value pairs (CouchBase), Graph database(Neo4j).
8 Lectures

References:

1. Big Data For Dummies: Alan Nugent, Fern Halper, Judith Hurwitz, and Marcia Kaufman
2. Hadoop- The Definitive Guide: Tom White, O'Reilly
3. Be A Big D: Deep Pandey
4. Hadoop For Dummies: Dirk deRoos

Cloud Computing

1. **Introduction:** Understanding the Cloud Computing landscap;, From collaborative to the Cloud – A short history Client – Server Computing, Peer-to-Peer Computing, Distributed Computing, Collaborative Computing, Cloud Computing, Functioning of Cloud Computing, Cloud Architecture, Cloud Storage, Cloud based Service Offerings & applications; Real cases and applications of Cloud Computing -Service Modeling, Infrastructure Services, Platform Services, Software Services - Software as service modes- Massively scaled software as a service- Scale of Economy, Management and Administration.
8 Lectures
2. **Inside Cloud Computing:** Making Strategy Decisions- Governance Issues- Monitoring Business Processes; Cloud Service Administration- Service Level Agreements and Monitoring-Support Services- Accounting Services, Resource Management- IT Security- Performance Management- Provisioning- Service Management, Untangling Software Dependencies.
8 Lectures
3. **Cloud Computing Technology & Storage:** Clients – Mobile – Thin – Thick, Security - Data Linkage, Network- Basic Public Internet- The Accelerated Internet- Optimised Internet Overlay- Site-to-Site VPN- Cloud Providers, Cloud Consumers, Bundling instances; Elastic Block storage and its usage; Simple DB Service, NoSQL database; Storage security; Merits and demerits of storage
8 Lectures
4. **Accessing the Cloud & Data Management:** Platforms- Web Application Framework- Web Hosting Services- Proprietary Methods, Web Applications- API's in Cloud Computing, Browsers for Cloud Computing; Amazon web services and its integration; Introduction to Microsoft Cloud and its use in .NET environment; Data Security- Data Location- Data Control- Securing data for transport, Scalability and Cloud Services- Large Scale Data Processing- Databases and Data Stores- Data Archival.
8 Lectures
5. **Discovery of Private and Hybrid Clouds:** Defining a private cloud- Public, Private, and Hybrid Clouds – A Comparison, Examining the Economics of the private cloud- Assessing capital expenditures- Vendor Private Cloud Offerings, The Up Key Vendors- Service Oriented- Systems Integrators- Technology Enablers; Cloud Computing standards; Cloud Governance; Basics of Distributed computing: Basics of Hadoop; Hadoop Distributed File System, Introduction to HIVE, OPSWorks Application management Service; Migrating to the cloud using the WAVE approach
8 Lectures

References:

1. Bloor R, Kaufman M, Halper F, Judith Hurwitz: Cloud Computing for Dummies, Wiley India
2. Antohy T Volte: Cloud Computing – A Practical approach, McGraw Hill
3. James E Smith, Ravi Nair: Virtual Machine, Morgan Kaufmann
4. John Rittinghouse & James Ransome: Cloud Computing implementation management & strategy, CRC Press
5. Michael Miller: Cloud Computing- Web based application that changes the way you work and collaborate online, Que Publishers
6. Syed A Ahson, Mohd Ilyas: Cloud Computing and Software Services – Theory & Techniques, CRC Press

Computer Animation

1. **Basics of Animation:** Drawings with the help of basic shapes, Animal study, Human anatomy, Shading techniques, Drawing for animation, About 2D and 3D drawings, Motion Studies, Drawing for motion; Introduction to 2D animation, Basic geometric transformations, Keyframe animation; Basics of 3D Studio Max; Adding colour and light; Rendering & environment effect; Introduction to Photoshop; Digital Image Editing using Photoshop
8 Lectures
2. **Web Designing:** Introduction to HTML, Multimedia authoring applications, Web Page Design applications, FTP Utilities, Graphic optimization applications, Internet Access and HTML, Planning Web Sites, The Dreamweaver Environment, Viewing and Managing HTML Code ; Defining and creating a website; Introduction to Audio/Video Editing tools & Technology; Digital TV production; Modeling and animation using Maya
8 Lectures
3. **Computer Animation:** Creating Your First Flash Animation – how to create a new blank movie file in Flash MX – and the tools and steps involved in making your first simple animation using motion twining – basic shapes – Flash Animation 2 - Shape Twining – pick up at the end of where we left off – Shape twining in Flash MX.
4. **Character modeling & Animation:** Polygonal Modeling – Using primitives - Converting 5-,6-,7-,8-,9-, -Sided Polys to Quads – Creating Linear Templates – Working With Poly Editing Tools: Making Simple Hand – Sub div Proxy Modeling – Splitting Polygons – Creating Areas of Details on a Poly Mesh(Surface); Character Animation – Skeletons – Clusters and Lattices Forward and Inverse Kinematics – Using the IKRP Solver, IKSC Solver, IK Spine handle Solver, IK Spring Solver, Human IK Solver – Switching between FK and IK – The Animation Process: Posing, Timing and Refining
8 Lectures
5. **Visual Effects:** Visual Effects, Description, Types, Particles, Analysis, Size, Sand Effects, Smoke Effects, Fire Effects, Cloud Effects, Snow Effects.Fluid Effects, Coloring, designing Clouds Background, Designing Fog Effects.Explosion Effects, Fire Effects with flames, Space Effects and designs, Designing Thick Smoke; Designing Paint Effects, Coloring paints, Designing Trees and green effects, Designing Weather and seasons,Effects on seasons,Designing Glass image, Designing Different glass reflection, Designing Glow Effects, Liquid Effects and Reflection design; Designing Special Effects, Designing effects of Hair and shape,Designing Fur Effects, Designing Clothes and effects; Visual Effects Tool and advanced functions, Converting images from 2D to 3D Pictures. Creating 3D Effects, Differentiation 2D effects and 3D effects.
8 Lectures

References:

1. GRAPHICS & ANIMATION BASICS, by SUZANNE WEIXEL / CHERYL MORSE
2. Kelly L. Murdock, **3ds max™ 4 Bible**, John Wiley & Sons
3. Paul Steed, **Modeling a Character in 3DS Max**, Wordware Publishing;
4. TECHNIQUE OF FLIM & VIDEO EDITING HISTORY THEORY & PRACTICE, by KEN DANCYGER
5. Tom Meade and Shinsaka Anima : The Complete Reference Maya 6 Published by Tata MC.Graw – Hill Publishing Company Limited edition 2004.
6. Robert Reinhardt and Snow Dowd : Macromedia Flash 8 Bible, Published by Wiley India Pvt Ltd.2006
7. Vikas Gubta & Kogent Solutions Inc. : Multimedia and Web Design.
8. A Revolutionary 3-Stage Sub learning System Published by dream tech.
9. Paul Marino : 3D Animation and Film making Using Game engines.
10. The Art of Machinima Published by Dreamtech edition – 2005.
11. Asoke K.Ghosh : Game Design Process – NIIT Published by Practice – Hall of India Private Ltd.