BODOLAND UNIVERSITY
REGULATION AND SYLLABUS
MASTER OF COMPUTER APPLICATIONS (MCA)
(w.e.f. academic session 2020-2022)

REGULATION

1. The Master of Computer Application Course, called the M.C.A. course hereafter, Shall comprise of two academic years and each *Academic Year* shall consist of two semesters. Each semester shall approximately consist of 15 Weeks of teaching and 6 weeks of other formalities including semester Examination and 5 weeks of semester break.

2. To be eligible for admission to the M.C.A. course the candidate should be a Graduate of a degree course of at-least three year duration in any discipline and having passed the higher secondary (10+2) level examinations with mathematics as a subject or one mathematics paper in under graduation course.

3. (a) Each subject taken by a student in semester , from 1ST to 4TH , shall consist of one or more of the following parts :
    (i)   Theory (written examination)
    (ii) Sessional (progressive evaluation).
    (iii) Practical/viva-voce examination
          Project Dissertation/Viva Voice

    (b) In order to pass a subject of 1ST to 4TH semester a candidate shall have to obtain the minimum pass marks as shown below :
    (i)   Theory based subject:

Theory (Written Examination) (I)	Min Pass Theory	Sessional (progressive Evaluation) (II)	Min Pass Sessional	Total of I & II	Minimum Pass Percentage (Individually in I and II)
75	30	25	10	100	30+10 =40

    (ii) Laboratory based subject:

Part)	Total Marks	Minimum Pass Percentage
Sessional (Progressive Evaluation)	100	40
Practical Examination & Project Viva	100	40
Seminar	50	20

    If a student fails to secure the pass marks in a theory based subject, the student shall reappear only in the written examination part of the subject. If a student fails to secure the pass marks in a laboratory based subject, he/she shall re appear only the practical examination part of the subject.

    (c) The Semester-wise distribution of total marks from first to fourth semester shall be as follows :-

Semester	Theory based subjects	Laboratory based subjects
1st to 4th	500	200

    (d) The Viva-Voce examination for Laboratory/Project shall be conducted by the university. The Viva-Voce examination board for a candidate shall consist of the following members :-
    1   An external examiner
    2   An internal examiner.
    3   The head of the department

4. Semester Examinations are divided into two groups: odd (i.e. first & third) and even (i.e. second & fourth). Each group of examination will be held once in an academic year.

5. (a) A student will not be eligible for appearing semester examination if he/she had not attended at least 70% of the classes held for each subject taught in the semester and/or has not passed the Sessional (s) of the laboratory/theory based subject(s), if any, of the semester. At the time of applying for permission to sit for a semester examination a student must produce a certificate from the Principal of the concerned affiliated college to the effect, that the student has satisfactorily completed the course work of the semester and has fulfilled all the conditions stated above.

   (b) A student allowed to appear in the 1ST semester examination is eligible for provisional promotion to 2ND semester. But his/her subsequent promotions to higher semester from 2ND semester will be as per clauses 5(c), 5(d).

   (c) A student will not be allowed to take admission in 3RD semester if he/she has failed in more than three theory based subjects of 1st semester.

   (d) A student will not be allowed to take admission in 4TH semester if he/she has more than three arrears in theory based subjects of 2ND semester.

6. A candidate satisfying relevant clauses of regulation 5(a) through 5(d), and subsequent relevant clauses will be allowed to sit for a semester examination (from first to third) on payment of the prescribed fees separately for each semester examination in which the candidate desires to appear.

7 A student failing to pass the examination of the M.C.A. degree course within 4 years from the date of his/her first admission into the course will not be allowed sit further for any M.C.A. examination. However under special circumstance the Vice-Chancellor of the University on recommendation of the principal of the concerned affiliated college may extend the period by one more year only.

8. (a) A candidate will be awarded M.C.A. degree on passing all the subjects of all the four semesters.

   (b) For the purpose of the determining class in which a candidate is to be placed, marks secured by him/her in all semester examinations from the 1ST to 4TH semester shall be added to give the total marks.

   (c) On assessment as per clause 8(b) above, a candidate securing 60% marks and above will be awarded a first class and a candidate securing below 60% having the minimum aggregate of 40% marks will be awarded a second class.

9 A student discontinuing studies for any reason, after completion of the first & second semester courses will be provided, on request, a certificate by the University or Principal of the concerned affiliated college with intimation to the university.

STRUCTURE OF MCA SYLLABUS OF G.U. wef 2020
(All Papers carry Credit 5)

1st Semester subjects

Paper	Subject Name	Theory/ Practical Marks	Sessional Marks	Total Marks
1.1	Intriduction to Computer and Programming (ICP)	75	25	100
1.2	Digital Systems & Computer Organisation (DSCO)	75	25	100
1.3	Mathematical Foundation of Computer Science (MFCS)	75	25	100
1.4	Operating Systems (OS)	75	25	100
1.5	Probability and Statistics (PS)	75	25	100
1.6	Laboratory-I (LAB-1)	100	100	200
			TOTAL	700

2nd Semester subjects

Paper	Subject Name	Theory/ Practical Marks	Sessional Marks	Total Marks
2.1	Data Structure and Algorithms (DSA)	75	25	100
2.2	System Software (SS)	75	25	100
2.3	Object Oriented Programming and Design with Java (OOPD)	75	25	100
2.4	Computer Networks (CN)	75	25	100
2.5	Computer Oriented Numerical Methods(CONM)	75	25	100
2.6	Laboratory-II (LAB-2)	100	100	200
			TOTAL	700

3rd Semester subjects

Paper	Subject Name	Theory/ Practical Marks	Sessional Marks	Total Marks
3.1	Database Management Systems (DBMS)	75	25	100
3.2	Software Engineering(SE)	75	25	100
3.3	System Administration(SA)	75	25	100
3.4	Computer Based Optimisation Techniques (CBOT)	75	25	100
3.5	Formal Languages and Automata Theory (FLAT)	75	25	100
3.6	Laboratory-III (LAB-3)	100	100	200
			TOTAL	700

4th Semester subjects

Paper	Subject Name	Theory/ Practical Marks	Sessional Marks	Total Marks
4.1	Management Information System (MIS)	75	25	100
4.2	Data Mining and Warehousing	75	25	100
4.3	Web Programming Technologies (WPT)	75	25	100
4.4	Elective I	75	25	100
4.5	Elective II	75	25	100
4.6	Project Work	100	100	200
			TOTAL	700

ELECTIVE SUBJECTS:

Elective I & II

(a) Software Testing and Quality Control
(b) C# and .Net Framework
(c) Advanced Web Programming Technologies
(d) GUI based application development with RDBMS
(e) Programming Languages(PL)
(f) Computer Graphics(CG)
(g) System Simulation and Modelling (SSM)
(h) Number theory and Cryptography(NTC)
(i) Computer and Network Security (CNS)
(j) Information Storage and Retrieval (ISR)
(k) Advanced Database (AD)
(l) Image processing (IP)
(m) Artificial Intelligence (AI)
(n) Remote Sensing and GIS (RSG)
(o) Software Project Management (SPM)
(p) Soft Computing(SC)
(q) Distributed Systems (DS)
(r) Wireless Networks (WN)

Paper : MCA 1.1
Subject Name : IINTRODUCTION TO COMPUTER & PROGRAMMING (ICP)
Marks : (Theory-75 Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Introduction**: Introduction to Computers, its generations, Computer organisation-Von Neumann Architecture, Major hardware and software components of a digital computer, Introduction to software, its classifications. Programming- its methodologies. Concepts of Machine and high level language, Concept of Assemblers and compilers	2
2		**Algorithm** : Problem solving methodologies, Bottom –up and Top down design, Problem and algorithms, notion of Algorithms, its tools , design and analysis of algorithms, Performance of an algorithm.	4
3	3.1	**Features** of high level languages, structured programming techniques, Assignment statement, input-output statements; Expressions; data types; conditional statements, Iterative statements; Array data type and use of arrays; character data type and text processing. (Using C as HLL),	3
	3.2	**Functional and procedural abstraction**; Recursion; Pointer data type and simple use of pointers. Documentation, Debugging.	3
4		**File and data processing**: Structures and Unions, File input and output statements, Using C programs to be processed data files as input and output.	3

Books:
1. Dromey, G.: How to solve it by computer, PHI(EEE), 1985
2. Kanetkar, Let us C, BPB
3. Jeri, Elliot: Problem Solving and Programming Design in C, Pearson
4. Balaguruswamy: Programming in ANSI C, TMGH
5. Balagurusamy : Fundamentals Of Computers,TMH
6. Venugopal : Mastering C, TMH

Paper : MCA 1.2
Subject Name : DIGITAL SYSTEMS AND COMPUTER ORGANISATION (DSCO)
Marks : (Theory-75 Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Representation of Information**: Number System: Binary, octal, hexadecimal; Positive and negative numbers; fixed point and floating point quantities. Arithmetic operations: Addition, subtraction. Character codes: ASCII and EBCDIC, Redundant coding for error detection and correction: Concept of parity codes, Hamming Codes (SEC-DEC)0 and distance.	3
2	2.1	**Logic Design**: Boolean algebra, Boolean variables and functions- canonical and standard forms, truth table, minimization of Boolean functions- Karnaugh map, tabulation methods..	2
	2.2	**Combinational logic circuits:** AND, OR, NAND, NOR and NOT gates and tri-state buffer; Implementation of Boolean functions using logic gates; Multiplexers, decoders, encoders, simple arithmetic and logic circuits.	4
3		**Sequential circuits:** flip-flops, shift registers and counters- synchronous and asynchronous. Concept of bus and register transfer language, state table, state diagram and state equations.	3
4		**Memory Devices**: Semiconductor memory - RAM, ROM; Magnetic core and surface memory- disk, drum, tape; Access time and cost considerations: Concepts of volatility, random access, serial access, direct access, online and backup storage.	2
5		**Basic CPU organization:** Simplified functional block diagram of a CPU; Instruction execution process.	1

Books:
1. Mano, M.M.: Digital Logic and Computer Design, Pearson
2. Rajaraman V, Radhakrishnan : An introduction to Digital Computer Design. PHI
3. Mano, M.M.; Computer System Architecture, Pearson
4. Hamacher, Vranesic, Zaky: Computer organization, McGraw Hill.
5. Uyemura . J.P.: Digital Systems Design an integrated approach,   Cengage
6. Leach : Digital Principles & Applications,7/e, TMH
7. Tocci : Digital Circuits,PE

Paper : MCA 1.3
Subject Name : MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE
Marks : (Theory-75   Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Set**: Set, subset, power set, properties of set, operations on sets, products on set, representation of set in computer partitions.	2
2		**Functions and relation:** Binary relation, types of relation , equivalence relation and equivalence class, closure of relation, function, different types of functions.	2
3		**Logic**: truth tables, algebra of propositions, logical arguments, predicate calculus	3
4		**Mathematical induction** : recurrence relation, permutation and combination, elementary properties,	3
5		**Algebraic structure**: Semi groups, monoid group, subgroup, normal subgroup, symmetric group, some properties(elementary)	2
6		**Principle of counting**: Principle of inclusion and exclusion, pigeonhole principle.	1 ½
7		**Introduction to Graph theory:** Basic concepts- finite and infinite graphs, incidence and degree, isolated and pendant vertices, null graph; Paths and Circuits- isomorphism, sub-graphs, walks, connected and disconnected graphs and components, Euler graphs, Bi-partite graphs, Hamiltonian paths and circuits; Trees- properties of trees, rooted and binary trees, spanning trees, fundamental circuits, spanning trees in weighted graphs; Cut-sets- properties; Matrix representation of graphs-incidence matrix, sub matrices, circuit matrix, cut-set matrix, path matrix, adjacency matrix, Directed graphs.	4

Books:
1. S Santha, Discrete mathematics, Cengage Learning
2. Tremblay & Manohar. Discrete Mathematical Structures with application to C.Sc. Mc. Graw Hill
3. Veerarajan, Discrete Mathematics, TMGH
4. Liu and Mahapatra, Discrete Mathematics, TMH
5. Rosen : Discrete Mathematics, 6/e, TMH
   Kolman : Discrete Mathematics, PHI

Paper : MCA 1.4
Subject Name : OPERATING SYSTEMS (OS)
Marks : (Theory-75   Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Overview**: Evolution, current status and future trends. Structural overview.	1
2		Process concepts: Process states, process control block, process scheduling algorithms. Support for concurrent processes: Mutual exclusion, shared data, critical sections, busy form of waiting, lock and unlock primitives, synchronization, block and wakeup. Inter process communication issues, primitives.	5
3		**System Deadlock**: Prevention, detection and avoidance.	2
4		**Memory management**: Contiguous and non-contiguous allocation, virtual memory, segmentation, paging, page scheduling and replacement algorithms.	4
5		**File Systems**: Management, protection mechanisms. I/O management, disk scheduling. Design of UNIX, LINUX- a case study. An overview of network and distributed operating systems.	3

Books:
1. Silberschatz A, Galvin P: Operating system concepts, 4th ed. AWP.
2. Milenkovic M.: Operating System- Concepts and Design, MGH Tanenbaum
3. Operating System- Design and Implementation,   PHI (EEE).
4. Bach, M.: Design of the UNIX operating system, PHI (EEE).
5. Deitel, Deitel, choffnes, Operating systems, Pearson

Paper : MCA 1.5
Subject Name : PROBABILITY AND STATISTICS
Marks : (Theory-75 Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Probability:** Probability Theory: sample spaces; Events and probability; Discrete Probability; Union, intersection and compliment of events; conditional probability; Bay's Theorem; Random variables and Distribution: random variables, Discrete Probability Distribution - Binomial, Poisson, Geometric and Hyper geometric distributions; Density functions; Continuous probability distribution - Uniform, Exponential, Normal, Student's t,X^2, Beta and F - static. Expectations; Characteristics Functions.	7
2		**Statistics**: Basic statistics: Measures of central tendencies- Mean, Median, Mode; Measures of dispersion:-Range, Variance and Standard deviation: Frequency distributions and cumulative frequency distributions and cumulative frequency	3
3		**Moments and Moment generating functions:** Linear correlation coefficient: Linear and Non-linear regression; Multiple correlation and multi-regression;	3
4		**Sampling**: Theory of sampling: Population and sample; sampling survey methods and estimation. Statistical inference; testing of hypothesis and inference. Central limit theorem.	2

Books	1	Hogg,Tanis and Rao: Probability and Statistical Inference , Pearson
	2	Mendenhall,Beaver, Beaver , Probability and Statistics, Cengage.
	3	Yule, U.G., Kendall, M.G: An Introduction to the Theory of statistics, Chalies Griffin and Co.Ltd.
	4	Milton : Introduction To Probability & Statistics, TMH
	5	Das : Statistical Methods, combined edition, TMH
	6	Leon & Garcia : Probability & Statistics, PE

Paper : MCA 1.6
Subject Name : PROGRAMMING LABORATORY-I
Marks : (Theory-100 Sessional- 100)

LAB PART	PARA	Laboratory Content	Total Weeks
1 (75%)	1.1	Computer Basics, Operating Systems basics and commands	3
	1.2	Simple Programs, Conditional statements, arrays	2
	1.3	Complex programs using functions and subroutines	3
	1.4	Pointers, structures, Unions and Files	3
2(25%)		Simple programming on Statistical methods	4

Books: As given in MCA 1.1 and MCA 1.5

MCA 2ND SEMESTER

Paper : MCA 2.1
Subject Name : DATA STRUCTURE AND ALGORITHMS
Marks : (Theory-75   Sessional- 25)

UNIT	PARA	Content	Weeks
1		Concept of data structures and their effect on algorithms; Data object, abstract data type.	2
2		Data structures: array, linked list, record, linear list, stacks and queue; Trees: binary tree, balanced tree, search tree; Graphs; Hash table;	6
3		Algorithms for manipulation of the data structures, sorting, searching algorithms, graph algorithm	5
4		Concept of complexity of algorithms and their analysis	2

Books:
1. Aho and Ullman, Data Structures and Algorithms,
2. Horowitz and Sahni, Fundamentals of Algorithms, Narosa   Publishing House.
3. Cormen, Leiserson, Rivest, Introduction to Algorithms, MIT Press & McGraw-Hill Book Company
4. Samanta : Classical Data Structures , PHI
5. Lipschutz : Data Structures, TMH
6. Coremen : Introduction To Algorithms, PHI

Paper : MCA 2.2
Subject Name : SYSTEM SOFTWARE
Marks : (Theory-75   Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Overview**: Definition and classification of system software.	1
2		Assemblers: Assembly language, Assembly process, Data structures, Macros and macroprocessors.	3
3		**Linkers and loaders**: Basic concepts, Static and dynamic linking, shared libraries, loaders, overlays. Case study of the Unix linking system, Windows DLLs, OLEs.	4
4		**Compilers**: Introduction: Phases of a compiler, Languages and grammer, Chomshy hierarchy. Lexical analysis: Finite automata, Lexical analyzer, Lexical analyzer generator (LEX). Parsing: Top-down and Bottom-up parsers, shift-reduce parser, recursive descent (operator precedence) parser, LL(1), LR parsers, Parser generator (YACC).	5
5		**System Software Tools: Text Editor-** Overview of editing process, user interface, editor structure, interactive debugging system, debugging functions and capabilities, relationship with other parts of the system, user interface criteria. Eg: LaTeX	2

Books:
1. Aho,A.V., Sethi, and Ullman J.d: complier design.
2. Dhandhere, System programming and operating systems, Tata   McGrawHill.
3. Leland.L.Beck, System software, An introduction to System Programming, Pearson Education
3. Louden, Compiler construction, Cengage

Paper : MCA 2.3
Subject Name : OBJECT ORIENTED PROGRAMMING AND DESIGN WITH JAVA (OOPD)
Marks : (Theory-75   Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Part - I : Object Oriented Programming** Object, Class. State and Behavior of an object, Attributes and Operations of a class. Encapsulation and Data Hiding: Interface, Implementation, Access modifiers. Inheritance: Reusing, Is_a relationship, Generalization, Specialization, superclass and subclass, Abstraction. Composition: Has_a relationship, Aggregation, Association, Composition. Multiplicity and cardinality. Polymorphism, getter & setter, Operator overloading. Local attributes, Object attributes, Class attributes. Constructor: Default Constructor, Multiple Constructor, Constructor overloading. Error Handling.	6
2		**Part – II : Object Oriented Design**	4
	2.1	**Class Model:** Class and Object, Link and Association, Generalization and Inheritance, OCL. Enumeration, Multiplicity, Scope, Visibility, Association End Name, Ordering, Bags and Sequences, aggregation, Constraints on Objects, Generalization Sets and Links.	
	2.2	**State Model:** Signal Events and Change Events; States, Transitions and Conditions. State Diagrams: Basic notations, One-shot State Diagrams, Activity Effects, Do-Activities, Entry and Exit Activities, Completion Transition, Sending Signals, Nested States, Concurrency and Synchronization of Concurrent Activities.	
	2.3	Synchronization of Concurrent Activities.	

		Interaction Model: Use Case Models with Include, Extend, Generalization, Sequence Models. Activity Models, sending & receiving signals, swimlanes, Object flows.	
3		**Part-III : Development Stages and Life Cycles** System conception, Analysis, System design, Class design, Implementation, Testing, Training, Deployment and Maintenance.	5

Books
1. Matt Weisfeld: The Object Oriented Thought Process, Addison-Wesley.
2. Rambaugh et al.: Object Oriented Modeling and Design, PHI (EEE).
3. Rambaugh Booch, Jackobson : Unified Modelling Language Referance Mannual.
4. Barclay, Savage : Object-Oriented Design with UML and Java, Elsevier Butterworth-Heinemann

Paper   : MCA 2.4
Subject Name   : COMPUTER NETWORKS (CN)
Marks   : (Theory-75   Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Overview**: Goals of networking, types, application, topologies, Switching techniques, Standards, performance issues. Network Architecture: ISO-OSI reference model, design philosophy, layer, protocol, interface, and service concepts. Layer-wise functionality	1
2		**Physical Layer**: Concepts of data transmission, modulation and multiplexing methods, modem, encoding methods, communication media, standard protocols. Medium Access Control sublayer – channel allocation, ALOHA, CSMA, CSMA/CD, token ring, token bus, Standard LAN/WAN, MAC Protocols. Protocols (IEEE 802.X), satellite networks.	3
3		**Data link layer**: Framing, error control techniques, data link protocols and their performance. Sliding window protocols, examples of DLL protocols.	3
4		Introduction to Network layer, Network Layer: Routing, Congestion and deadlock control algorithms. Internetworking issues and devices, gateways, bridges and routers, IP v4/v6 & X. 25 protocols.	3
5		Transport layer: Connection management, ICP, X.25. Sessionand presentation layer: Remote procedure call. Data Compression method. Data encryption and decryption. Application layer: Email, Remote login, File transfer, Network file system. Network security-issues, threats, attacks to networks, design of security system, recent trends in network security.	5
6		Advance concepts in computer networking wireless network, ad hock networks etc.	2

Books:

1. Tanenbaum A.S. Computer Network. PHI (EEE).
2. Stalling, Data and Computer Network, PHI (EEE).
3. Stevens, Unix Network Programming, PHI (EEE).

Paper   : MCA 2.5
Subject Name   : COMPUTER ORIENTED NUMERICAL METHODS
Marks   : (Theory-75   Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Interpolation**-Polynomial Interpolation, difference tables and calculations of difference.	2
2	2.1	**Numerical differentiation**- Newton's Interpolation, Lagrange's interpolation and Newton's divided difference formulae.	1 ½
	2.2	**Numerical integration**- Trapezoidal rule,Simpson's (1/3 and 3/8)rules, Gaussian Quadrature formula , Romberg integration	1 ½
3		**Simultaneous linear equations**- Direct methods: Gauss elimination , Jacobi's. Iterative methods: Gauss-Jordan , Gauss- Seidal	3
4		**Solution of non linear equations of one variable**- Iterative methods: Zeros of transcendental equation and zeros of polynomials using Bisection, Iterative, False-Position, Secant and Newton Raphson methods. Convergence of these methods	3
5		**Ordinary differential equations of one and two variables**- Euler's method, Modified Eular's method , Runga Kutta (2nd and 4th) methods, Milne's methods. Predictor – corrector methods.	4

Books:
1. Gerald and Wheatley : Applied Numerical Analysis ,Pearson
2. Niyogi : Numerical Analysis and algorithm ,TMGH
3. Schilling and Harris : Applied numerical methods for Engineering, Cengage
4. Scheld: Numerical Analysis, TMGH
5. Chapra : Numerical Methods For Engineers, TMH

Paper   **: MCA 2.6**
Subject Name   **: PROGRAMMING LABORATORY-II**
Marks   **: (Theory-100   Sessional- 100)**

LAB PART	PARA	Laboratory Content	Total Weeks
1(75%)	1.1	Concept of Object oriented programming in C++	1
	1.2	Simple link list, Stack, queues,	2
	1.3	Single, double, circular Link lists, queues	2
	1.4	graphs and trees, Several searching and sorting techniques, using Graphs and trees	3
	1.5	B Tree, B+ Trees: Insertion deletion techniques	3
2(25%)		Simple programming on Numerical Methods	4
Books		As on MCA 2.1 and MCA 2.5	

MCA 3RD SEMESTER SYLLABUS

Paper   **: MCA 3.1**
Subject Name   **: DATABASE MANAGEMNET SYSTEMS (DBMS)**
Marks   **: (Theory-75   Sessional- 25)**

UNIT	PARA	Content	Weeks
1		**Overview** : Concept of database, its advantage and disadvantages, redundancy Control; Database architecture, Client server model, ANSI model, data processing basics.	1
2		**Database models**: representational, conceptual, physical models, data independence, Modelling of real world situation: ER/EER models; Relational, Network, Hierarchical, Relational and their comparisons	2
3		**Relational Data model**: definition of relation, integrity constrains, DDL, DML, Relational algebra, and relational Calculus. Functional dependency, Normalizations decompositions, Canonical forms	3
4		**Database storage structures**: indexing, hashing and grid files	2
5		**Database languages**: SQL, Embedded SQL. PL/SQL, QBE. Query optimisation.	2
6		**Transaction Processing concepts**: transactions, serializability, Concurrency Control Techniques, locking protocols, 2PL, Timestamp based protocols	3
7		Recovery Techniques and protocols	1
8		Brief overview of object relational databases, client-server models, distributed databases, Spatial and temporal databases, deductive databases, multimedia databases	1

Books   1.   Silberschatz and Korth, Sudershan; Database system concepts, McGraw Hill.
          2.   Elmasri and Navathe; Fundamentals of database systems, PE
          3.   Das Gupta. P.K. Database Management System, Oracle SQL & PL/SQL
          4   Leon : Fundamentals Of Database Management Systems, TMH

Paper   **: MCA 3.2 Paper**
Subject Name   **: SOFTWARE ENGINEERING**
Marks   **: (Theory-75; Sessional- 25)**

UNIT	PARA	CONTENT	Weeks
1		Overview of system analysis and design: Information systems concepts, system environment, elements of a system, characteristics and types, system development life cycle.	1
2		Introduction to software engineering : Basic concepts of SE, different phases of a software development life cycle, life cycle models, planning software project.	2
3		Software requirements engineering process: Functional and non functional requirements, user requirements, system requirements, the SRS document,requirements elicitation and analysis, system modelling, system modelling tools, DFD,DD,UML etc.	2
4		Software design : Concenpt of fundamental design approaches top down and bottom up, structured, object based and object oriented design, modular design, architectural design, user interface design.	2

5	Software testing and maintenance : Concepts of software testing, type of testing, testing strategies, post implementation review and software maintenance.	2
6	Software project and quality management : Measures and measurements, cost estimation, cocomo model, scheduling, quality concepts, software reliability and quality standards.	3
7	Software risk management : Software risks, risk strategies risk identification, risk projection, risk refinement.	2
Books	1.Awad.E.H..System analysis and design 2.Pressman. R.S..Software Engineering: A practitioner's Approach. Mc Graw-Hill 3.Sommerville, Software Engineering, Pearson education	

Paper : MCA 3.3
Subject Name : SYSTEM ADMISTRATION
Marks : (Examination-75 ; Sessional- 25)

UNIT	PARA	CONTENT	Weeks
1		Introduction: What is System Administration? History of System Administration. System Administration Roles. Basics of Windows NT/2000/2003 and Unix/Linux. History.	1
2		Files Systems and Editing Files: File Attributes, File Operations, File Access permission, File Systems.	1
3		Software installation concepts: Concept of open Source software and paid software, Advantages of open source software, a brief overview of various open source software.	1
4		Administrative Tasks: User and group administration.	2
5		Server Configuration: Dynamic Host Configuration Protocol (DHCP), NFS, DNS with Bind, Web Server, FTP server, Mail Server, Proxy Server , Samba service, RAID.	2
6		Networking: Purpose of Networking, Network Hardware, Network services, network address assignment, assignment of routing protocol, Directory services, Network design, Network security, Intrusion – Detection system.	2
7		Backup and Disaster Recovery: What is the Disaster Recovery System? Quick-Reference Tables for Backup and Restore Procedures, Supported Features and Components, System Requirements, How to Access the Disaster Recovery System, Master Agent Duties and Activation, Local Agents, Configuring Features to Back Up, Configuring a Storage Location, Configuring a Backup Schedule, Starting a Manual Backup, Checking Backup Status, Restoring a Backup File, Restoring a Cluster, Viewing the Backup and Restore History, Trace Files, Command Line Interface.	3
8		Cloud computing system administration: Install and configure the Cloud Management application for the provider (for example, AWS, Azure, or VMware), Set properties for Cloud Management, Run Discovery on the cloud resources	2
9		System security: Defending systems against unauthorized access, vulnerability and penetration tests, Monitoring traffic for suspicious activity, Configuring and supporting security tools (firewalls, antivirus, and IDS/IPS software), Implementing network security policies, Identifying threats.	2
Books		1. System Administration By Pankaj Sharma 2. The Practice of Cloud System Administration: by Christine Hogan, Strata R. Chalup and Thomas A. Limoncelli. 3. Linux: The Complete Reference, Sixth Edition Paperback – by Richard Petersen. 4. Linux All-in-One for Dummies Paperback – 2018 by Emmett Dulaney 5. Unix and Linux System Administration Handbook by Evi Nemeth, Garth, Snyder, Trent R. Hein 6. Linux Bible by Christopher Negus 7. Linux Administration: a beginner's guide, Wale Soyinka, Seventh Edition, Mcgraw- Hill Education, 2016	

Paper : MCA 3.4
Subject Name : COMPUTER BASED OPTIMISATION TECHNIQUES (CBOT)
Marks : (Theory-75   Sessional- 25)

UNIT	PARA	Content	Weeks
1	1.1	**Linear Programming**: Mathematical model, assumptions of linear programming, Principles of simplex method, Revised simplex method, Applications, Duality, Dual Simplex method, sensitivity analysis	3
	1.2	**Special type of linear programming problems: Transportation and assignment problems.**	3
2		**Integer programming**: introduction, Branch and bound techniques, Assignment and travelling salesman problems with algorithmic approach.	4
3		**Dynamic programming**: deterministic and probabilistic dynamic programming	3
4		**Queueing model:** Specification and measure of queueing systems, Structures of basic queueing system- Definition and classification of stochastic processes, Characteristics of a Queing system, Interpretation of a model, Single Channel waiting line- (M/M/1) (∞: FIFO), Single channel finite population queue (M/M/1): (C/FIFO), Multichannel Queing problem (Infinite population) (M/M/C): (∞: FIFO), Earlang Distribution (M/Ek/1): (∞: FIFO).	2

Books		
	1	Natarajan, Balasubramani, Tamilasari : Operations Research , Pearson
	2	Gillett, B.G.: Introduction to operations research - A Computer oriented Algorithmic approach, McGraw-Hill.
	3	Srinath, L.S: Linear programming, East-west, New Delhi.
	4	Hiller, F.S. and Liberman, G.J.: Introduction to Operations Research, Holden Day In
	5	Taha: Operations Research , Pearson

Paper : MCA 3.5
Subject Name : FORMAL LANGUAGE AND AUTOMATA THEORY
Marks : (Theory-75   ; Sessional - 25)

UNIT	PARA	Content	Weeks
1		**Concepts of Automata Theory**: Automata, Computability and Complexity, Alphabets, Strings, Languages, Grammars.	1
2		**Automata and Languages:**	
	2.1	**Finite Automata**: Deterministic and non deterministic finite Automata, Equivalence of DFA & NFA, Finite Automata with Epsilon- Transitions.	2
	2.2	**Regular Expression (RE) and Languages:** Building RE, operators of RE, Conversion of RE to Automata and Automata to RE. Application of RE and its algebraic laws.	2
	2.3	**Non Regular Languages**: Pumping Lemma and its application.	1
3		**Context Free Grammars and Languages:**	
	3.1	Context-free Grammars: Definition and Derivation of languages. Ambiguity in Grammars and languages. CHOMSKY NORMAL FORM (CNF).	2
	3.2	Pushdown – Automata: Definition, The language of a PDA, Equivalence of PDA and CFG's.	2
	3.3	Non-Context-free Languages: Application of Pumping Lemma for non- Context free languages.	1
4		**Computability Theory:**	
	4.1	Turing Machines: Notations, ID for Turing Machine, i.e., recursively enumerable languages, Acceptability and Halting, Multi Traces Turing Machine. The Church- Turing Thesis.	2
	4.2	Variants of Turing Machines: Multitape Turing Machine, Non-Deterministic Turing Machine, Enumerator, Equivalence of one tape and multitape Turing Machine.	2

Books		
	1.	Hopcroft, Motwani & Ullman: Introduction to Automata Theory, Languages and Computation. 3rd Edn. LPE.
	2.	Theory of Computation: Michael Sipser CENCAGE Learning
	3	Martin : Introduction To Languages & Theory Of Computation, TMH

Paper : MCA 3.6
Subject Name : PROGRAMMING LABORATORY-III
Marks : (Theory-100   Sessional- 100)

UNIT	PARA	Laboratory Content	Total Weeks
1 (75%)	1.1	Concept of Object oriented programming in Java 2.6	2
	1.2	Example of Inheritance, Multiple inheritance, Polymorphism related programs	5
	1.3	Designing of DFD, Class Diagram with UML/SE Tools	4
2(25%)		Programs related to Computer graphics	4
Books:		As given in MCA 3.4 and MCA 3.5	

MCA 4TH SEMESTER SYLLABUS

Paper : MCA 4.1
Subject Name : MANAGEMNET INFORMATION SYSTEM (MIS)
Marks : (Theory-75 ; Sessional- 75)

UNIT	PARA	Content	Weeks
1.		**MANAGEMENT INFORMATION SYSTEM (MIS)** (20% credit): Organization and Information Systems, Changing Environment and its impact on Business - The IT/IS and its influence. The Organization: Structure, Managers and activities - Data, information and its attributes - The level of people and their information needs - Types of Decisions and information - Information System, categorization of information on the basis of nature and characteristics.	2
	2	**KINDS OF INFORMATION SYSTEMS** (20% credit): Transaction Processing System (TPS) - Office Automation System (OAS) - Management Information System (MIS) - Decision Support System (DSS) and Group Decision Support System (GDSS) - Expert System (ES) - Executive Support System (EIS or ESS).	2
	3	**COMPUTER IN TELECOMMUNICATION AND NETWORKS** (20% credit): Communication, Media, Modems & Channels - LAN, MAN & WAN - Network Topologies, Internet, Intranet and Extranet. Wireless technologies like Wi-Fi, Bluetooth and Wi-Max.	3
	4	**MANUFACTURING AND SERVICE SYSTEMS** (10% credit): Information systems for Accounting, Finance, Production and Manufacturing, Marketing and HRM functions - IS in hospital, hotel, bank.	2
	5	**ENTERPRISE SYSTEM** (10% credit): Enterprise Resources Planning (ERP): Features, selection criteria, merits, issues and challenges in Implementation - Supply Chain Management (SCM): Features, Modules in SCM - Customer Relationship Management (CRM): Phases. Knowledge Management and e-governance.	2
	6	**CHOICE OF IT** (10% credit): Nature of IT decision - Strategic decision - Configuration design and evaluation Information technology implementation plan.	2
	7	**SECURITY AND ETHICAL CHALLENGES** (10% credit): Ethical responsibilities of Business Professionals – Business, technology. Computer crime – Hacking, cyber theft, unauthorized use at work. Piracy – software and intellectual property. Privacy Issues and the Internet Privacy. Challenges – working condition, individuals. Health and Social Issues, Ergonomics and cyber terrorism.	2
Books	1.	"Management Information Systems", Kenneth J Laudon, Jane P. Laudon, Pearson/PHI,10/e, 2007	
	2.	"Management Information Systems", W. S. Jawadekar, Tata McGraw Hill Edition, 3/e, 2004	
	3	MIS by Ralph Stair	
Ref.		1. "Introduction to Information System", James A. O' Brien, Tata McGraw Hill, 12th Edtion. 2. "Management Information Systems", S.Sadagopan, PHI, 1/e, 2005 3. "Management Information Systems", Effy Oz, Thomson Course Technology, 3/e, 2003 4. Corporate Information Strategy and Management", Lynda M AppleGate, Robert D Austin et al, Tata McGraw Hill, 7th Edition.	

Paper : MCA 4.2
Subject : Data Mining & Warehousing
Marks : (Theory-75 ; Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Data warehousing (50%):**	
	1.1	Introduction to data warehousing, its characteristics, data types, application and scopes of data warehouse. Data warehouse types.	1
	1.2	Design of data warehouse: Data warehouse models, schema and their comparison with respect to actual applications, Process flows within data warehouse. Load manager, warehouse manager and query managers. Aggregations, Metadata.	2
	1.3	Hardware and operational Design: Data warehouse server , parallel processing, SMP , MPP and cluster computing and other factors. Data warehouse tuning and testing: Tuning and testing of data warehouse and their need.	3
	1.4	Case Study: A practical data warehouse schema design.	1
2		**Data mining (50%):**	
	2.1	Data mining , KDD and their stages, goals of data mining, research methodology and concept learning, data warehouse and data mining, OLTP and OLAP, DSS, Expert systems.	2
	2.2	Data mining Tools: Query tools, visual tools, neural networks, genetic algorithms, SVM and decision support systems.	3

	2.3	Data mining algorithms: Association rule algorithms, Clustering algorithms, Pattern recognition algorithms, k–means and nearest neighbour algorithms.	2
	2.4	Case study: A practical KDD stages design.	1

Books	1.	Dolf Zantinge, P. Zantinge, Data mining, PHI
	2.	Sam Anahory, Data Warehousing in the real world , Pearson
	3.	Tan, Data Mining, Pearson.
	4.	Han. J and Kamber. M, Data mining, Concept and Techniques, Esevier
	5.	Principles of Data Mining. Hand. David, Mannila .Heikki, Smyth, Padhraic. PHI

Paper : MCA 4.3
Subject Name : WEB PROGRAMMING TECHNOLOGIES
Marks : (Theory-75 ; Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Introduction to Internet Technology:** Overview of Networking protocols and OSI Model. Internetworking concepts	2
2		**Internet Protocols and Architecture and Background work:** TCP/IP, IP, IP Addressing & Datagrams, IPv6, ARP, RARP, BOOTP, DHCP, ICMP. TCP, UDP, Ports & Sockets, TCP Connection & properties, TCP Segment format, Active & Passive Open Connections. DNS, DNS Server, Email Architecture, SMTP, POP & IMAP, FTP, TFTP. WWW, web server & web browser, HTTP commands & interaction, Architecture of Web browser, CGI, TELNET.	4
3		**Web Development Technologies:** Client Side Programming: Different client-side scripting: JavaScript, VBScript etc. HTML; CSS, XML, DTD; Server Side Programming: Servlets, JSP, Java beans, EJB, Struts, JSF, ASP.NET; Web Servers: IIS, Apache; RIA, Ajax; Types of web pages, ActiveX Controls, Java Applets, Tiers in web applications; Database connectivity: ODBC, JDBC.	4
4		**Web Security:** Confidentiality, authentication, Integrity, Non-repudiation, Access Control, and Availability. Sniffing, spoofing, phishing, pharming. Web Security: Cryptography, Cipher Text, Digital Signature, Digital Certificates. Network Security: SSL, Firewalls, IP Security, VPN.	2
5		**Web Services & Middleware:** Concept, RPC, CTM, Message Queuing. DCOM & CORBA: basic interface, Architecture; ORB, IDL, IIOP, RMI. Web Services.	2
6		**Wireless Internet:** Mobile IP, addressing and its work. WAP: Architecture, Gateway.	1

Books	1	Achyut S Godbole, Atul Kahate: Wed Technologies – TCP/IP to Internet Architectures, Tata McGraw Hill.
	2	Deitel & Deitel: Web Technology, Pearson Education
	3	Raj Kamal: Internet and Web Technologies, Tata McGraw Hill

Paper : MCA 4.4
Subject Name : ELECTIVE-I
Marks : (Theory-75 ;Sessional- 25)

Paper : MCA 4.5
Subject Name : ELECTIVE-II
Marks : (Theory-75 ;Sessional- 25)

Paper : MCA 4.6
Subject Name : PROJECT WORK
Marks : (Practical -100; Sessional- 100)

Syllabus for Elective subjects (I and II):

Elective-I
a. PROGRAMMING LANGUAGES
b. SYSTEMS ANALYSIS AND SIMULATION
c. COMPUTER GRAPHICS
d. INFORMATION THEORY & CRYPTOGRAPHY
e. ARTIFICIAL INTELLIGENCE
f. ADVANCE DATABASE MANAGEMENT SYSTEM
g. DISTRIBUTED SYSTEM

Paper : MCA 4.4
Subject Name : PROGRAMMING LANGUAGES
Marks : (Theory-75 ;Sessional- 25)

UNIT	PARA	Content	Weeks
1		Introduction to various programming languages paradigms and their implementation issue.	2
2		Imperative Programming: - Block structure, scope rules, parameter passing, construct like core routine etc. Language like Pascal, C, Fortran.	2.5
3		Object Oriented Programming: - Objects, classes, instances, hierarchies and inheritance, encapsulation, hiding, abstraction in languages like C++, Java.	2.5
4		Functional Programming: - Functions, recursion, polymorphic data types, type checking and type inference, lambda calculus, storage calculation in languages like LISP, NL.	3
5		Logic Programming: - Programming with horn clauses, SLD resolution including unification, Backtracking, cuts in languages like Prolog.	2.5
6		Concurrent Programming: Process synchronization primitive in languages like ADA,LINDA.	2.5

Books:

Paper : MCA 4.4
Subject Name : SYSTEMS ANALYSIS AND SIMULATION
Marks : (Theory-75 ;Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Role of Modelling in Systems Analysis**: Computer Simulation of Stochastic Systems';	3
2		Generation of Pseudo-Random Numbers and Stochastic Variates using the computer;	3
3		**Simulation of Queuing Systems**; Using special purpose languages for simulating queuing systems, GPSS and/or SLAM	3
4		**System Dynamics**; Simulation of Systems with Feedback ,using DYNAMO in System Dynamics;	3
5		Cases on Simulation in Production; Finance, Marketing and Corporate Planning; Project Work.	3

Books:
1. Banks, J., Catson, S., Nelson, B.L., "Discrete-Event System Simulation", (2nd Edition). Prentice Hall of India, N. Delhi, 1996.
2. Deo, N., "System Simulation with Digital Computers". Prentice Hall of India, 1979.
3. Law, A.M., and Kelton, W.D., "Simulation Modelling and Analysis", (2nd Edition). McGraw Hill, N. Y, 1991.

Paper : MCA 4.4
Subject Name : COMPUTER GRAPHICS
Marks : (Theory-75 ; Sessional- 25)

UNIT	PARA	Content	Weeks
1	1.1	**Overview of graphics systems**: Display devices, CRT, raster and random scan displays, DVST, Flat panel and 3-D viewing devices, digital frame buffer.	2
	1.2	**Raster Scan Systems**: Video controller and raster scan display processor, ,	2
	1.3	**Graphics monitors and input devices**.	
2		**Output primitives**: Line and point drawing, line drawing algorithms (DDA, Bressenham's line drawing), Circle generating algorithms, ellipse generating algorithms.	2
3		Attribute output primitives: line attributes, curve attributes, area fill attributes, character attributes.	1
4		**2-D Graphics**	
	4.1	Basic and composite transformations, translation, rotation, scaling.	1
	4.2	Other transformations: reflection and shear	1
	4.3	Viewing and clipping: Two dimensional viewing functions, window to view port transformation, clipping operations, point and line clipping algorithms (Cohen-sutherland). Polygon clipping algorithm (Sutherland-Hodgeman), Curve clipping , text clipping , exterior clipping.	2
5		**3-D Graphics**:	
	5.1	Three dimensional display methods.	1
	5.2	3-D transformation, translation, rotation and scaling.	1
	5.3	Visible surface detection methods: Classification of visible surface detection algorithms(scan line algorithm, depth buffer method, depth sorting method)	2

Books:
1. Hearn D., Baker P.M.: Computer Graphics, Prentice-Hall,1986.
2. Foley,,Van.Dam Fundamentals of Interactive Computer Graphics,AW1982.
3. Giloi, W.K.: Interactive Computer Graphics; Prentice-Hall, 1978.
4. Newman, W., Sproule, R.F.: Principles of Interactive Computer Graphics, MGH,
5. Rogers, D.F.: procedural Elements for Computer Graphics, McGraw-Hill, 1983.
6. Harrington, S.: Computer Graphics: A programming Approach, Tata McGrawHill,

Paper : MCA 4.4
Subject Name : INFORMATION THEORY & CRYPTOGRAPHY
Marks : (Theory-75 ;Sessional- 25)

UNIT	PARA	Content	Weeks
1		Uncertainty, Information and Entropy Information Measures Characteristics on information measure, Shannon's concept of information, Shannon's measure of information, Model for source coding theorem communication system: Source coding ad line / channel coding, channel mutual information capacity (Bandwidth).	3
2		Channel coding, Theorem for discrete memory less channel, Information Capacity theorem: Error detecting & error correcting codes, types of codes: Block codes, Tree codes, Hamming and Lee Metrics, Description of linear block codes by matrices, Description of linear tree codes by matrices, Parity check codes, and Parity check polynomials.	3
3		**Compression:** Loss less and lossy, Huffman codes, Binary image compression schemes, Run length encoding, CCIIT group 31-D compression, CCITT group 3 2D compression, CCITI group 4 2D compression.	3
4		**Video Image Compression:** Requirement of full motion video compression. CITT H 261 Video coding algorithm, MPEG compression methodology. MPEG-2 compression, Audio (speech) compression	3
5		Cryptography: Encryption, Decryption, Cryptogram (hypertext). Concept of cipher, Crypto analysis. **Keys:** Single key (secret key) cryptography, two-key (public-key) cryptography. Single key cryptography. **Ciphers:** Block cipher codes, Stream ciphers, Requirement for secrecy, The Data Encryption Standard, Public Key Cryptography: Diffle-Helhman public key distribution, The Rivest-Shamir-Adelman (R-S-A) system for public key cryptography. Digital signature.	3
Books:	1.	Information theory and cryptography : Ranjan Bose , TMGH	

Paper - MCA 4.4
Subject Name : ARTIFICIAL INTELLIGENCE
Marks : (Theory-75 ;Sessional- 25)

UNIT	PARA	Content	Weeks
1		**Introduction** : goals and objectives of artificial intelligence, problem space and problem characteristics, state space representation.	1
2		**Problem solving techniques:** Generate and test, Hill climbing, search problem reduction techniques, constraint propagation, Means and analysis, Heuristic search techniques, Heuristic problem solving, Case based reasoning.	3
3		**Game playing:** Graph search, Game trees and associated techniques, minimax and alpha beta pruning.	3
4		**Knowledge representation and inference:** Procedural and deductive approaches, production system formalism, predicate logic: first order and second order, Rule based system, semantics, net, conceptual dependencies, conceptual path, frame, scripts, associated inferencing mechanism, resolution in predicate logic, Unification, natural deduction theorem, proving forward and backward deduction, different techniques for reasoning under uncertainty, monotic and non monotic reasoning, constraint satisfaction problem.	4
5		Rule based system, meta language, Expertise, transfer self explaining system Case study : Dendral, Mycin,	2
6		**Introduction to neural network**: Definition and representation of artificial neuron and its analogy with biological neuron, basic concepts of tree layer neural network, learning by back propogation.	2
Books:	1.	Nilson N J, Principles of Artificial Intelligence. Springer	
	2.	Rich and Night,m Artificial intelligence, MGH	

Paper - MCA 4.4
Subject Name : ADVANCE DATABASE MANAGEMENT SYSTEMS
Marks : (Theory-75 ;Sessional- 25)

UNIT	PARA	Content	Weeks
1.		**Query Processing** : Basics of query processing, query processing steps, external sorting, Query tree and graphs, query optimisations methods, heuristics and cost based methods, use of searching techniques and, Disk storage and access paths, cost considerations in searching and sorting. Different types of queries and their access paths with cost considerations, Joins and their costs, minimisation of costs of queries using shortest access paths.	3
2.		**Parallel databases** :	3

		Parallel database and its difference with client server, structure of a machine, performance of a system, scale-up and speedup , data distribution methods, skew and its handling Parallel sorting techniques, Parallel join and machine structure.	
3		**Distributed databases**: Differences and similarities with parallel processing, data fragmentation and distribution, data transparency, Cost of queries in a distributed environment, semi join. Transactions in a distributed environment, transaction Coordinator and transaction manager and their roles. Failure of a coordinator and manager, blocking. Concurrency control protocols in distributed environment: Single site, primary copy , multiple site considerations. Timestamp based protocols.	3
4		**Object Oriented databases**: Object and classes, sub class and super class, encapsulation, inheritance, multiple inheritance and polymorphism. Object orientation programming languages. Data structures of OODB, defining classes and data manipulation using OOP techniques.	3
5.		Spatial , temporal and Multimedia databases: Definition of spatial , temporal and multimedia data bases, storage considerations, SQL for spatial, temporal and multimedia data retrieval.	3

Books 1. Silberschatz and Korth, Sudershan; Database system concepts, McGraw Hill.
       2. Elmasri and Navathe; Fundamentals of database systems; Narosa Publishing Co.

Paper - MCA 4.4
Subject Name   : Distributed System
Marks   : (Theory-75; Sessional- 25)

UNIT	PARA	Content	Weeks
1.		INTRODUCTION : Introduction to Distributed systems-examples of distributed systems, challenges- architectural models- fundamental models - Introduction to interprocess communications-external data representation and marshalling- client server communication-group communication – Case study: IPC in UNIX	3
2.		DISTRIBUTED OBJECT AND FILE SYSTEM : Introduction - Communication between distributed objects - Remote procedure call - Events and notifications - Java RMI case Study - Introduction to DFS - File service architecture - Sun network file system - Introduction to Name Services- Name services and DNS - Directory and directory services	3
3		DISTRIBUTED OPERATING SYSTEM SUPPORT: The operating system layer – Protection - Process and threads - Communication and invocation - Operating system architecture - Introduction to time and global states - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical clocks - Global states - Distributed debugging – Distributed mutual exclusion.	3
4		TRANSACTION AND CONCURRENCY CONTROL – DISTRIBUTED TRANSACTIONS : Transactions – Nested transaction – Locks - Optimistic concurrency control - Timestamp ordering - Comparison of methods for concurrency control - Introduction to distributed transactions - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery	3
5.		SECURITY AND REPLICATION : Overview of security techniques - Cryptographic algorithms – Digital signatures - Cryptography pragmatics – Replication - System model and group communications – Fault tolerant services – Highly available services – Transactions with replicated data	3
Books	1.	. George Coulouris, Jean Dollimore, Tim Kindberg "Distributed Systems Concepts and Design" Third Edition – 2002- Pearson Education Asia.	

Elective-II

a.   Computer Networks and Security
b.   Information storage and retrieval
c.   Image processing
d.   Software project Management

Paper   : MCA .4.5
Subject Name   : Computer Networks and Security
Marks   : (Theory-75 ;Sessional - 25)

UNIT	PARA	Content	Weeks
1.		Course Introduction and terminology	1
2.		Conventional Cryptography : Definitions, Classical Cryptography, Galois Field, Unicity Distance, Entropy, Perfect Secrecy DES, AES and others symmetric cryptography.	3
3		Asymmetric Cryptography: Number Theory, public key cryptography, RSA and Elliptic Curve Cryptography, Key management using symmetric and asymmetric key.	3
4		Authentication: Message authentications and hash functions, hash algorithms, Digital Signatures and Authentication Protocols.	3

5.		Operating System security : Computer systems overview, Buffer overflow, Securing UNIX	2
6		Network and System Security:	
		a. Vulnerability, Monitoring/Sniffing, Spoofing b. Firewalls, Intrusion Detection	3
		c. PGP, Kerberos d. IPSec, SSL	

Books	1.	W Stallings, "*Cryptography and Network Security: Principles and Practice, 4/e*", Prentice Hall, 2006.
Ref.	1.	B. Schneier, A*pplied Cryptography,* 2nd Ed, John Wiley & Sons, Inc., 1996.
	2.	A. Menezes, P. van Oorshot and S. Vanstone, *Handbook of Applied Cryptogrphy*, CRC Press, 1997.
	3.	C. Kauffman, R. Perham and M. Speciner, *Network Security: Private Communication in a Public World*, Prentice-Hall, 1994.
	4.	H. C. A. van Tilborg, *Fundamentals of Cryptology,* Kluwer Academic Publishers, 2000.

Paper : MCA 4.5
Subject Name : **Information storage and retrieval**
Marks : **(Theory-75 ;Sessional - 25)**

UNIT	PARA	Content	Weeks
1.		Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses.	2
2.		Information Retrieval System Capabilities: Search, Browse, Miscellaneous. Cataloguing and Indexing: Objectives, Indexing Process, Automatic Indexing, information Extraction.	3
3		Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure.	3
4		Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages	2
5.		User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, Weighted searches of Boolean systems, Searching the Internet and hypertext. Information Visualization: Introduction, Cognition and perception, Information visualization technologies.	3
6.		Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems. Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example – TREC results.	2
Books	1.	Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.	

Paper : MCA 4.5
Subject Name : **Pattern Recognition and Image processing**
Marks : **(Theory-75 ; Sessional - 25)**

UNIT	PARA	Content	Weeks
1		Image digital representation. Elements of visual perception. Sampling and quantisation. Image processing system elements.	3
2		Fourier transforms. Extension to 2· D, OCR, Walsh, Hadamard transforms	3
3		Enhancement and segmentation: Histogram modification. Smoothing, sharpening. Thresholding. Edge detection. Segmentation. Point and region dependent techniques.	3
4		Image encoding: Fidelity criteria. Transform compression. KL, Fourier, DCT. Spatial compression, Run length coding. Huffman and contour coding.	3
5		Restoration: Models. Inverse filtering. Least squares filtering. Recursive filtering.	3

Books: 1. Gonslaez, et.a1, "Digital Image Processing", Addison Wesley, Reading, M.A., 1990.

Paper : MCA 4.5
Subject Name : **Software project Management**
Marks : **(Theory-75 ; Sessional - 25)**

UNIT	PARA	Content	Weeks
1		FUNDAMENTALS :Conventional Software Management – Evolution of Software Economics – Improving Software Economics – Conventional versus Modern Software Project Management.	3
2		SOFTWARE MANAGEMENT PROCESS FRAMEWORK : Lifecycle Phases – Artifacts of the Process – Model Based Software Architectures – Workflows of the Process – Checkpoints of the Process	3
3		SOFTWARE MANAGEMENT DISCIPLINES : Iterative Process Planning – Organization and Responsibilities – Process Automation – Process Control and Process Instrumentation – Tailoring the Process.	3
4		MANAGED AND OPTIMIZED PROCESS	3

Data Gathering and Analysis – Principles of Data Gathering – Data Gathering Process – Software Measures – Data Analysis – Managing Software Quality – Defect Prevention.

| 5 | CASE STUDIES | 3 |

COCOMO Cost Estimation Model – Change Metrics – CCPDS–R..

Books: Text Book

1. Walker Royce "Software Project Management A Unified Framework", Pearson Education,2004
2. Humphrey Watts, "Managing the software process", Addison Wesley, 1989. (Unit IV)

Ref.

1. Ramesh Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
2. Bob Hughes, Mikecotterell, "Software Project Management", 3rd Edition, Tata McGraw