

Appendix AK-22**MANONMANIAM SUNDARANAR UNIVERSITY
Tirunelveli****M.Tech. in Computer and Information Technology – (CBCS)
(Full-time/Week-End (4 Semesters))
Regulations, Curriculum, Scheme and Syllabus
(with effect from 2005-2006 and afterwards)****A. REGULATIONS**

M.Tech. degree program in Computer and Information Technology exposes students to a wide range of advanced IT courses, combined with specialized research which culminates in a thesis. Such a combination gives students the breadth and depth necessary for pursuing careers in academics as well as industry.

A1: Duration of the Course:

The requirements for the M.Tech program is four semesters spread over 2 years for full time students. However, it is possible to get permission to spend the fourth semester elsewhere to do the thesis work. If someone wants to carry out the thesis work in a company, or at some other educational institution, it is allowed by the Department.

The University Department also offers a part-time and Week-end M.Tech programs for working professionals satisfying the eligibility conditions mentioned in the '**Eligibility for Admission**'. The Week-End Students will register for four semesters spread over 2 years with an undertaking from the employer promising 10 lab hours of computer access per week at the working place other than the week ends. The other conditions and requirements of full time students will apply to Week-End students also. It is possible to convert one's status from full-time to part-time/Week-End and vice-versa.

A2: Eligibility for Admission:

The minimum eligibility conditions for admission to the M.Tech. program in Computer and Information Technology are given below.

The candidates for admission into the first semester of the M.Tech. program in computer and Information Technology course will be required to have qualified for the Bachelor's degree in Engineering/Technology in any one of the following disciplines

1. Information Technology
2. Computer Science & Engineering

3. Electronics and Communications Engineering
 4. Electronics and Instrumentation Engineering
 5. Electronics and Electrical Engineering
 6. Any discipline in Engineering/ Technology with at least one compulsory theory and practical course in Computer Engineering/ Information Technology
- (or)
- Master of Science (M.S. or M.Sc.) degree in any one of the following disciplines
7. Information Technology and E-Commerce
 8. Information Technology
 9. Computer Science
 10. Any combination of the above disciplines
- (or)
11. M.Sc. in Mathematics/Physics/Statistics/Operations Research
- (or)
12. MCA.
 13. AMIE or Grad.IETE or equivalent
 14. DOEACC 'B' Level qualification (MCA Level) of DOEACC Society of Ministry of Communications and Information Technology, Govt. of India.

The applicant must have a sufficient background in Information Technology to complete the degree requirements with reasonable performance.

The candidates with a valid GATE score in any of the disciplines mentioned in eligible subjects will be given priority over non-GATE candidates.

Credit Transfer for M.E./M.Tech holders in circuit branches/ DOEACC 'C' Level (M.Tech. level) qualified candidates and other equivalent qualification holders to get admission in to the M.Tech. degree in Computer and Information Technology: Candidates who have qualified the DOEACC 'C' Level (M.Tech. level) or M.E./M.Tech. in Information Technology related branches or any other equivalent qualification can apply for the award of M.Tech. degree in Computer and Information Technology degree awarded by Manonmaniam Sundaranar University through credit transfer programme. The board of studies in Information Technology and Engineering will identify the list of equivalent papers qualified by the candidate and specify the list of additional papers to be qualified for the award of M.Tech. degree in Computer and Information Technology provided the candidate possesses at least 50% transferable credits which will be decided only by the board of studies in Information Technology and Engineering. The prospective candidate should pay one semester fee along with the usual admission fee and other fee applicable through the department. On getting admission, the candidate has to pay the examination fee and register

for the list of identified papers to be qualified. No formal classes will be available for such candidates who have to appear for the university examinations directly for those identified papers. Their external marks alone will be taken into consideration for the award of the degree, meaning that their internal marks will be the same as the external marks obtained in the final mark statement.

A3: Course Requirement for the Degree:

The University requirement for the M.Tech. Program is completions of 72 credits of course work, out of which 60 credits should be through the regular course work, and 12 units should be through the M.Tech. major project followed by a thesis on the major project. A typical course is normally considered to be 3 or 4 credits. No candidate will be eligible for the Degree of Master of Technology in Computer and Information Technology, unless she/he has undergone the prescribed courses of study for a period not less than 4 semesters in the case of full-time/week-end studies and has acquired 72 credits and other passing requirements in all subjects of study.

A4: Requirements of Attendance, Progress and Conduct:

A candidate will be permitted to appear

- a. For the semester examination only if the candidate keeps not less than 75 percent attendance in each subject.
- b. The candidate's conduct should have been satisfactory.

The candidate failing to fulfill the above conditions will have to repeat the subject/semester.

A5: Assessment

The assessment will comprise Continuous Internal Assessment (CIA) carrying a maximum of 50% marks and Semester Examination carrying a maximum of 50% marks in each subject of study including Project work.

Semester examination will be conducted for all subjects of study, at the end of each Semester.

The Project Report/Thesis should be submitted through the Guide to the Head of the Department at the end of 4th Semester in case of full time/week end students and for the part-time students, the submission is at the end of 6th semester. The last date for submission of thesis will be six months from the date of last examination of the third semester. However, in exceptional cases, based on the recommendation of the Guide the Head of the Department may permit an extension of time not exceeding 31 days. Candidates who submit the thesis thereafter will be treated as second appearance for the project work.

A6: Passing Requirements and Classification of Successful candidates:

A candidate who secures not less than 50 percent of the total marks in the semester examinations and Continuous Internal Assessment (CIA) put together in any subject of study with not less than 40 percent separately in the semester examinations and in Continuous Internal Assessment (CIA) will be declared to have passed the subject.

A candidate who fails in project work / thesis viva voce examination may be permitted to submit the project work/thesis afresh and appear for the viva voce examination on a second occasion, if so recommended by the examiners.

Candidate failing to secure the requisite minimum marks in CIA work in any subject(s) may be permitted to register for a second time and re-earn CIA marks in the subject(s) by undergoing the CIA procedure for that subject(s) again.

A Candidate who successfully completes the course and satisfies the passing requirements in all the subjects of study and curricular requirements will be declared to have qualified for the award of the Degree.

A successful candidate securing not less than 60 percent of the aggregate marks will be declared to have qualified for the M.Tech. Degree in First Class.

Candidate passing all subjects in the first appearance and securing not less than 75 percent of the aggregate marks will be declared to have qualified for the award of M.Tech. Degree in First class with distinction.

All other successful candidates will be declared to have qualified for the award of degree in Second Class..

A7: Academic Session

The academic session normally begins in the fourth week of July/first week of August every year and ends in the middle of July. It consists of three terms:

Odd Semester : July last week - November last week

Even Semester : December last week - April last week

Summer Term : The middle of May - The middle of July

Each semester consists of about 18 weeks with a one week mid semester recess. The last week of each semester is the end semester examination week and one week during the semester is used for the two mid-semester examinations. Thus there are about 15 working weeks in each semester. The summer term consists of about 8 working weeks.

**B. SCHEME OF EXAMINATION FOR
M.Tech. in Computer and Information Technology - (Full-Time/Week-
End)**

Duration : Four Semesters – 72 Credits

Subject Code	Subjects	No. of Credits	Int. Marks	Ext. Marks	Total Marks	Duration of Exam
FIRST SEMESTER						
S11MT	Advanced Computer Architecture	4	50	50	100	3
S12MT	Modern Operating Systems	4	50	50	100	3
S13MT	Principles and Current Trends in Information Technology	3	50	50	100	3
S14MT	Algorithm Analysis and Design	4	50	50	100	3
S15MT	Advance Computer Graphics and Multimedia	4	50	50	100	3
I Semester Total		19	Credits			
SECOND SEMESTER						
S21MT	Computer Communication	3	50	50	100	3
S22MT	Advanced Database Management Systems	3	50	50	100	3
S23MT	Software Engineering and UML	4	50	50	100	3
S24MT	Advanced Digital Image Processing	4	50	50	100	3
S25MT	Fuzzy Logic and its Applications	4	50	50	100	3
SP2MT	Mini Project	3	50	50	100	3
II Semester Total		21	Credits			
THIRD SEMESTER						
S31MT	Artificial Neural Networks	4	50	50	100	3
S32MT	Engineering Research Methodology	4	50	50	100	3
S33MT	Elective I (Select any one from Group A)	3	50	50	100	3
S34MT	Elective II (Select any one from Group B)	3	50	50	100	3
S35MT	Elective III (Select any one from Group C)	3	50	50	100	3
SP3MT	Mini Project	3	50	50	100	3
III Semester Total		20	Credits			
FOURTH SEMESTER						
SP4MT	Major Project & Viva-Voce	12	50	50	100	3
OVERALL TOTAL		72	CREDITS			

LIST OF ELECTIVES

Subject Code	Subjects	No. of Credits	Int. Marks	Ext. Marks	Total Marks	Duration of Exam
GROUP A						
S3AMT	Data Mining	3	50	50	100	3
S3BMT	Grid Computing		50	50	100	3
S3CMT	Multimedia Systems Design and Development	3	50	50	100	3
S3DMT	Cryptography	3	50	50	100	3
S3EMT	E-Commence Applications	3	50	50	100	3
S3FMT	Display Systems Engineering	3	50	50	100	3
GROUP B						
S3GMT	Programming Image Processing through IDL	3	50	50	100	3
S3HMT	Research topics in Knowledge and Data Engineering	3	50	50	100	3
S3JMT	Digital Signal Processing	3	50	50	100	3
S3KMT	Client Server Computing	3	50	50	100	3
S3LMT	Distributed Operating Systems	3	50	50	100	3
S3MMT	Telecommunications – Converging Technologies	3	50	50	100	3
GROUP C						
S3NMT	Topics in AIX – System Administration	3	50	50	100	3
S3PMT	Research topics in Mobile Computing	3	50	50	100	3
S3QMT	Topics in Internet Technology	3	50	50	100	3
S3RMT	Topics in Networking	3	50	50	100	3
S3SMT	Parallel Processing	3	50	50	100	3
S3TMT	Information Technology and Cyber Laws	3	50	50	100	3

M. Tech in Computer and Information Technology

C. SYLLABUS

I SEMESTER

S11MT - ADVANCED COMPUTER ARCHITECTURE

Unit I

Introduction: Evaluation of computers generations of computers – basics of computer architecture – stored program organization (Von Neumann architecture) – instruction formats and types – addressing modes – stack organization.

Unit II

Processor Design: Processor basics – CPU organization – data representation – instruction sets – data path design – fixed point arithmetic – ALU – floating point arithmetic – control design – basic concepts – hard wired control – micro programmed control – pipeline control.

Unit III

Memory and I/O systems : Memory technology – memory systems – virtual memory – high speed memories – interleaved memories – caches – design methods – associative memories – input / output system – programmed I/O – DMA and interrupts – I/O processors.

Unit IV

Parallel Processing : Parallelism in uni processor system – parallel computer structures – architectural classification schemes – pipelining – instruction and arithmetic pipelining – principles of designing pipelined processors – vector processing requirements.

Unit V

Advanced computer architecture : RISC machines – design principles – RISC versus CISC – examples RISC architecture SPARC – static and dynamic data flow design – fault tolerant computers.

References:

1. John P Hayes, Computer architecture and organization, III edition McGraw Hill, 1998.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer organization, McGraw Hill, 2002.
3. Heuring V.P and Jordan H.F, Computer systems design and architecture, Addison Wesley, 2000.

S12MT - MODERN OPERATING SYSTEMS

Unit I

Operating System Strategies : Multiprogramming System – Batch Systems – Time Sharing Systems – Personal Computers and Work stations – Process Control and Real – time Systems – Networks – The Genesis of Modern operating Systems – Using the operating System : The Abstract Model of Computing – Resources (Windows NT files and POSIX files) – other Resources – Creating Processes in Unix and Windows NT – Threads (C Threads and Windows NT Threads)

Unit II

Operating system organization: Factors in OS Design – Basic Functions – Basic Implementation Considerations – Device Management: Device Management Approaches – Buffering – Device Drivers – Device Management Approaches – Buffering – Device Drivers – Device Management issues – Process Management: The system view of Processes and Resources – Initialising the operating system – Process address spaces – The Process Abstraction – The Resource – Abstraction – Process Hierarchy.

Unit III

Scheduling: Scheduling Mechanisms – Strategy Selection – Nonpreemptive strategies – Preemptive Strategies – Basic Synchronization Principles: Interacting Processes – Coordinating Processes – Semaphores – Shared Memory Multiprocessors – High-level Synchronization: Alternative Synchronization Primitives – Monitors – Interprocess communication – Explicitly Ordering Event Execution.

Unit IV

Deadlock: Preamble – System Deadlock Model – Prevention – Avoidance – Detection and Recovery – Memory Management: Basics – Memory Allocation – Dynamic Address Relocation – Memory Management Strategies – Virtual Memory: Address Translation – Paging – Static paging Algorithms – Dynamic Paging Algorithms – Segmentation.

Unit V

File Management: Files – Low-level file Implementations – Supporting other storage Abstractions – Memory – Mapped Files – Directories – Directory Implementation – OS Protection and Security: Authentication – Internal Access Authorization and Implementation – Cryptography – Remote Files: Sharing Information Across the Network – Remote Disk Systems – Remote File systems – File - level caching – Directory systems and Their Implementations.

References:

1. Operating Systems, Gary Nutt – Addison Wesley – Second Edition.
2. Operating Systems, Milenkovic, Tata McGraw Hill Publications.
3. Peterson J.L Galvin and Silberschatz A, “Operating System Concepts “, Addison Wesley.

4. Deitel H.M., "Operating System ", Addison Wesley

S13MT - PRINCIPLES AND CURRENT TRENDS IN INFORMATION TECHNOLOGY

Unit I

Evolving Wireless Applications – Personal Positioning – Meter reading – email – Wireless Docking – Web suffering-lan access and mobility ports – Communications basics- AMPS – Damps –GSM –CDMA – LMDS-Blue Tooth- Wireless Lans - Communications basics: Powers of 10- frequency – wave length – the frequency spectrum- band width – power measurements –bel – decibel – decibel above – signal to noise ratio – propagation loss- transmission rate constraints – nyquist relationship—Shannon’s law – radio frequency spectrum allocation –band nomenclature-applications.

Unit II

AMPS: Evolution – Components – Network Access - Frequency utilization – Channel utilization – Signaling – Voice Channel Signaling co channel signaling - Data over AMPS- Case study and lessons learned – Operating rates-cellular ready modem protocols - D-AMPS: TDMA-advantages – Disadvantages – Digital radio – Voice coding methods – Channel banks – PCM – TDM and line driver – Waveform coding – Voice coding – Hybrid coding – Modulation – Baud rate- TDM operation – Frames – Time slot format – Digital channel traffic signaling – Control channel operations – the IS –136 digital control channel – PCS overview- Extended battery life – Frequency utilization – Logical channels – Super frames and hyper frames –the PCS layered model – PCS messaging – Modem operations.

Unit III

GSM : Frequency allocation – governing body – GSM services – voice transport – data services – bearer services – teleservices – supplementary services – the subscriber identity module-frequency allocation –initial European GSM – united kingdom GSM – PCS 1900- TDMA operations- time slot utilization – speech coding – framing and channel organization – the GSM multiframe -data over GSM –modem incompatibility – adapter use-information transfer modes – inbound data fax – data copression – short message service – features – utilization- SMS centers – using the internet - CDMA: CITA requirements – deployments – IS 95- comparison with AMPS and TDMA -capacity – frequency allocation – speech coding – channel structure –down link channels – up link channels – CDMA data services – the CDMA air interface protocol stack – SMS -3CDMA -UMTS /IMT –2000- CDMA 2000

Unit IV

The WAP Protocol suite: Basic components – Architecture – Wireless Datagram Protocol - Port number use – The adaptation layer – Protocol operation – Wireless Transport Layer Security – Connection Management – Encryption support – The Wireless Application

Environment – The Makeup Language - Local Multipoint Distribution Service : Frequency allocation – Frequency Blocks, bands – Band width capacity – Architecture – Frequency considerations – The LMDS cell- Base station – the network interface unit – Access methods - Modulation- system capacity – FDMA –TDMA- Increasing cell capacity –LMDS advantages – Disadvantages.

Unit V

Multichannel multipoint distribution system : Frequency band – Potential Market – basic Architecture – Advantages of use – Potential Disadvantages – MDS –MMDS – Frequency Assignments – Transmission Methods – Multipath Communications – Minimizing Multipath Reflections - Blue Tooth : Compatibility problems –blue tooth to the rescue – potential utilization –comparison with infrared (IR) – system architecture – master slave relationship – power operating modes interface support – communications channels – networking - Wireless Lans: General characteristics – spread spectrum technology – application s- inventory control –hospital – hotel – training- trade shows – wireless rational – the IEEE 802.11 wireless LAN standard –initial effort –frequency selection – environments – architecture – operation – wireless home networking.

Reference :

Information Technology by Cygansky, Prentice Hall of India. Edn. ASIA.

S14MT - ALGORITHM ANALYSIS AND DESIGN

Unit I

Mathematics Review, background model – Algorithm analysis – running time calculations – General rules – Solutions for the maximum subsequence sum problem – Logarithms in the running time – checking analysis.

Unit II

Abstract Data Type (ADT) – List ADT – Array implementation of lists – Linked List – Doubly and circularly linked lists – Stack ADT – Queue ADT – Trees: Binary trees – Binary search trees.

Unit III

Hashing: Hash function – open Hashing – Closed Hashing – Priority Queues (Heaps): Binary Heap – Applications of priority queues Sorting: Insertion Sort – Shell Sort – Heapsort – Mergesort – Quicksort.

Unit IV

Graph Algorithms: Topological sort – Shortest Path algorithms – Network Flow Problems – Minimum Spanning tree – Application of DFS.

Unit V

Algorithm Design Techniques – Geedy Algorithms: Scheduling problem – Huffman codes – Approximate bin packing – Divide and Conquer : Running time of Divide and Conquer algorithms – Closest – Points problem – The selection problem – Theoretical Improvements for Arithmetic Problems.

References:

1. Data Structures and Algorithms Analysis in C++ - Mark Allen Weiss: Pearson Education Asia
2. Data Structures, Algorithms and Applications in C++ - Sahni : McGraw Hill Publication.

S15MT - ADVANCED COMPUTER GRAPHICS AND MULTIMEDIA

Unit I

Introduction to Graphics: The origin and importance of Computer Graphics – Graphics Hardware – Application of Computer Graphics – Graphics programming languages. Raster and Vector Graphics: Introduction to raster and vector system – Display and Hardcopy Techniques – Raster scan Display System, Video Controller – Vector scan display system – Display of Text and natural models – Input Devices for Interactive Operation – Image Scanning.

Unit II

Windows Graphics Programming (WGP) Introduction to Windows and APIs – WGP Fundamentals – Graphics Device Interface (GDI) – Device Control (DC) – GDI Coordinate system – creating and pointing Regions and Drawing models – Handling colors palettes and Bitmaps – Toolbar and status bar – Managing Windows with bitBlt – Modern methods.

Unit III

Introduction to Interactive Computer Graphics – Device Independence – Event handling – GUI Design – Geometrical Transformations for 2D and 3D Graphics – Matrix Representation of 2D Transformation and Homogeneous Coordinates – Windowing, View ports and clipping – matrix representation of 3D Transformation and composition of 3D Transformation – Projection in 3D – Planar Geometric Projection – Coordinate Systems.

Unit IV

Algorithms for Geometric and Raster Graphics: Introduction – clipping – Scan conversion Routines and Antialiasing – Filling Algorithms – Raster Graphics Algorithms.

Unit V

Multimedia – Overview – Multimedia operating systems – Compression Technology for Multimedia – System Requirements and Configurations for Multimedia –Multimedia Servers – Multimedia delivery, Multimedia Tools – Databases and Multimedia – Multimedia Applications.

References:

1. Computer Graphics - Donals Hearn/M.Parline Baker - Computer Graphics, Prentice Hall of India Ltd.

2. Computer Graphics & Multimedia – N. Krishnan, SCITECH Publications, Chennai, 2002.
3. Computer Graphics - A Programming Approach – Ivan Harrington, McGraw Hill Publications.
4. Interactive Computer Graphics – Neumann and Sproull, McGraw Hill Publications.
5. Fundamentals of computer graphics and multimedia by D.P.Mukherjee
6. Multimedia in Practice technology and applications by Judith Jeffcoate.

II SEMESTER

S21MT - COMPUTER COMMUNICATION

Unit I

Principles of Data Communication: Communication Models – Data transmission – Signal encoding Techniques – Multiplexing.

Unit II

Layered Architecture: Protocol Architecture – Digital data communication techniques – Data Link control.

Unit III

Wide Area Network: Circuit Switching and Packet Switching – Asynchronous Transfer Mode – Routing in Switched Networks – Congestion Control in Switched Data Networks.

Unit IV

Local Area Networks: LAN Protocol Architecture – Topologies – Transmission Media – Bridges – Switches – High Speed LANs.

Unit V

Network Protocols and Security: Internet Protocols – Transport protocols – Network Security – SMTP – MIME – HTTP – SNMP.

References:

1. Data and Computer Communications – William Stallings – 7th Edition – Prentice Hall of India, 2004.
2. Data Communication and Networking – Behrouz – A. Forouzan – 3rd Edition – Tata McGraw – Hill, 2004.
3. Communication Networks – Leon, Garcia – 2nd Edition – Tata McGraw Hill, 2004.
4. Communication Networks Principles and Practice – Kasers, Narang, N Narang – Tata McGraw Hill, 2005.- -----

S22MT - ADVANCED DATABASE MANAGEMENT SYSTEMS

Unit I

Introduction to Database Systems : Advantages of DBMS – Describing and Storing Data in a DBMS - Queries in a DBMS – Transaction Management – Structure of a DBMS

The Entity – Relationship Model: Overview of Database Design - Entities, Attributes and Entity Sets – Relationship Sets – Additional Features of the ER Model - Conceptual Databases Design with the ER Model - Conceptual Design for Large Enterprises.

The Relational Model: Introduction to the Relational Model - Integrity Constraints Over Relations - Enforcing Integrity Constraints - Querying Relational Data - Logical Database Design: ER to Relational - Introduction to Views – Destroying/Altering Tables and Views.

Unit - II

Relational Algebra and Calculus: Preliminaries - Relational Algebra - Relational Calculus - Expressive Power of Algebra and Calculus. SQL Queries: Fundamentals-Form of the basic SQL Query – Nested Queries –Aggregate Operators-Designing Active Databases-Overview of transaction management: ACID Properties-Transaction and Schedule-Concurrent Execution-Lock based Concurrency-Performance of Locking –Introduction to Crash Recovery.

Unit – III

Parallel and distributed databases- architectures for parallel databases - parallel query evaluation – data portioning – parallelizing sequential operator evolution code parallelizing individual operations – bulk loading and scanning architecture. Sorting-Joins-Parallel Query Optimization-Introduction to Distributed Databases. Types of Distributed Databases- Distributed DBMS Architectures-Client-Server Systems-Collaborating Server Systems-Middleware Systems-Storing Data in a Distributed DBMS-Fragmentation-Replication-Distributed Catalog Management- Naming Objects-Catalog Structure-Distributed Data Independence- Distributed Query Processing- Nonjoin Queries in a Distributed DBMS-Joins in a Distributed DBMS- Cost-Based Query Optimization-Updating Distributed Data-Synchronous Replication-Asynchronous Replication-Introduction to Distributed Transactions. Distributed Concurrency Control-Distributed Deadlock-Distributed Recovery-Normal Execution and Commit Protocols-Restart after a Failure-Two-Phase Commit Revisited-Three-phase Commit

Unit - IV

Schema Refinement and Normal Forms: Introduction to Schema Refinement-Functional Dependencies-Reasoning about FDs-Normal Forms-Properties of Decomposition-Normalization-Schema refinement in Database Design-Other kinds of Dependencies

Unit V

OBJECT-DATABASE SYSTEMS: New Data Types- Defined Abstract Data Types- Defining Methods of an ADT-structured Types-Manipulating Data of Structured Types- Object Identity, and Reference Types- Notions of Equality-Dereferencing Reference Types- Inheritance- Defining Types with Inheritance- Binding of Methods- Collection Hierarchies, Type Extents, and Queries -Database Design for an ORDBMS-Structured Types and ADTs- Object Identity-Extending the ER Model-Using Nested Collections-New Challenges in Implementing an ORDBMS- Storage and Access Methods- Query Processing-Query Optimization.

References:

1. DATA BASE MANAGEMENT SYSTEMS, Second Edition, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill International.
2. Data Base Management Systems, Elmashree & Navathe, Pearson Education Asia.
3. Data Base System Concepts, Schilbertz & Henry Korth, 4th Edition, McGraw Hill Publications, 2002.

S23MT - SOFTWARE ENGINEERING AND UML**Unit I**

The Software Process : Client, Developer, and User- Requirements Phase: Specification Phase - Design Phase- Implementation phase- Integration phase - Maintenance Phase- Retirement - Problems with Software Production - Essence and Accidents - Improving the Software Process - Capability Maturity Models - Other Software Process Improvement Initiatives - Costs and Benefits of Software Process Improvement.

Software Life Cycle Models: Build and Fix Model - Water Fall Model - Rapid Prototyping Model - Increment Model - Extreme Programming - Synchronize - and -Stabilize Models - Spiral Model - Object Oriented Life Cycle Model - Comparison of life cycle model.

Unit II

Planning and Estimating :Planning and the Software Process – Estimating Duration and Cost – Components of a Software Project Management Plan – Software Project Management Plan Framework - IEEE Software Project Management Plan.

Requirements Phase : Requirements Elicitation – Requirements Analysis – Rapid Prototyping – Human Factors – Rapid Prototyping as a Specification Technique – Reusing the Rapid Prototype – Management Implications of the Rapid Prototyping Model – Experiences with Rapid Prototyping – Techniques for Requirements Elicitation and Analysis.

Specification Phase : The Specification Document – Informal Specifications – Structured Systems Analysis – Other Semiformal Techniques – Entity – Relationship Modeling – Finite State Machines – Petri Nets.

Unit III

Design Phase: Design and Abstraction – Action Oriented Design – Data Flow Analysis – Transaction Analysis – Data-Oriented Design – Object-Oriented Design.

Implementation and Integration Phase: Introduction to Implementation and Integration – Testing during the Implementation and Integration Phase – Integration Testing of Graphical User Interfaces – Product Testing – Acceptance Testing.

Maintenance Phase : Maintenance Programmers – Maintenance Case Study – Management of Maintenance – Maintenance of Object-Oriented Software – Maintenance Skills versus Development Skills – Reverse Engineering – Testing during the Maintenance Phase.

Unit IV

Introducing the UML : An Overview of the UML – A Conceptual Model of the UML – Architecture — Mechanisms – Components - Basic Structural Modeling: Modeling the Vocabulary of a System – Modeling the Distribution of Responsibilities in a System — Modeling Primitive Types – Relationships : Modeling Simple Dependencies – Modeling Single Inheritance – Modeling Structural Relationships – Common Mechanisms: Modeling New Building Blocks – Modeling Comments – Modeling New Semantics – Modeling New Properties – Diagrams: Modeling Different Views of a System – Modeling different Levels of Abstraction – Modeling Complex Views – Class Diagrams, Advanced Class: Modeling the Semantics of a Class – Advanced Relationships: Modeling Webs Relationships – Interfaces, Types, and Roles: Modeling the Seams in a System – Modeling Static and Dynamic Types

Unit V

Packages: Modeling Groups of Elements – Modeling Architectural Views – Instances: Modeling Concrete Instances – Modeling Prototypical Instances – Object Diagram, Usecasediagrams, Interaction diagrams, Activity diagrams, Statechart diagrams, Deployment diagrams

References:

Classical and Object Oriented Software Engineering, Stephen R.Schach, McGraw Hill International Edition, 2002.

1. Engineering, Sommerville, Addison-Wesley, 2000.
2. Software Engineering, 5th Edition, Roger Pressman, McGraw Hill, 2001.
3. Object Oriented and Classical Software Engg, Lethbridge, McGraw Hill, 2002.
4. The Unified Modeling Language User Guide – Grady Booch et. al, Pearson Education Asia, 2001

S24MT - ADVANCED DIGITAL IMAGE PROCESSING

Unit I

Digital Image Fundamentals: Fundamental steps in Image Processing –Components of Image Processing System-Image Sampling and Quantization-Basic Relationships between Pixels. Image Enhancement in Spatial Domain: Basic Gray level Transformations-Histogram Processing- Enhancements using Arithmetic/logic Operations-Basics of Spatial Filtering-Smoothing Filters-Sharpening Filters.

Unit II

Image Enhancements in the Frequency domain : Smoothing Filters-Sharpening Filters-Homomorphic Filters - Image Restoration: Degradation model –Noise Models-Restoration in the presence of Noise- Wiener Filter. Color Image Processing : Color Fundamentals-Color Models-Basics of full Color image Processing-Color Transformations

Unit III

Wavelets and Multi-resolution Processing: Image Pyramids and Subband Coding - Wavelet Transform in one dimension- FWT. Image Compressions: Fundamentals – Image Compression models – Elements of Information Theory – Error – Free Compression – Lossy compression – Image Compression standards.

Unit IV

Image segmentation: Detection of discontinuities – Edge linking and Boundary detection – Thresholding – Region Orientation Segmentation – use of motion in segmentation.

Unit V

Morphological Image Processing: Basic Binary morphological Operations. Basic grayscale morphological Operations. Representation and Description: Representation-Boundary Descriptors.

References:

1. Refael C. Gonzalez & Richard E. Woods - Digital Image Processing, Addison Wesley publication corporation, 1993
2. Image Processing Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac, Roger Boyle, Second Edition, Vikas Publishing House, 2001.

S25MT - FUZZY LOGIC AND ITS APPLICATIONS**Unit I**

Uncertainty and Imprecision – Statistics and Random Processes – Uncertainty in Information – Fuzzy Sets and membership – Chance versus Ambiguity. - Classical Sets and Fuzzy Sets: Classical Sets – Fuzzy Sets – Sets as Points in Hypercubes - Classical Relations and Fuzzy Relations: Cartesian Product – Crisp Relations – Fuzzy Relations – Tolerance and Equivalence Relations – Fuzzy Tolerance and Equivalence Relations. Membership Functions.

Unit II

Fuzzy-to-Crisp Conversions: Lambda-Cuts for Fuzzy Sets – Lambda-Cuts for Fuzzy Relations – Defuzzification Methods. Fuzzy Arithmetic, Numbers, Vectors, and the Extension Principle : Extension Principle – Fuzzy Numbers – Interval Analysis in Arithmetic – Approximate Methods of Extension – Fuzzy Vectors.

Unit III

Classical Logical and Fuzzy Logic: Classical Predicate Logic – Fuzzy Logic – Approximate Reasoning – Fuzzy Tautologies, Contradictions, Equivalence, and Logical Proofs – Other Forms of the Implication Operation – Other Forms of the Composition Operation. Fuzzy Rule-Based Systems: Natural Language – Linguistic Hedges – Rule-Based Systems – Graphical Techniques of Inference.

Unit IV

Fuzzy Nonlinear Simulation: Fuzzy Relational Equations – Partitioning – Nonlinear Simulation Using Fuzzy Rule-Based Systems – Fuzzy Associative Memories (FAMs). Fuzzy Decision Making: Fuzzy Synthetic Evaluation – Fuzzy Ordering – Preference and Consensus – Multiobjective Decision Making – Fuzzy Bayesian Decision Method – Decision Making under Fuzzy States and Fuzzy Actions.

Unit V

Fuzzy Classification: Classification by Equivalence Relations – Cluster Analysis – Cluster Validity – Classification Metric – Hardening the Fuzzy- Similarity Relations from Clustering. Fuzzy Pattern Recognition: Feature Analysis – Partitions of the Feature Space – Single Sample Identification – Multifeature Pattern Recognition – Image Processing – Syntactic Recognition.

Reference:

1. Fuzzy Logic with Engineering Applications-Timothy Ross, McGraw Hill Publications.

SP2MT Mini Project

III SEMESTER

S31MT - ARTIFICIAL NEURAL NETWORKS

Unit I : Introduction to Neuroscience : Biological and Artificial

Introduction to neuroscience – learning of human brain – artificial neuron model – activation function – single, multiplayer neural network – supervised and unsupervised training – perceptron –training of perceptron, Adaline and Madaline –architecture – training.

Unit II : Feed forward networks

Back propagation –training algorithm – applications, Radial Basis Function network(RBFN) – architecture and training algorithm, counter propagation –self organizing map –training algorithm and application

Unit III :Statistical training methods and recurrent networks

Boltzmann machine, Cauchy machine and Gaussian machine –training, Hopfield network –Associative memories –applications –traveling salesman problem –Bidirectional associative memory(BAM) –continuous, adaptive and competitive BAMs.

Unit IV: ART and special networks

Adaptive Resonance Theory(ART) –architecture –classifications in operation – application, Cognitron –architecture –training, Neocognitron –architecture –training, Optical Neural Networks

Unit V: Applications of neural networks

Neural networks in image processing –compression, pattern recognition rate coded restricted Boltzmann machine for face recognition –application neocognitron for integrated chip image processing –optical neural networks in image recognition

References:

1. Neural computing : Theory and practice – by Phillip D. Wasserman, ANSA research. Inc, Van nostrand reinhold, New York.
2. Introduction to Neural networks using Matlab 6.0 –by S N Sivanandam, S Sumathi, S N Deepa, Tata McGraw-Hill Publishing company Limited, New Delhi.
3. Neural networks –by Simon Haykin
4. Neural networks –by Satish Kumar, Tata McGraw-Hill Publishing company Limited, New Delhi.

S32MT - ENGINEERING RESEARCH METHODOLOGY

Unit I:

Basic research methodology: Objectives and Motivation in Research - Types of Research - Approaches and Significance of Research - Research Methodology versus Research Methods - Research Process-Finding a Research Advisor/Guide, What to Look for in a Potential Research Advisor/Guide, How to Find an Advisor/Guide, The Advisor-Advisee Relationship; Finding a Topic and Beginning Research, Getting Research Ideas, How to be an Active Reader and Listener, Getting Exposed to Research, Directed Study; Formulating the Research Problem: Develop the Nucleus of an Idea, Extensive Literature Survey:A Trap to Avoid, Choosing an Idea, Stay Active - Measure of Good Research - Common Problems for Researchers

Unit II:

Overview of the Theory of Science and history of scientific research - Overview of Research Methodology for Engineering Research - Science versus Engineering - Distinct perspectives of goals Research methodology for circuit branches: Formulating the Research Problem - Research Design - Evolution of Computing Research

Unit III:

Research Methods for Engineering Research - History of ideas in computing - Measurements based research methods in computer engineering - Measurements based research methods in Signal and Image Processing, Graphics, Vision and Pattern Recognition - Deductive Methods in Computing Science

Unit IV:

Deductive Methods in Signal and Image Processing, Graphics, Vision and Pattern Recognition - Inductive Methods in Computing Science - Inductive Methods in Signal and Image Processing, Graphics, Vision and Pattern Recognition - Building Models – Simulation

Unit V:

Searching for scientific papers - Writing and presentation of a research paper for a conference or journal - Review and opposition of engineering/scientific research papers - Writing a good thesis: Research report writing - Converting your research thesis into a monograph - Research education, the research society and research policy

Text and Reference: Lecture Notes by Prof.Dr.Krishnan Nallaperumal on “Engineering Research Methodology - A Computer Science and Engineering and Information Technology Perspective.

LIST OF ELECTIVES

GROUP A

S3AMT - DATA MINING

UNIT I

Introduction:- What is Datamining? DataMining on what kind of data, Datamining Functionalities, Classification of DataMining Systems, Major Issues on Datamining, Introduction to OLAP,OLAP technology for Data Mining, Data warehousing, Data warehousing to Datamining, Optimizing Data for mining, Data preprocessing.

UNIT II

Data Mining Primitives:- Datamining Querylanguage, Association Rules in largeDatamining , KDD Process, Fuzzy sets and logic, , Classification and Prediction:- Information retrieval, Dimensional Modeling of Data, Pattern Matching, Estimation Error-Em,MLE.

UNIT III

Models based on Summarization:- Bayes Theorem, Chi squared Statistics Regression, Decision Tree. Neural Networks, Genetic Algorithms. **Cluster Analysis-** Outlier, Cluster Vs Classification, Clustering Issues, impact of Outliers on clustering, clustering problems, Clustering Approaches.

UNIT IV

Clustering Algorithms:- Hierarchical algorithm-SingleLink, MSTSingle Link, Complete Link, Average Link, Dendrogram. Partitional Algorithm-MST,Squared Error, K-Means, Nearest Neighbor, PAM, BEA, GA, Categorical algorithm,Large Database.

UNIT V

Web Mining:- Introduction,Webdata,Web Knowledge Mining Taxonomy, Web Content mining, Web Usage Mining Research, Ontology based web mining Research, Web mining Applications.

References:

- 1) DataMining Concepts and Techniques -Jaiwei Han Micheline Kamber
- 2) DataMining with SQL- Technical Reference Material.

S3BMT - GRID COMPUTING

UNIT I

Introduction-cluster computing models-grid models-mobile grid models-applications-vision of mobile grids-Parset:Semantics of the parset construct-expressing parallelism through parsets-implementing parsets on a loosely coupled distributed system

UNIT II

Anonymous Remote Computing Model: Introduction-Issues in parallel computing on interconnected workstations-existing distributed Programming approaches-The ARC model of computation-the two-tired ARC language constructs-Integrating task parallelism with data parallelism:A model for integrating task parallelism into data parallel programming platforms-integration of the model into ARC-design and implementation-applications.

UNIT III

Anonymous remote computing and communication model: introduction-location-independent inter-task communication with DP- DP Model of iterative grid computations-design and implementation of distributed pipes-Parallel programming model on CORBA-introduction-existing works-notion of concurrency-system support-case study-Parallel Programming Model on CORBA: introduction-existing works-notion of concurrency-system support-implementation.

UNIT IV

Sneha-Samuhan:grid computing model-introduction-a parallel computing model over grids-design and implementations of the model-performance studies-Introducing mobility into anonymous remote computing and communication model: Introduction-issues in mobile clusters and parallel computing on mobile clusters-moset overview-moset computation model-implementation-performance

UNIT V

Distributed simulated annealing algorithms for job shop scheduling-introduction-distributed algorithms for job shop scheduling-implementation-Parallel simulated annealing algorithms: Introduction-simulated annealing technique – clustering algorithm for simulated annealing-combination of genetic algorithm and simulated annealing algorithm-implementation of the algorithm-Epilogus:DOS grid-mobile grid monitoring system-healthcare application scenario.

TEXT BOOK

1. GRID COMPUTING –A Research monograph-by D.Janakiram,Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005

S3CMT - MULTIMEDIA SYSTEMS DESIGN AND DEVELOPMENT

Unit I

INTRODUCTION - Definition of Multimedia - Emergence of Multimedia Systems - From Bush's Memx to Multimedia Systems - Hypertext and Hypermedia systems - Interactive Multimedia Systems - Multimedia on-line. Multimedia Hardware : Hardware peripherals - CD - ROM Drives, and DVD's - Video Graphics & Video Capture Utilities - Audio Cards - Digital Cameras & Camcorders - Mobile Multimedia - Multimedia Software - Multimedia development tools - Programming vs. Authoring - Multimedia authoring tools (Director, Authorware, ToolBook, Visual Basic etc.) - Animation and Image manipulation tools (An overview of tools like: PhotoShop, 3D Studio, Flash, Bryce etc.) - Audio and Video editing tools (An Overview of tools like SoundForg, Adobe - Premier etc.)

Unit II

Media Integration and Production Issues : Multimedia Elements - Text manipulation and Integration issues - Graphic manipulation and Integration issues; Working with different graphic files (JPEG, GIF, TIFF, PSD, PICT, BMP, etc.) - Audio manipulation and Integration issues; From MIDI to Digital Sound production. Issues in "sampling" digital sound and producing CD quality audio for IMS - Video manipulation and Integration issues; An overview of AVI, QuickTime -MPEG; video capturing and integration, synchronisation issues, etc. - Managing IMS Production - Audio Asset management, Video asset management and Graphic asset production - The authoring tree for integration and production.

Unit III

Designing for Usability - Human Factors in the Design of Interactive-Multimedia Systems - Human Computer Interaction: General overview - User Interface design: theories, principles and guidelines - Interactive Design & Prototyping - Techniques for Prototyping; - Rapid Prototyping, Storyboards techniques, etc - Models of the User in design - User requirement modelling - Soft systems methodology - Participatory design - Cognitive models - Issues on Usability - Testing for Usability.

Unit IV

Issues in Design & Developments of Interactive Multimedia Systems (IMS) - An overview of design models for IMS - Review of Hypermedia design models: from Hyper-G, AHM and CMIFed to RMM - Key Issues in the Design of Interactive Multimedia Systems - "Navigate" or "Getting Lost in Hyperspace" looking at navigational - equirements in the design process - Importance of the use of appropriate metaphors in the design of IMS - Detailing task requirements and planning Media preparation - The IMS "Design and Development process model " - Applying the DDPM to two different case studies - Case studies.

Unit V

Evaluation of Interactive Multimedia Systems : evaluation methodologies - Formative vs. Summative techniques - Observation or "Illumination" - Developing appropriate evaluation methodologies for IMS. The WWW as a Hypermedia Environment: The emergence of the Internet & the WWW - The WWW as a hypermedia WWW - The

WWW and Interactivity - Issues in delivering Multimedia content on the WWW - Synchronised Integrated Mark-up Language (SMIL) - Animation on the WWW - Audio content - Video content - VRLM - Design and Development issues in the WWW - Case studies. Multimedia as a developing Technology.

References:

1. Design and Development of Interactive Multimedia Systems – Mohamed DASTBAZ - Tata McGraw Hill Publications, New Delhi, 2002.
2. Multimedia, Make it work, Tay Vaughan, Tata McGraw Hill Publications, New Delhi.
3. Multimedia System, John F.Koegal Buford, Pearson Education Asia
4. Multimedia Literacy, Fred T.Hofstetter, McGraw Hill, 2001.

S3DMT - CRYPTOGRAPHY

Unit I

Cryptography: Security Provided by Computer Operating Systems – Attacks that Bypass Operating Systems – Added Protection Through Cryptography – The Role of Cryptography in Data Security - Symmetric-Key Cryptography: Some Crypto Jargon – Generating a Key – Attacks on Encrypted Data – Symmetric Algorithms: The Key Table – Symmetric Algorithms : Block Versus Stream Ciphers – Digital Encryption Standard – Triple DES – Commercial DES – Replacements.

Unit II

Symmetric-Key Management: Password-Based Encryption – Hardware-Based Key Storage – Biometrics - The Key Distribution Problem and Public-Key Cryptography: Sharing Keys in Advance – Using a Trusted Third Party – Public-Key Cryptography and the Digital Envelop – Security Issues – Some History of Public-Key Cryptography – How Public-Key Cryptography Works – Comparing the Algorithms – Protection Private Keys – Using the Digital Envelop for Key Recovery .

Unit III

The Digital Signature: The Uniqueness of a Digital Signature – Message Digests – Back to digital Signatures – Trying to Cheat – Implementing Authentication, Data Integrity, and Non repudiation – Understanding the Algorithms – Comparing the Algorithms – Protecting Private Keys – Introduction to Certificates – Key Recovery - Public-Key Infrastructures and the X.509 Standard : Public-Key Certificates – The Components of a PKI – Registering and Issuing Certificates – Revoking a Certificate – Trust Models – Managing Key Pairs – Deploying PKI – The Future of PKI – Certificate Policies and Certification Practice Statements - Network and Transport Security Protocols

Unit IV

Internet Protocol Security – The Authentication Header Protocol – The Encapsulating Security Payload Protocol – Security Associations – Security Database – Key Management – Secure Sockets Layer – Session and Connection States – The Record Layer Protocol – The Change Cipher Spec Protocol – The Alert Protocol – The Handshake Protocol - Application-

Layer Security Protocols: S/MIME – Secure Electronic Transaction [SET] - Hardware Solutions : Overcoming Software Limitations: Cryptographic Accelerators – Authentication Tokens – Smart Cards – JavaCards – Other Java Tokens – Biometrics – Combining Authentication Methods

Unit V

Digital Signature: Beyond Security: Legislative Approaches – Legal Guidelines from the American Bar Association – Legal Concepts Related to Digital Signatures – Requirements for the Use of Digital Signatures – Current and Pending Legislation – Dealing with Legal Uncertainties - Doing it Wrong: The Break-Ins: Measuring Losses – Types of Security Threats – Identifying Intruders – Case Studies – Information Security: Law Enforcement - Doing it Right: Following Standards: Security Services and Mechanisms – Standards, Guidelines, and Regulations – Developer Assistance – Case Studies.

References:

1. RSA Security's Official Guide to Cryptography, Steve Burnett & Stephen Paine, Tata McGraw Hill Publishing Company, 2001.
2. Davis, IP Sec Securing VPNs, Tata McGraw Hill Publishing Company, 2001.
3. King, Security Architecture Design, Deployment & Operations, Tata McGraw Hill Publishing Company, 2001.
4. Nash, PKI Implementing and Managing E-Security, Tata McGraw Hill Publishing Company, 2001.

S3EMT - E-COMMERCE APPLICATIONS

Unit I

Introduction to E-Commerce: The scope of E-Commerce - Definition - Internet commerce - Electronic Markets - Electronic Data Exchange. Business Strategy in an Electronic Age: The value chain - supply chains - Porter's value chain Model - Inter organisational value chains - Competitive Advantage using e-commerce.

Unit II

Strategic implications of IT - Business capability - Strategy formulation and Implementation Planning - e-commerce implementation - e-commerce evaluation. Case Studies : Airline Booking Systems - Web Booking Systems - Competitive outcomes.

Unit III

Business to Business Electronic Commerce: Inter-organisational Transactions - Electronic Markets - Advantages and Disadvantages of Electronic Markets and its future. Electronic Data Interchange (EDI): Definitions, Examples - EDI Technology - EDI Communications - Implementation - EDI Agreements - Security.Purchasing On-line.

Unit-IV

Business to Consumer Electronic Commerce: The e-shop - e-commerce technologies - consumer e-commerce advantages and disadvantages - Internet Concepts - TCP/IP - Uses of Internet - Internet Age Systems.

Unit V

A page on the web - HTML Basics - Client Side Scripting - Server side scripting.
The elements of e-commerce: Internet e-commerce security - A Web Site Evaluation Model - Internet Bookshops - Internet Banking - online share dealing - e-diversity - Technology Adoption.

Reference:

1. E-Commerce : Strategy, Technologies and Applications - David Whiteley - Tata McGraw Hill Publishing Company, 2000.
2. E-Commerce Logistics and Fulfillment - Deborah L.Bayles - Pearson Education Asia - Addison Wesley Longman (Singapore) Pte. Ltd.
3. Managing your e-commerce business - Brenda Kienan - 2nd edition - Prentice Hall of India, New Delhi, 2001.
4. Cases in E-Commerce – Jeffrey F.Rayport – McGraw-Hill 2002.

S3FMT - DISPLAY SYSTEMS ENGINEERING**Unit I**

Introduction to Display Systems: Character of the display field - Processing system - Component system - Data organization and display technology - The structure of the information display technology. Display system development : High definition displays - Aural component of visual realism - Display systems.

Unit II

Principle Of Vision And Application Of Visual Properties: Sources of Illumination - Luminance and Colour response of eye - Photometry quantities, Colour representation, Function of Camera - Television system, Video colorimetry, Video system characteristics - Working principle and display application of LED, LD, IR Emitters - Liquid crystal and plasma devices. Alpha numeric displays, Optical fibre displays.

Unit III

Measuring Display Parameters: Visual acuity - Contrast – Flicker - Visual spectrum - Measurement of colour Displays - Application of Zone pattern Signal. Broadcast Sound Display: Basic Sound - Behaviour of sound waves - Hearing concept - Loud Speakers - Basic stereo - Processing of Audio - Digital Audio - Dolphy system - Surround sound system.

Unit IV

Recording, Printing and Reprographic Media: Video Cassette recorders: Video Tape characteristics - Tape recording and playback - VCR-TV link - Digital Video Disc (DVD): DVD technology - Disc and data details DVD Audio - DVD Video - DVD on Computer - DVD production - Printers and Plotters - Reprographic system.

Unit V

Cathode Ray Tube And Projection Display Systems: Cathode ray Tube fundamentals - CRT Deflection systems - Colour CRT Display Devices. Projection System Fundamentals - Projection Display systems.

References:

1. Jerry Whitaker, “ Electronic Displays Technology, Design, and Applications”, McGraw-Hill International Editions. 1994.
2. H.R.Luxenberg, L.Kuehn, “ Display Systems Engineering”, McGraw-Hill Book Company, 1968.
3. Jim Taylor, “ DVD Demystified “ Second Edition, McGraw-Hill International Edition, 2001.
4. Michael Talbot- Smith, “ Broadcast Sound Technology”, Second Edition, Butterworth-Heinemann Ltd. 1990.
5. J.I.Ponkove, “ Display Devices “ Topics in Applied Physics, Vol-40, Springer –Verlag , Berlin Heidelberg New York, 1980.

GROUP B

S3GMT - PROGRAMMING IMAGE PROCESSING THROUGH IDL

Unit I

Overview of IDL programming: Overview of IDL Applications - Creating and Running Programs in IDL - Executing Batch Jobs in IDL - Creating SAVE Files of Programs and Data - Creating Procedures and Functions - Library Authoring - Program Control structures - Debugging and Error-Handling - Building Cross-Platform Applications - Writing Efficient IDL Programs - Multithreading in IDL-Components of the IDL Language: Expressions and Operators-Working with Data in IDL – Strings – Arrays – Structures – Pointers - Files and Input/Output. IDL Object Programming: The Basics of Using Objects in IDL - Creating an Object Graphics Display - Positioning Objects in a View - Working with Image Objects - Working with Plots and Graphs - Working with Surface Objects - Creating Volume Objects - Polygon and Polyline Objects - Annotating an Object Display - Animating Objects - Selecting Objects - Displaying, Copying and Printing Objects - Displaying, Copying and Printing Objects

Unit II

Creating Applications in IDL: Creating IDL Projects - Providing Online Help For Your Application - Distributing Runtime Mode Applications - Distributing Virtual Machine Applications - Distributing Callable IDL Applications - Distributing ActiveX Applications. Creating Graphical User Interfaces in IDL: Creating Widget Applications - Using the IDL GUIBuilder - Widget Application Techniques.

Unit III

Fundamentals of color image processing-Noise generators for digital image processing-Digital image transform algorithms:-2-D Discrete Fourier Transform-Row-Column FFT algorithm-Memory problems in 2-D DFT calculations-Vector-radix fast Fourier transform algorithm - Polynomial transform FFT – Two dimensional power spectrum estimation – Discrete Cosine Transform – Two Dimensional discrete cosine transform – Discrete wavelet transform. Digital image filtering and enhancement: Introduction – Direct implementation of two-dimensional FIR digital filters – Fast fourier transform implementation of FIT digital filters – Block methods in the linear convolution calculation – Inverse filter implementations – Wiener filters – Median filter algorithms – Digital filters based on order statistics – Signal Adaptive order statistic filters – Histogram and histograms equalization techniques – Pseudocoloring algorithms – Digital image halftoning Image interpolation algorithms – Anisotropic Diffusion – Image Mosaicing – Image watermarking.

Unit IV

Digital image Compression: Introduction – Huffman coding – Run-length coding – Modified READ coding – LZW compression – Predictive coding – Transform image coding – JPEG2000 compression standard. Edge detection algorithms: Introduction – Edge detection – Edge thresholding - Hough transform – Edge-following algorithms – Other Recent works on Compression and edge detection.

Unit V

Image Segmentation algorithms: Introduction – Image segmentation by thresholding – Split/merge and region growing algorithms – Relaxation algorithms in region analysis – Connected component labeling – Texture description. Shape description: Introduction – Chain codes – Polygonal approximations – Fourier descriptors – Quadtrees – Pyramids – Shape features – Moment descriptors – Thinning algorithms – Mathematical morphology – Grayscale morphology – Skeletons – Shape decomposition – Voronoi tessellation – Watershed transform – Face detection and recognition – Other Recent works in segmentation and Shape description.

Reference:

1. Digital Image Processing Algorithms and Applications, I.Pitas – A. Wiley – Interscience Publication, 2000.
2. Getting Started with IDL, IDL Version 6.0, July 2003 Edition.
3. iTool User's Guide, IDL Version 6.0, July 2003 Edition.

S3HMT - TOPICS IN KNOWLEDGE AND DATA ENGINEERING

S3JMT - DIGITAL SIGNAL PROCESSING

Unit I

Discrete Time Signal and System: Discrete signals – decimation and interpolation-aliasing and sampling theorem, Linear time invariant systems. Discrete –time system classification – by difference equation-impulse response –stability causality and convolution sum : z-Transform and system analysis

Unit II

DFT and its computation -Discrete-time fourier Transform(DTFT),DFT and properties, Computation of DFT and IDFT using Fast Fourier Transform(FFT) – Radix two DIT and DIF algorithms, Calculations of Power spectrum using DFT – periodogram.

Unit III

Digital Filters - Design of linear phase FIR filter using windows method, Frequency sampling method.Analog design approximation of Butterworth and Chebyshev filter.Design of IIR Filters by indirect methods-Impulse invariant methods – Bilinear Z – Transformation method – Design of HPF BPF using frequency transformation

Unit IV

Implementation of Digital filters: Realization of IIR structure – Direct, Cascade, Parallel and Lattice structure –Realisation of FIR Structure – Direct and Lattice Structure – Finite word length effects in digital filter – representation of number, quantization, analysis of quantization effects, limit cycles in IIR Filter – Scaling

Unit V

Application: Basics in Multirate signal processing – sampling – ratio conversion – sub-band coding of speech and audio signal, Musical sound processing.

References:

1. Sanjit K Mitra – Digital Signal Processing – A computer Based approach 2nd edition, Tata McGraw-Hill publishing company limited, 2001.
2. Salivahanan – Digital signal Processing – Tata McGraw-Hill Publishing company Limited, 2000.
3. John G Proakis & Manolakis – Digital Signal processing Principle algorithms and application 2nd edition – Prentice Hall of India Pvt., Limited, 1995.
4. David J Defatta, Joseph G Lucas William S Hodgkin – Digital Signal processing A system design approach, John Wiley , 1995

S3KMT - CLIENT-SERVER COMPUTING

Unit-I

Communication systems-definitions-functions-layers and protocols-OSI reference model-client/server components- remote procedure calls- Evolution of processing - advantages of client/server computing.

Unit-II

Distributed computing environment-multitiered, cooperative client / server and cooperative processing techniques. Single system image-distributed presentation-distributed processing, distributed data-Software distribution and management.

Unit-III

Clients-role and functions of clients-GUI- requirements for standard GUI -GUI features-example GUIs-X terminal-motif-open look.-Servers-functions of server-hardware architecture for servers.

Unit-IV

Cooperative processing structure-Presentation functions: distributed and remote presentations-application logic functions: distributed functions , transactions and distributed transaction processing. Data management logic functions: distributed data and data management architecture. remote data management.

Unit-V

Data distribution methods-relational model-manual extract-snap shot-replication-fragmentation-data distribution. Distributed data access: remote request-remote transaction-distributed transaction - distributed request. Database transaction management: database transactions -two phase commit protocols.

References:

1. Client/Server Architecture, Alex Berson, McGraw-Hill International Edition 1997.
2. Dewire, Client Server Computing, Tata McGraw Hill Publications, 1998.

S3LMT - DISTRIBUTED OPERATING SYSTEM

Unit I

Introduction to Distributed Systems: Goals – Hardware Concepts – Software Concepts – Design Issues – Communication in Distributed Systems: Layered Protocols - Asynchronous Transfer Mode Networks – The Client – Server Model – Remote Procedure Call – Group Communication.

Unit II

Synchronization in Distributed Systems: Clock Synchronization Systems: Clock Synchronization - Mutul Exclusion - Election Algorithms - Atomic Transaction - Deadlocks in Distributed Systems - Processes and Processors in Distributed Systems: Threads - System Models - Processor Allocation - Schedulingin Distributed Systems - Fault Tolerance - Real-Time Distributed Systems.

Unit III

Distributed File Systems: Distributed File System Implementation - Treends in Distributed File Systems - Consistency Models - Page-Based Distributed Shared-Variable Distributed Shared Memory - Object-Based Distributed Shared Memory - comparison.

Unit IV

Amoeba: Introduction to Amoeba - Objects and Capabilities in Amoeba - Process Management in Amoeba - Communication in Amoeba - The Amoeba Servers - Mach:

Introduction to Mach - Process Management in Mach - Memory Management in Mach - Communication in Mach - Unix Emulation in Mach.

Unit V

Chorus: Introduction to Chorus - Process Management in Chorus - Memory Management in Chorus - Communication in Chorus - Unix Emulation in Chorus - Cool: An Object-Oriented Subsystem - Comparison of Amoeba, Mach, and Chorus - DCE: Introduction to DCE - Threads - Remote Procedure Call - Time Service - Directory Service - Security Service - Distributed File System.

Reference:

Distributed Operating System, Andrew S. Tanenbaum, Pearson Education Asia, 2001

S3MMT - TELECOMMUNICATIONS-CONVERGING TECHNOLOGIES

Unit I

Introduction to Telecommunications: Fragmentation of the Audience -Concentration of Ownership and Conglomeration -Globalization - Hypercommercialization - The Inevitability of Convergence -Studying Telecommunications - Conflicting Telecommunications Cultures -Radio and Audio :Technological and Economic Roots -Early Advances in Audio Recording -The Coming of Broadcasting - The Coming of Regulation - Advertising and the Networks -Contemporary Radio -FM, AM, and Noncommercial Radio - Radio's Local Nature - Radio's Fragmented Nature - Radio's Specialized Nature - Radio's Personal Nature - Radio's Mobile Nature -The Business of Radio -Radio as an Advertising Medium - Deregulation and Ownership -New Technology, Audience Fragmentation, and Convergence -Satellite and Cable - Digital Technology -Digital Radio - Web Radio Television :Technological and Economic Roots -Mechanical and Electronic Scanning - The Freeze -The Fifties -Television and Its Audiences -Network Television -The Affiliates -The Networks and Program Content -New and Converging Television Technologies -Remote Control - Cable - VCR - DVD - Direct Broadcast Satellite (DBS) - Digital Video Recorders - The Internet - Digital Television.

Unit II

Noncommercial Broadcasting -The Roots of Educational Broadcasting - Educational Television -From Educational to Public Broadcasting -Public Broadcasting Today- Criticisms of Public Broadcasting - NPR – PRI- PBS -Other Noncommercial Broadcasters -College Radio - Community Radio - Religious Radio and Television Stations -Corporate and Industrial Telecommunications - Roots of Corporate and Industrial Telecommunications - Corporate and Industrial Telecommunications Today -Converging Technologies and Applications of Corporate and Industrial Telecommunications -Satellites and Videoconferencing - Satellites and Video Networks - Satellite-Delivered Media Tours and Video News Releases - Telecommunications Satellites - CD-ROM, Videodiscs, and Multimedia - The Internet and World Wide Web - Converging Functions .

Unit III

Cable -Technological and Economic Roots -Cable Reception and Distribution - Cable's Economic Structure - Early Regulation of Cable -Cable Today -Programming - Concentration - The Telcos – Satellite -The Internet: -Technological Roots of the Internet - The Development of the Computer - Military Applications - The Personal Computer-The Internet Today -The Operation of the Internet -The Internet and Its Users -The Commercialization of the Internet -E-commerce and E-tailing - Portals - Concentration - Emerging Internet Technologies: The Heart of Convergence -Wireless Internet - Embedded Systems - Push Technology - MP3 - Internet Video - Linux .

Unit IV

The Practice of Telecommunications -Conceptualizing and Counting the Audience-The Broadcast versus the Telecom Model -The Broadcast Audience -The Roots of Audience Measurement -A.C. Nielsen - Arbitron -Contemporary Radio Ratings -Contemporary Television Ratings -Demographics - Sampling -Ratings Problems and Controversies - Broadcaster/Ratings Service Conflict - Why the Ratings Are Used -Counting Internet and Web Users -Advertising -The Roots of Broadcast Advertising -Early Television Advertising - The Evolution of Television Commercials - Combating Clutter -Contemporary Radio Advertising -Radio Sales - Radio as an Advertising Medium-Contemporary Television Advertising -Television Sales - Television as an Advertising Medium Contemporary Cable Television Advertising -Cable as an Advertising Medium - Barter and Co-op Advertising - Other Forms of Broadcast and Cable Advertising Contemporary Online Advertising -Online Classified Advertising - The Web as an Advertising Medium -The Advertising Environment - The Regulation of Advertising - Increased Audience -Segmentation - Criticism of Advertising.

Unit V

Programming :Radio Programming -Programming Music Format Commercial Radio - Programming News and Information Format - Consultants, Syndicators, and Networks - Programming Noncommercial Radio-Broadcast Television Programming -Programming Prime Time Network Television - How a Program Gets on the Air - Changes in Program Ownership - Programming Practices - Programming Non-Prime Time Network Television - Programming Local Commercial Television -Syndication -Buying Syndicated Programming - National Cable Television Programming - Global Telecommunications :-The Roots of Global Telecommunications -International Telecommunications Before Satellites - Satellites and Global Telecommunications -Global Telecommunications Today -Comparative Analysis: Four Theories and Five Concepts - Programming -The Debate Over Cultural Imperialism - Telecommunications Rights and Responsibilities:-Rights and Regulations -The Roots of Telecommunications Regulation -Defining and Refining the First Amendment - Other Issues of Media Freedom -The Federal Communications Commission -Other Regulatory Agencies - Contemporary Issues In Regulation -Contemporary Cable Regulation - Regulating Digital Television - Regulating the Internet - Ethics and Self Regulation -Social Responsibility - Media Industry Ethics -Defining Ethics - Three Levels of Ethics - Balancing Conflicting Interests - Theories of Moral Reasoning - Applying Media Ethics -Making Ethical Decisions

Codes of Ethics and Self Regulation -Other Forms of Self Regulation - Limitations of Self Regulation -Effects -The Effects Debate -The Pros and Cons of Media Effects Media Effects -Violence - Drugs and Alcohol - Gender and Racial Stereotyping - Political Campaigns and Voting - Prosocial Effects-Online Democracy -Information, Knowledge, and Understanding .

Reference:

Kimberley Massey – Introduction to Telecommunications – Converging Technologies, McGraw-Hill publishing Company limited,2000

GROUP C

S3NMT – TOPICS IN AIX – SYSTEM ADMINISTRATION

UNIT 1

Introduction To AIX Programming: - Introduction to AIX-Introduction to File System –System Administration-Login-Logout-AIX Commands-Files and Directories Commands-AIX Directories view –working with AIX Files –File Permissions-AIX Editors.

UNIT II

Boot Process:- The boot process, system initialization,/etc/inittab file, recover a boot process. Run levels:- RC.*files – show – modify and reset the boot list - AIX shell basics - shell variables. AIX configuration:- ODM commands, LINUX application under AIX 5L - LINUX affinity, network file system - the CHDEV command - NTP.conf file-network security. AIX Shell Basics, Shell Variables.

UNIT III

AIX Processes:-Processes –Controlling Processes –Customizing the user and groups-Useradd command options. AIX User administration: - User administration related commands, User administration related files, User administration tasks. File systems: - File system types, file system structure, file system management.

UNIT IV

Backup and recovery: - The MKSYSB command – managing tape backup media – backup strategies – related backup and restore commands. Monitoring and performance tuning:- Monitoring file system growth – The system error log – Tuning using the / etc/tunable files – Recovery from a full file systems. AIX Commands Reference:-AIX Utilities – grep-sort-head and tail, transferring files from DOS-Login to Remote Hosts-FTP and tor commands-xargs, diff, compress data ,cat command, expr utilities ,AIX Windows Concepts.

UNIT V

Using the Common Desktop Environment –Components of the CDE- AIX Activity-CDE Mail Applications-CDE User Customization- Style Manager environments-Activity – Creating a Workspace. AIX applications :- Electronic mail and send mail – Overview of mail system, mail daemons, mail queue directory:/var/spool/ mqueue, mail logs, mail aliasing and forwarding, mail addressing - Editing files using vi.

S3PMT – TOPICS IN MOBILE COMPUTING**Unit I*****MOBILE COMPUTING ARCHITECTURE***

History of Computers-History of Internet-Internet the Ubiquitous Network-Architecture for Mobile Computing-Three-Tier Architecture-Design Considerations for Mobile computing-Mobile Computing through Internet-Making Existing Applications Mobile-Enabled

Unit –II**EMERGING TECHNOLOGIES**

Introduction- Blue tooth-Radio Frequency Identification (Rfid) -Wireless Broadband (WiMAX) –Mobile IP

GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS (GSM)

Global System for Mobile Communications-GSM Architecture-GSM Entities-Call Routing in GSM-PLMN Interfaces-Gsm Addresses and Identifiers-Network Aspects in GSM-GSM Frequency Allocation-Authentication and Security

Unit – III**SHORT MESSAGE SERVICE (SMS)**

Mobile Computing over SMS-Short Message Services (SMS)-Value Added Services through SMS

GENERAL PACKET RADIO SERVICE (GPRS)

GPRS and Packet Data Network-GPRS Network Architecture-GPRS Network Operations-Data Services in GPRS-Applications for GPRS-Limitations of GPRS-Billing and Charging in GPRS

Unit – IV**CDMA & 3G****Introduction-Wireless Data –Third Generation Networks****WIRELESS LAN**

Introduction-Wireless LAN Advantages- IEEE 802.11 Standards-Wireless LAN Architecture-Mobility in Wireless LAN-Deploying Wireless LAN-Mobile Ad Hoc Networks and Sensor Networks-Wireless LAN Security-WiFi Versus 3G

Unit – V**SECURITY ISSUES IN MOBILE COMPUTING**

Introduction-Information Security-Security Techniques and Algorithms-Security Protocols-Public key Infrastructure-Trust-Security Models-Security Frameworks for Mobile Environment

Text Book : MOBILE COMPUTING by ASOKE K TALUKDER, ROOPA R YAVAGAL TECHNOLOGY, APPLICATIONS AND SERVICE CREATION@ 2005, TATA McGraw-Hill Publishing Company Limited, First reprint 2006

S3QMT – TOPICS IN INTERNET TECHNOLOGIES**Unit I:**

Introduction to the Internet - *History of the Internet* - *Structure of the Internet* - *Network and Computer Use Policies* - Internet Addresses, Electronic Mail and Mailing Lists - Telnet, SSH and other Net Utilities - File Transfer Protocol - Introduction to the World Wide Web & Web Browsers - File Transfer Protocol II.

Unit II:

Web Search Methodologies - Advanced Web search and research techniques - the OSI Model, Packets, and Internet Connectivity - Internet Routing, IP Addressing and Domain Name Service - Email: the Details.

Unit III:

Internet Text, Voice and Video Communications - Understanding Intranets - Basic Server Application Installation and Administration - Strategies for Using the Internet and Advanced Connectivity Techniques - Policies Restricting Access and Use.

Unit IV:

Introduction to HTML & Web Authoring - Intellectual Property Issues - HTML Tags and Page Composition - Introduction to Color and Graphics for the Web - Introduction to Page Design - Electronic Contracting, Digital Signatures and Information System Security

Unit V:

Advanced Site Design: Using Tables and Frames - Preparing Graphical and Multimedia Elements - Cascading Style Sheets (CSS) & Dynamic HTML (DHTML) - Privacy Rights and Data Collection Practices - Online Data Input - The Internet Standards Process & Professional Associations - Hosting a Web Site. Online Reading : <http://www.itwebmaster.iit.edu>

S3RMT – TOPICS IN NETWORKING

UNIT I

COMPUTER NETWORKS AND THE INTERNET:

What is Internet-The Network Edge-The Network Core-Access Networks and Physical Media-ISPs and Internet Backbones-Delay and Loss in Packet Switched Networks-Protocol layers and their Service Models-History of Computer Networking and the Internet.

APPLICATION LAYER:

Principles of Network Applications-File Transfer:FTP-Electronic Mail in the Internet-DNS.

UNIT II

TRANSPORT LAYER:

Introduction and Transport Layer Services-Multiplexing and De-Multiplexing-Principles of Reliable Data Transfer-Connection Oriented-Transport: TCP-Principles of Congestion Control-TCP Congestion Control.

UNIT III

THE NETWORK LAYER:

Introduction-Virtual Circuit and Datagram Networks-What is Inside a Router? -The Internet Protocol(IP):Forwarding and Addressing in the Internet-Routing Algorithms-Routing in the Internet-Broadcast and Multicast Routing.

UNIT IV

THE LINK LAYER AND LOCAL AREA NETWORKS:

Error detection and Correction Techniques-Multiple Access-Protocols-Link Layer Addressing-Ethernet.

WIRELESS AND MOBILE NETWORKS:

Introduction-Wireless Links and Characteristics-WiFi: 802.11Wireless LANs-Cellular Internet Access-Mobility Management: Principles-Mobile IP- Managing Mobility in Cellular Networks.

UNIT V

SECURITY IN COMPUTER NETWORKS:

What is Network Security-Principles of Cryptography-Authentication-Integrity-Key Distribution and Certification-Access Control: Firewalls - Attacks and Countermeasures-Security in many layers: Case Studies.

TEXT BOOK:

”COMPUTER NETWORKING”, JAMES F.KUROSE ,KEITH W.ROSS, Pearson Education Publication, Third Edition. CHAPTERS 1,2,3,4,5,6,8.

REFERENC BOOKS:

1. “COMPUTER NETWORKS”, ANDREW S.TENANBAUM, Fourth Edition, Prentice hall of India Publication.
2. “INTRODUCTION TO DATA COMMUNICATIONS AND NETWORKING” BEHROUZ FOROUZAN, Tata McGraw Hill Edition, 1998
3. COMMUNICATION NETWORKS –PRINCIPLES AND PRACTICE, KASERA, NARANG, TMH

S3SMT – PARALLEL PROCESSING**Unit – 1: Parallel Computer Models**

Multiprocessors and Multi computers – Multi vector and SIMD Computers – PRAM and VLSI models – program and Network properties – program Flow Mechanism – System Interconnection Architectures – Parallel processing Applications – speedup performance.

Unit -2 : Hardware Technologies

Processor and Memory Hierarchy: Advanced processor Technology – Super scalar and Vector Processors – Memory Hierarchy Technology-Virtual Memory Technology-Bus. Cache and Shared Memory organization.

Unit-3: Processor Development Techniques

Linear Pipeline Processors – Non-linear pipeline processors-Instruction pipeline Design: Introduction Execution Phases, Mechanism for Instruction pipelining, dynamic instruction scheduling-Arithmetic pipeline design: Computer Arithmetic principles, Multifunctional Arithmetic pipelines-Super scalar and super pipeline design.

Unit-4 : Parallel and Scalable Architectures

Multiprocessor system interconnection – Cache coherence and synchronization mechanism: The Cache Coherence Problem, Snoopy Bus Protocols, Directory – based protocols – Message – passing mechanisms – multi vector multiprocessors – compound vector processing – SIMD computer organizations-Principles of multithreading-Fine-grain multi computers-Scalable and multithreaded Architectures.

Unit – 5 : Parallel Programming Software

Parallel programming models – parallel languages and compilers – dependence analysis of data arrays – code optimization and scheduling – parallel programming environments –

multiprocessor UNIX design goals – master-slave and multithreaded UNIX – multicomputer UNIX extensions.

TEXTBOOK

1 Kai Hwang, "Advanced Computer Architecture – Parallelism, Scalability,

Programmability", McGraw Hill, 1993

REFERENCE

1. Kai Hwang and Faye A Briggs, "Computer Architecture and Parallel Processing", McGraw Hill, 1985.
2. Michel J. Quinn. "Parallel Computing Theory and Practice", McGraw Hill, 1994.
3. Joel M. Cichlow, "An Introduction to distributed and parallel computing", 2nd Edn., PHI, 1997.
4. S. Lakshmi Varahan, Sudharshan K. Dhall, "Analysis and design of parallel algorithms", McGraw Hill, 1990.

S3TMT – INFORMATION TECHNOLOGY AND CYBER LAWS

Unit I

Crimes of this millennium – checks and balances against arbitrary arrests – concept of cyber crime and the IT Act- Hacking – Teenage Web Vandals – Cyber Fraud and Cyber Cheating – Virus on the Internet – other IT Act offences – Network service providers – Criminal justice in India and Implications

Unit II

Contracts in the Infotech World – Click Wrap and Shrink Wrap contracts – contract formation under the Indian context – contract formation on the Internet – Terms and conditions of the Contract – jurisdiction and information technology act – foreign judgements in India – IPR disputes – misuse of the law of jurisdiction – jurisdictional disputes with respect to the internet in USA.

Unit III

Concept of Domain Name and Reply to Cyber squatters – meta-tagging – copyright ownership and assignment – licence of copyright – copyright term and respect for foreign works – copyright infringement remedies and offences – copyright protection of content on the Internet – computer software piracy

Unit IV

Concept of permanent Establishment – PE in cross border E-Commerce – the united nations model Tax treaty – law of double taxation avoidance agreements – Tax Agents of non-residents under the Income tax act and the relevance to E commerce – impact of the internet on customs duties – taxation policies in India

Unit V

Digital signatures – Digital signature certificate – certifying authorities and liability in the event of Digital signature compromise – status of Electronic records as Evidence – proving Digital signatures – proof of Electronic agreements – proving electronic messages – goods and services – consumer complaint – defect in goods and deficiency in services- restrictive and unfair trade –practices – reliefs under CPA – consumer for as, jurisdictions and implications on cyber consumers in .

Reference:

Cyberlaw Simplified – Vivek Sood, Tata McGraw Hill, 2001.

SP3MT – MINI PROJECT

SP4MT – MAJOR PROJECT & VIVA-VOCE