Syllabus of M.Sc. in Computer Science (DDE)

Part - I

Paper Code		Title	Marks	Cr. Points
101	Group - A	Mathematical Computation	50	4
	Group – B	Automata	50	4
102	Group - A	Data Structure	50	4
	Group – B	Algorithm	50	4
103	Group - A	Advanced Computer Architecture	50	4
	Group – B	Graphics & Multimedia	50	4
104	Group - A	Software Engineering	50	4
	Group – B	Advanced DBMS	50	4
105	Group - A	Data Structure Lab	50	4
	Group – B	Graphics Lab	50	4
106	Group - A	DBMS Lab	50	4
	Group – B	Seminar	50	4
		Total	600	48

Part - II

Paper Code		Title	Marks	Cr. Points
201	Group - A	Computer Network	50	4
	Group – B	Web Technology	50	4
202	Group - A	Artificial Intelligence	50	4
	Group – B	Soft Computing	50	4
203	Group - A	Advanced Operating System	50	4
	Group – B	Compiler Design & System Software	50	4
204	Group - A	Image Processing	50	4
	Group – B	Mobile Computing	50	4
205	Group - A	Network Lab & Artificial Intelligence Lab	50	4
	Group – B	Operating System Lab	50	4
206		Major Project	100	8
		Total	600	48

Marks distribution for Theory and Practical examinations of M.Sc. Part – I in Computer Science, DDE, VU

THEORY Papers (100 marks):

No of questions to be answered	Marks per question	
10 (out of 12)	2	10 × 2 = 20
10 (out of 15)	3	10 × 3 = 30
06 (out of 10)	5	06 × 5 = 30
	Internal Assessment	20
	Total	100

PRACTICAL Papers (For 50 marks per group):

1 question to be answered (out of 10)	30 × 1 = 30
Viva voce	10
Practical Note Book (PNB)	10
Total	50

Syllabus of M.Sc. Part-I, Computer Science (DDE)

A. Theory	**400 Marks**
1. Paper 101	**100**
2. Paper 102	**100**
3. Paper 103	**100**
4. Paper 104	**100**
B. Practical	**200 Marks**
1. Paper 105	**100**
2. Paper 106	**100**

Paper 101
Mathematical Computation & Automata
F.M.-100

SLM 1: **Propositional logic and Proof techniques:** Syntax, semantics, valid, satisfiable and unsatisfiable formulas, encoding and examining the validity of some logical arguments. forward proof, proof by contradiction, contrapositive proofs, proof of necessity and sufficiency.

SLM 2: **Sets, relations and functions:** Operations on sets, relations and functions, binary relations, partial ordering relations, equivalence relations, principles of mathematical induction. Finite and infinite sets, countable and uncountable sets, Cantor's diagonal argument and the power set theorem, Schroeder-Bernstein theorem.

SLM 3: **Introduction to counting:** Basic counting techniques - inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating function.

SLM 4: **Algebraic structures and morphisms:** Algebraic structures with one binary operation - semigroups, monoids and groups, congruence relation and quotient structures. Free and cyclic monoids and groups, permutation groups, substructures, normal subgroups. Algebraic structures with two binary operations - rings, integral domains and fields. Boolean algebra and Boolean ring.

SLM 5: **Introduction to graphs:** Graphs and their basic properties - degree, path, cycle, subgraphs, isomorphism, Eulerian and Hamiltonian walks, graph coloring, planar graphs, trees.

SLM 6: **Introduction, regular languages and finite automata:** Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.

SLM 7: **Context-free languages and pushdown automata:** Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

SLM 8: **Context-sensitive languages:** Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

SLM 9: **Turing machines:** The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

SLM 10: **Undecidability:** Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages.

Paper 102
Data Structure & Algorithm
F.M.-100

SLM 11: **Introduction to data structure and arrays:** Basic Terminology, Elementary Data Organization, Structure operations, Algorithm Complexity and Time-Space trade-off. Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered List, Sparse Matrices and Vectors.

SLM 12: **Stacks and queues**: Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Applications of recursion in problems like 'Tower of Hanoi'. Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, D-queues and Priority Queues.

SLM 13: **Linked list and Trees:** Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction. Basic terminology of tree, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm. Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees.

SLM 14: **Searching, Hashing and Sorting**: Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation. Insertion Sort, Bubble Sorting, Quick Sort, Two Way Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting.

SLM 15: **Graph and File Structures**: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees. Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B+ Tree index Files, B Tree index Files, Indexing and Hashing Comparisons.

SLM 16: **Models of computation and asymptotic Notation**: RAM,TM etc. time and space complexity, Big-O, omega, theta etc.; finding time complexity of well known algorithms like- heapsort, search algorithm etc. Recursion- Definition, Use, Limitations, Examples: Hanoi problem. Tail Recursion

SLM 17: **Divide and Conquer, Dynamic Programming:** Basic method divide and conquer, use, Examples: Merge sort, Quick Sort, Binary Search, Basic method dynamic programming, use, Examples: matrix-chain multiplication, All pair shortest paths, single-source shortest path, Travelling Salesman problem

SLM 18: **Branch and Bound** : Basic method of branch and bound, use, Examples: The 15-puzzle problem, Basic method of backtracking, use, Examples: Eight queens problem, Graph coloring problem, Hamiltonian problem, **Greedy Method :**Basic method, use, Examples: Knapsack problem, Job sequencing with deadlines, minimum spanning tree(Prim's and Kruskal's algorithms)

SLM 19: **Lower Bound Theory, Disjoint Set Manipulation and graph traversal algorithms:** Bounds on sorting and sorting techniques using partial and total orders. Set manipulation algorithm like UNION-FIND, union by rank, Path compression. BFS and DFS

SLM 20: **Notion of NP-completeness and Approximation algorithms:** P class, NP-hard class, NP-complete class, Circuit Satisfiability problem, Clique Decision Problem. Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes: 0/1 knapsack problem.

SLM 21: **Overview of von Neumann architecture:** Instruction set architecture; The Arithmetic and Logic Unit, The Control Unit, Memory and I/O devices and their interfacing to the CPU; Measuring and reporting performance; CISC and RISC processors.

SLM 22: **Pipelining and Instruction-level parallelism:** Basic concepts of pipelining, data hazards, control hazards, and structural hazards; Techniques for overcoming or reducing the effects of various hazards. Concepts of instruction-level parallelism (ILP), Techniques for increasing ILP; Superscalar, super-pipelined and VLIW processor architectures;

SLM 23: **Hierarchical Memory Technology:** Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.

SLM 24: **Vector and Array Processors Principles:** Instruction types, Compound, Vector loops, Chaining, Array processor structure and algorithms, Case studies of contemporary microprocessors.

SLM 25: **Multiprocessor Architecture:** Centralized shared-memory architecture, synchronization, memory consistency, interconnection networks; Distributed shared-memory architecture, Cluster computers.

SLM 26: **Introduction to computer graphics & graphics systems**
Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

SLM 27: **Scan conversion:**
Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

SLM 28: **2D and 3D transformation & viewing**

Basic transformations: translation , rotation, scaling ; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines , parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation , clipping operations , point clipping , line clipping, clipping circles , polygons & ellipse.

3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

SLM 29: **Curves, Hidden surfaces and Color & shading models**

Curve representation, surfaces , designs , Bezier curves , B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal - geometry. Light & color model; interpolative shading model; Texture.

SLM 30: **Multimedia**

Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia. Image, video and audio standards. Audio: digital audio, MIDI, processing sound, sampling, compression. Video: MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression. Animation: types, techniques, key frame animation, utility, morphing. Virtual Reality concepts.

Paper 104
Software Engineering &Advanced DBMS
F.M.-100

SLM 31: **The Product:**
Software, Software Myths, The process : Software engineering : A Layered Technology, Software Process Models, The linear sequential Model, The prototyping Model, The RAD Model, Evolutionary Software Process Models, Component – Based Development, Fourth Generation Techniques, Software process and project metrics : Software measurement.

SLM 32: **Software project planning:**
Project planning objectives, Software scope, Decomposition Techniques, Empirical estimation models, The Make/Buy Decision.,

SLM 33: **Risk analysis and Management:** Reactive versus proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, Risk mitigation, monitoring, and management, Safety risks and hazards, The RMMM Plan, Project scheduling and technique : Basic concept, Defining a task set for the software project, Defining a task Network, Scheduling, Earned value analysis.

SLM 34: **Software Quality Assurance**:
Quality Concepts, The Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability, Mistake Proofing for Software, Introduction to ISO standard.

SLM 35: **Software Testing Technique**:
Software testing fundamentals, Test case design, White-box Testing, Basis path testing, Control structure testing, Black-box testing, Testing for specialized environments, architectures and application, Object-Oriented Analysis : Introduction to UML Diagrams, Use Case Diagrams, Class Diagrams, Collaboration Diagrams, Implementation Diagrams.

SLM 36: **Introduction :** Concept & Overview of DBMS, Concepts of Different Database Models, Database Languages, Functions of Database Administrator, Database Users, Three Schema architecture of DBMS.

SLM 37: **Relational Databases:** Integrity Constraints revisited: Functional, Multi-valued and Join Dependency, Template Algebraic, Inclusion and Generalized Functional Dependency, Chase Algorithms and Synthesis of Relational Schemes. Query Processing and Optimization: Evaluation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Null Values and Partial Information.

SLM 38: **Parallel and Distributed Databases:** Distributed Data Storage: Fragmentation and Replication, Location and Fragment Transparency, Distributed Query Processing and Optimization, Distributed Transaction Modeling and Concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

SLM 39: **Advanced Transaction Processing:** Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors. Active Databases: Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and Concurrency Control, Compensation and Databases Recovery.

SLM 40: **Deductive Databases:** Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation. Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases. Case Studies: Gemstone, O2, Object Store, SQL3, Oracle xxi, DB2.

Paper 105 (Practical)

Data Structure & Graphics Lab

F.M.-100

Group – A: **Data Structure Lab:** **50 Marks**

Write a program in C to implement simple Stack, Queue, Circular Queue, Priority Queue.

Write a menu driven program that implements singly linked list for the following operations:

Create, Display, Concate, merge, union, intersection

Write a menu driven program that implements doubly linked list for the following operations:

Create, Display, Count, Insert, Delete, Search, Copy, Reverse, Sort

Write a menu driven program that implements doubly linked list for the following operations:

Create, Display, Concate, merge, union, intersection

Write a menu driven program that implements Singly circular linked list for the following operations:

Create, Display, Count, Insert, Delete, Search, Copy, Reverse, Sort

Write a program in C for sorting methods.

Write a menu driven program in C to create a binary search tree, Traverse the tree in Inorder, Preorder and Post Order, Search the tree for a given node and delete the node

Write a program in C to implement insertion and deletion in B tree

Write a program in C to implement insertion and deletion in AVL tree

Write a menu driven program that implements Heap tree (Maximum and Minimum Heap tree) for the following operations. (Using array) Insert, Delete

Write a program to implement double hashing technique to map given key to the address space. Also write code for collision resolution (linear probing)

Write a program in C to implement Dijkstra's shortest path algorithm for a given directed graph.

Write a program in C to insert and delete nodes in graph using adjacency matrix.

Write a program in C to implement Breadth First search using linked representation of graph.

Write a program in C to implement Depth first search using linked representation of graph.

Write a program in C to create a minimum spanning tree using Kruskal's algorithm.

Write a program in C to create a minimum spanning tree using Prim's algorithm, etc.

Group – B: Graphics Lab: 50 Marks

Point plotting, line & regular figure algorithms
Raster scan line, circle and ellipse drawing algorithms
Clipping algorithms for points, lines & polygons
2-D transformations
Filling algorithms.
Curve drawing

Paper 106 (Practical)
DBMS Lab & Seminar
F.M.-100

Group – A: DBMS Lab: **50 Marks**

Structured Query Language
1. Creating Database
Creating a Database
Creating a Table
Specifying Relational Data Types
Specifying Constraints
Creating Indexes
2. Table and Record Handling
INSERT statement
Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements
3. Retrieving Data from a Database
The SELECT statement
Using the WHERE clause
Using Logical Operators in the WHERE clause
Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause
Using Aggregate Functions
Combining Tables Using JOINS
Subqueries
4. Database Management
Creating Views
Creating Column Aliases
Creating Database Users
Using GRANT and REVOKE
Cursors in Oracle PL / SQL
Writing Oracle PL / SQL Stored Procedures

Group – B: Seminar **50 Marks**

Syllabus of M.Sc. Part-II, Computer Science (DDE)

A. Theory	**400 Marks**
1. Paper 201	**100**
2. Paper 202	**100**
3. Paper 203	**100**
4. Paper 204	**100**
B. Practical	**200 Marks**
1. Paper 205	**100**
2. Paper 206	**100**

Paper 201
Computer Network & Web Technology
F.M.-100

SLM 41: **Overview of data communication and Networking:**
Introduction; Data communications: components, data representation(ASCII,ISO etc.),direction of data flow(simplex, half duplex, full duplex); Networks: distributed processing, network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN,WAN);Internet: brief history, internet today; Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

SLM 42: **Physical level:**
Overview of data(analog & digital), signal(analog & digital), transmission (analog & digital)& transmission media (guided & non-guided); TDM, FDM, WDM; Circuit switching: time division & space division switch, TDM bus; Telephone network;

SLM 43: **Data link layer and Medium access sub layer:**
Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC;
Point to point protocol, LCP, NCP, FDDI, token bus, token ring; Reservation, polling, concentration; Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA; Traditional Ethernet, fast Ethernet;

SLM 44: **Network layer:**
Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : Internet address, classful address, subnetting; Routing : techniques, static vs. dynamic routing , routing table for classful address; Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IPV6; Unicast and multicast routing protocols.

SLM 45: **Transport layer and Application layer:**
Process to process delivery; UDP; TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve Qos.
DNS; SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography, user authentication, security protocols in internet, Firewalls.

SLM 46: **Internet:**

Evolution of the Internet and the Growth of the World Wide Web. Client-Server model. Architecture of the Intranet/ Internet /Extranet. Access methods: dialup, ISDN, ADSL/2+, cable, LAN, WIFI, Mobile & Satellite. Application areas: E-commerce, Education Entertainment such as games and gambling. Portals, discussion forums, Weblogs, Podcasting, RSS / ATOM, Wiki, VoIP, video on demand. Search Engines, webbots, integrity of information, databases online. URL, TCP/IP fixed and dynamic IP addressing. Role of DNS.

Email: email clients, server and gateways; SMTP,POP3, IMAP & Webmail. File transfer – FTP. Remote login – telnet. WWW – HTTP and HTTPS. Role of W3C Accessibility. Mobile computing, wireless, 3G, GPS

SLM 47: **Style Sheets:**

CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML Style Rule Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study. Client- Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators- Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

SLM 48: **Host Objects :**

Browsers and the DOM-Introduction to the Document Object Model DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event Handling-Accommodating Noncompliant Browsers Properties of window-Case Study. Server-Side Programming: Java Servlets-Architecture -Overview-A Servelet-Generating Dynamic Content-Life Cycle-Parameter Data-Sessions-Cookies¬U RL Rewriting-Other Capabilities-Data Storage Servelets and Concurrency-Case Study- Related Technologies.

SLM 49: **Representing Web Data:**

XML-Documents and Vocabularies-Versions and Declaration - Namespaces JavaScript and XML: Ajax-DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data :XPATH-Template-based Transformations: XSLT-Displaying XML Documments in Browsers-Case Study- Related Technologies. Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm-Case Study-Related Technologies.

SLM 50: **Web Services:**

JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services: WSDL- Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies-Software Installation-Storing Java Objects as Files-Databases and Java Servlets.

Paper 202
Artificial Intelligence & Soft Computing
F.M.-100

SLM 51: Overview of Artificial intelligence- Problems of AI, AI technique, Tic – Tac – Toe problem., Problem Space & search. Heuristic Search Techniques,

SLM 52: Knowledge representation issues. Representing knowledge using rules.Symbolic reasoning under uncertainty. Statistical reasoning. Weak slot & filler structures. Strong slot & filler structures.

SLM 53: Game planning –Minimax search procedure, adding alpha beta cut-off's, iterative deepening, Planning. Natural language processing, Understanding.

SLM 54: Learning – induction & explanation based learning.

SLM 55: Basic knowledge of programming language like Prolog & Lisp.

SLM 56: Fuzzy Systems: Fuzzy sets, Fuzzy Logic, Fuzzy relations, Approximate Reasoning , Fuzzy logic Control systems. Application of Fuzzy Theory.

SLM 57: Artificial Neural Networks: Feed forward Networks & Supervised Learning, Perception learning rules, Adaline, Back Propagation, Associative memories, Hopfield networks,

SLM 58: Unsupervised learning Networks, Self-organizing feature map, Adaptive Resonance Theory, Radial Basis function,

SLM 59: Recurrent Neural Networks, Refinement Learning. Application of Neural network.

SLM 60: Genetic Algorithm(GA): Evolutionary Computing, Basics of Genetic Algorithm. Application of GA. Hybridisation of Soft computing methodology.

Paper 203
Advanced Operating System & Compiler Design & System Software
F.M.-100

SLM 61: Evolution of Operating Systems, Structural overview,

SLM 62: Concept of process and Process synchronization, Process Management and Scheduling, Hardware requirements: protection, context switching, privileged mode;

SLM 63: Threads and their Management;

SLM 64: Tools and Constructs for Concurrency, Detection and Prevention of deadlocks, Dynamic Resource Allocation,

SLM 65: Design of IO systems, File Management, Memory Management: paging, virtual memory management, Distributed and Multiprocessor Systems, Case Studies.

SLM 66: **Introduction:** Phases of compilation and overview.
Lexical Analysis (scanner): Regular language, finite automata, regular expression, from regular expression to finite automata, scanner generator (lex,flex).

SLM 67: **Syntax Analysis AND Semantic Analysis:** Context-free language and grammar, push-down automata, LL(1) grammar and top-down parsing, operator grammar, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc,bison)
Attribute grammar, syntax directed definition, evaluation and flow of attribute in a syntax tree.

SLM 68: **Symbol Table:** Its structure, symbol attributes and management.
Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.

SLM 69: **Intermediate Code Generation and Code Improvement (optimization):**
Translation of different language features, different types of intermediate forms.
Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc.
Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc.

SLM70: **Register allocation and target code generation**
Advanced topics: Type systems, data abstraction, compilation of object oriented features and non-imperative programming languages.

Paper 204
Image Processing & Mobile Computing
F.M.-100

SLM71: **Digital Image Fundamentals:** A simple image model, Sampling and Quantization, Imaging Geometry, Digital Geometry, Image Acquisition Systems, Different types of digital images.

SLM 72: **Bilevel Image Processing and Binarization and Segmentation of Grey level images:** Basic concepts of digital distances, distance transform, medial axis transform, component labeling, thinning, morphological processing, extension to grey scale morphology.
Histogram of grey level images, Optimal thresholding using Bayesian classification, multilevel thresholding, Segmentation of grey level images, Water shade algorithm for segmenting grey level image.

SLM 73: **Detection of edges and lines in 2D images:** First order and second order edge operators, multi-scale edge detection, Canny's edge detection algorithm, Hough transform for detecting lines and curves, edge linking.

SLM 74: **Images Enhancement and Color Image Processing:** Point processing, Spatial Filtering, Frequency domain filtering, multi-spectral image enhancement, image restoration.
Color Representation, Laws of color matching, chromaticity diagram, color enhancement, color image segmentation, color edge detection, color demosaicing.
Image Registration and depth estimation: Registration Algorithms, Setreo Imaging, Computation of disparity map.

SLM 75: **Image compression:** Lossy and lossless compression schemes, prediction based compression schemes, vector quantization, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme.

SLM 76: Introduction to MC, novel applications, limitations, and architecture. GSM :
Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

SLM 77: Medium Access Control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

SLM 78: Mobile Network Layer : Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

SLM 79: Mobile Transport Layer : Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

SLM 80: Database Issues : Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

Paper 205 (Practical)
Network & Artificial Intelligence Lab & Operating System Lab
F.M.-100

Group – A: **Network & Artificial Intelligence Lab** **50 Marks**

Problems and assignment based on Paper 201 and 202.

Group – B: **Operating System Lab** **50 Marks**

Problems and assignment based on Paper 203.

Paper 206
Major Project
F.M.-100

Major project: **100 Marks**