MAHARSHI DAYANAND SARASWATI UNIVERSITY
AJMER

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MAHARSHI DAYANAND SARASWATI UNIVERSITY
AJMER

पाठ्यक्रम

SYLLABUS

SCHEME OF EXAMINATION AND COURSES OF STUDY

FACULTY OF SCIENCE

Master of Computer Application

M.C.A. (Semester I & II)
(w.e.f. 2017-18)
M.C.A. (Semester III & IV)
(w.e.f. 2017-18)
M.C.A. (Semester V & VI)
(w.e.f. 2017-18)

मूल्य : 12/-

महर्षि दयानन्द सरस्वती विश्वविद्यालय, अजमेर

MAHARSHI DAYANAND SARASWATI UNIVERSITY,
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NOTICE

1. Change in Statutes/Ordinances/Rules/ Regulations, Syllabus and Books may, from time to time, be made by amendment or remaking, and a candidate shall, except in so far as the University determines otherwise comply with any change that applies to years he has not completed at the time of change. **The decision taken by the Academic Council shall be final.**

सूचना

1. समय-समय पर संशोधन या पुन: निर्माण कर परिनियमों/ अध्यादेशों/नियमों / विनियमों / पाठ्यक्रमों व पुस्तकों में परिवर्तन किया जा सकता है, तथा किसी भी परिवर्तन को छात्र को मानना होगा बशर्ते कि विश्वविद्यालय ने अन्यथा प्रकार से उनको छूट न दी हो और छात्र ने उस परिवर्तन के पूर्व वर्ष पाठ्यक्रम को पूरा न किया हो। **विद्या परिषद द्वारा लिये गये निर्णय अन्तिम होंगे।**

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Scheme of Examination
(For M. C. A.)

Theory:

Part A:
1. 10 Question of 1 mark each – 10 marks
2. Answer should not exceed more than 20 words
3. All questions are compulsory

Part B:
1. 5 Questions of 2 marks each – 10 marks
2. Answer should not exceed more than 50 words
3. All questions are compulsory

Part C:
1. 3 Questions of 20 marks each – 60 marks. There will be an internal choice in each question.
2. Answer should not exceed 400 words
3. All questions are compulsory.

Sessional:
There will be sessional (internal assessment) of 20 marks conducted by the department.

Practical:
Practical exams shall be conducted by one internal and one external examiner of a batch of 20 students in a day.
Duration of Practical exam is 3 hours.
A Laboratory Exercise File should be prepared by each student for each practical paper and should be submitted during practical examinations.
Practical of 50 marks distribution is as under:

a. 30 marks for practical examination exercise for 3 questions
b. 10 marks for Viva-voce
c. 10 marks for Laboratory Exercise File

Eligibility:
BCA/BSC (CS/IT)/BSC/Vocational/Graduate from any discipline with Math as one of the subjects with at least 50% marks in aggregate. Admission is strictly on the basis of merit.

Scheme of Examination
(For M. C. A.)

Reg. 17 (b)
The examination for the Master of Computer Applications will consist of 6 semesters. The examination shall consist of (a) Theory papers (b) Laboratory / Practical work (c) seminar (d) minor project and (e) industrial dissertation work. Candidates will be required to pursue a regular, full time course of study at the University department for a period of three academic years in order to be eligible for appearing in the examination.

1. Eligibility for M. C. A.: BCA/BSC(CS/IT)/BSC/Vocational/Graduate from any discipline with Mathematics as one of the subjects with at least 50% marks in aggregate.
2. Examination:

i. There shall be 51 papers (5 theory and 4 practical in semesters I to V, 4 theory and 2 practical in semester VI and 1 minor project in Semester V and 1 industrial dissertation and 1 seminar in Semester VI) of 5100 marks (I to VI Semester). There will be 1 Elective in III, IV Semester and 2 Electives in V Semester. Theory paper shall be of 3 hours duration having 100 marks. Out of 100 marks 20 marks shall be considered as internal assessment based on internal test and seminars and 80 marks will be of examination at the end of each semester as determined by the University. The practical shall be of 50 marks assessed by external examiner. The Minor Project work shall be of 50 marks based on project presentation and viva-voce, assessed by external examiner. The Seminar in VI Semester will be 100 marks which will be based on presentation and viva-voce assessed by external examiner. The Industrial Dissertation shall be 250 marks out of which 200 will be based on project presentation and viva-voce, assessed by external examiner and 50 marks will be assessed by internal examiner.

ii. To pass a semester a candidate shall have to score 40% marks in each subject (theory and practical) separately and also 50% marks in aggregate of all the papers prescribed for the examination.

iii. Due paper(s) will be applicable if a candidate obtains 50% marks in aggregate and fails in not more than two (2) papers (theory). Due paper(s) of I semester will be held along with the III semester, the due of III semester will be held along with V semester, the due paper(s) of II semester will be held along with the IV semester and due papers of the IV semester will be held along with the VI semester. The V and VI semester due paper(s) will be held in the I and II semester respectively of the next year. The chance of due paper(s) will be given thrice in each semester.

iv. Wherever a candidate appears at for a due paper examination he/she will do so according to the syllabus in force.

v. A candidate not appearing at any examination/absent in any paper of term end examination shall be deemed as fail.

3. A candidate for a pass in the examination shall be required to obtain:

i. At least 50% marks in the aggregate of all the papers prescribed for the examination and

ii. At least 50% marks in the practical(s) wherever prescribed at the examination, provided that if a candidate fails to secure at least 40% marks in each individual paper at the examination notwithstanding his/her having obtained the minimum percentage of marks required in the aggregate for that examination.

No Division will be awarded in the first, to fifth semester examinations.

Division shall be awarded at the end of the sixth semester Examination on the combined marks obtained at the first to fifth semester taken together as noted below:

Passed with First Division	60% of the aggregate marks taken together of all the Six semester examinations
Passed with second division	48%

All the rest will be declared to have passed the examination.

Provided that if a candidate clears any paper after a continuous period of three years since he/she was admitted to the M. C. A. then for the passing marks, i.e. 40% marks, shall be taken into account in the case of such course(s).

Provided further that in case where a candidate requires more than 40% marks in order to reach the requisite minimum aggregate i.e. 50% marks, as many marks, out of those actually secured by him/her will be taken into account as would enable him/her to make up the deficiency in the requisite minimum aggregate marks.

4. The grace marks shall be given up to 1% of the total aggregate marks of theory and practical of that semester in maximum one paper.
5. Candidates reappearing at an examination in a subsequent year shall be examined in accordance with the scheme and syllabi in force and shall be entitled to the award of the degree of year in which they clear the last failing/unclear paper.

TEACHING AND EXAMINATION SCHEME

Master of Computer Applications

Semester I

Paper Name (Theory)	Lec	Tut	Exam Hours	Max Marks	
				Sessional	Sem Exam
mca-101 Computer Organization	5	1	3	20	80
mca-102 Introduction to Programming	5	1	3	20	80
mca-103 Open Source Technology & Operating Systems	5	1	3	20	80
mca-104 Computer Networks	5	1	3	20	80
mca-105 Database Management Systems	5	1	3	20	80
Total of Theory (Sessional & Semester Exam Marks)					**500**

Paper Name (Practical)	Pract Hours	Exam Hours	Max Marks
mca-106 Lab-C Programming	4	3	50
mca-107 Lab-PC Software & Networkng	4	3	50
mca-108 Lab-Microprocessor, DBMS	4	3	50
mca-109 Lab-Open Source (Linux, PHP)	4	3	50
Total of Practical Marks			**200**
Total of Theory & Practical Marks			**700**

Duration: 3 hours **Max Marks: 80**

mca-101 Computer Organization

Number system, Logic Gates, Boolean Algebra, K-Map, combinational circuit, flip-flop, sequential circuit, encoder, decoder, multiplexer, shift register, fixed-point representation, floating-point representation.

Register transfer language, inter-register transfer, arithmetic micro operation, logic and shift micro operation, instruction codes, timing and control, input/output and interrupts.

Processor bus organization, arithmetic logic unit, stack organization, instruction format, addressing mode, data transfer and manipulation, program control, control memory, addressing sequence, micro program sequencer, micro instruction formats.

Block diagram of 8085 and pin configuration, 8086/8088 instruction set, data transfer instructions, arithmetic, logical, shift, rotate, flag, compare, jump instruction, subroutine, loop, addressing modes, memory hierarchy, associative memory, memory addressing, virtual memory, cache memory, cache coherence.

Duration: 3 hours **Max Marks: 80**

mca-102 Introduction to Programming

Introduction to Programming Concepts: Software, Classification of Software, ModularProgramming, Structured Programming, Algorithms and Flowcharts with examples.

Overview of C Language: History of C, Character set, C tokens, Identifiers, Keywords,Data types, Variables, Constants, Symbolic Constants , Operators in C, Hierarchy ofOperators, Expressions, Type Conversions and Library Functions.

Managing Input and Output Operation: Formatted and Unformatted I/O Functions,Decision making, branching and looping: Decision Making Statements - if Statement, if–else statement, nesting of if-else statements, else–if ladder, switch statement,?: operator

Looping - while, do-while, for loop, Nested loop, break, continue, and goto statements.Functions: Function Definition, prototyping, types of functions, passing arguments tofunctions, Nested Functions, Recursive functions.

Arrays: Declaring and Initializing, One Dimensional Arrays, Two Dimensional Arrays,Multi-Dimensional Arrays - Passing arrays to functions. Strings: Declaring andInitializing strings, Operations on strings, Arrays of strings, passing strings to functions.Storage Classes - Automatic, External, Static and Register Variables.

Structures-Declaring and Initializing, Nested structure, Array of Structure, PassingStructures to functions, Unions, typedef, enum, Bit fields. Pointers – Declarations,Pointer arithmetic, Pointers and functions, Call by value, Call by reference, Pointers andArrays, Arrays of Pointers, Pointers and Structures. Meaning of static and dynamicmemory allocation, Memory allocation functions, stack, single linked list, double linked list, circular linked list, prefix, postfix, infix, queue, d-queue.

Duration: 3 hours **Max Marks: 80**

mca-103 Open Source Technology & Operating Systems

Introduction to Operating Systems, goals of OS, operation of OS, resource allocater and related functions, classes of OS, batch processing, multi-processing, time sharing, distributed, real time systems, system calls, system programs, structure of OS, layer design of DOS, Unix, virtual machine OS, kernel based OS, micro-kernel based OS, architecture of Window 2000.

Process concept, interacting process, threads, fundamental of scheduling, scheduling criteria, long medium short term scheduling, scheduling algorithms , structure of concurrent system, critical section, critical region, inter-process communication, monitor and semaphores, implementation and uses.

Logical versus physical address, swapping, contiguous allocation, segmentation, paging, segmentation with paging, kernel memory allocation, page replacement algorithm, virtual memory, virtual memory with paging, demand paging, dead lock, characterization, methods for handling dead locks, prevention, avoidance, thrashing, allocation of frame, virtual memory using segmentation,

Architecture of Distributed system, inter-process communication protocol, network OS, issues in distributed design, issues of distributed file system, network structure, distributed system structure, file system, coordination. History of Linux, Linux architecture, Linux file System, file naming, types of files, directory command, file command, vi editor, locating files in Linux, filter pipe, shell variables, local and global variables, command substitution, if, while, for, shift, tar, basic networking commands in Linux.

Duration: 3 hours **Max Marks: 80**

mca-104 Computer Networks

Introduction to Data communications and networking, protocols, standards and architecture, topology, transmission mode, OSI model, analog and digital signals, periodic and aperiodic signals, time and frequency domain, Fourier analysis concept.

Encoding digital to digital conversion, analog to digital conversion, digital to analog conversion, analog to analog conversion, transmission of digital data, DTE-DCE interface, EIA-232, EIA-449, X.21, modem, cable modem, guided and unguided, transmission media

Multiplexing, TDM, FDM, WDM, DSL, HDLC, error classification, types of errors, error detection, error correction, virtual redundancy check, longitudinal redundancy check, cyclic redundancy check.

Asynchronous transfer mode, protocol architecture, ATM cells, ATM layers, switches, circuit switching network and concepts, routing, packet switching, X.25, virtual circuit approach, point-to-point layers, link control protocol, network control protocol.

Duration: 3 hours **Max Marks: 80**

mca-105 Database Management Systems

Information system, classification, conventional file system, object of database systems, data abstraction, data definition language, data manipulation language, database administrator. Database design stages, database model, database system architecture.

Centralized and client/server architecture in DBMS, entity relationship model, entities and entity sets their relationship, mapping constraints, generalization, aggregation, use of ER model for the design of databases, sequential, random, index sequential file organization, introduction and history of relational database, system relational algebra, normalization up to DKNF.

Create a Table in MS Access -Data Types, Field Properties, Fieldsnames, types, properties, default values, format, caption, validationrules Data Entry Add record delete recode and edit text Sort, find/replace,filter/select, re-arrange columns, freeze columns. Edit a Tables- copy, delete, import, modify table structure find replace.

Setting up Relationships- Define relationships, add a relationship, set a rule for Referential Integrity, change the join type, delete a relationship, save relationship Queries & Filter –difference between queries and filter,filter using multiple fields AND,OR,advance filter Queries create Query with one table,fiend record with select query, find duplicate record with query,find unmatched record with query, run query,save and change query.

Introduction to Forms Types of Basic Forms: Columnar, Tabular, Datasheet, Main/ Subforms, add headers and footers, add fields to form, add text to form use label option button, check box,combo box, list box Forms Wizard, Create Template.

Introduction to Reports,Types of Basic Reports: Single Column, Tabular Report Groups/Total, single table report multi table report preview report print report, Creating Reports and Labels, Wizard

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TEACHING AND EXAMINATION SCHEME

Master of Computer Applications

Semester II

	Paper Name (Theory)	Lec	Tut	Exam Hours	MAX MARKS Sessional	MAX MARKS Sem Exam
mca-201	Computer Oriented Numerical Methods	5	1	3	20	80
mca-202	Data Structures, Algorithm & Analysis	5	1	3	20	80
mca-203	Object Oriented Programming	5	1	3	20	80
mca-204	Visual Programming	5	1	3	20	80
mca-205	Web Programming	5	1	3	20	80
	Total of Theory (Sessional & Semester Exam Marks)					**500**

	Paper Name (Practical)	Pract Hours	Exam Hours	Max Marks
mca-206	Lab-C++ Programming & CONM	4	3	50
mca-207	Lab-Data Structures	4	3	50
mca-208	Lab-Visual Programming	4	3	50
mca-209	Lab-Web Programming	4	3	50
	Total of Practical Marks			**200**
	Total of Theory & Practical Marks			**700**

Duration: 3 hours **Max Marks: 80**

mca-201 Computer Oriented Numerical Methods

(Note: Students are allowed to carry FX-100 or higher version calculator in the examination)

Characteristics of Numerical Computation, Approximation, Significant Digit, Errors, Introduction to Matrix, Types of Matrix, Square, Row, Column, Diagonal, Unit, Null, Upper Triangular, Lower Triangular, Symmetric, Skew Symmetric, operation of matrix, trace, transpose, addition, subtraction, multiplication, determinant, inverse, Introduction to Linear Equations,

Bisection method, method of successive approximation, method of false position, Newton's iteration method, Newton Raphson method, Horner's method

Gauss Jordan method, Gauss Elimination method, Iterative methods, Jacobi method of iteration, Gauss Seidel Iteration method

Gregory Newton Forward and Backward interpolation Formula

Duration: 3 hours **Max Marks: 80**

mca-202 Data Structures & Algorithm Analysis

Definitions of Data Structure and Algorithm – Time and Space complexity- Algorithm notations.

Brute force and greedy algorithms, Divide and Conquer Strategy: Merge sort, quick sort, integer multiplication, matrix multiplication, exponentiation problem, convex hull problem, dynamic programming

Complexity theory: Decidability of problems: Halting problem, NP-class of problem, P class of problem, NP=P question, Polynomial reduction problem, Cook's theorem, NP hardness and NP completeness.

Control structures- Variables – Data types- Arrays- String processing – Sorting and Searching- Insertion-Selection-Merge- Radix-Binary Search- Linear Search-Hashing Binary tree- Representation – Traversing – Threaded Binary tree- Binary Search tree- Insertion deletion into a binary search tree- Heap sort

Graph- Representation of Graph- Shortest path – Operation on Graphs- Traversing a Graph- Topological Sorting – Files

Duration: 3 hours **Max Marks: 80**

mca-203 Object Oriented Programming

Object Oriented Concepts, Tokens, Expressions and Control Structures Introduction: Basic Elements of Programming, Console I/O Operations.

Control Structures: Control and Looping Statements. Function: Function Prototyping, Call and Return by Reference, Inline Function, Default and Const Arguments, Function Overloading, Arrays, Manipulators and Enumeration.

Classes and Object, Object Oriented Methodology: Basic Concepts/ Characteristics of OOP. Advantages and Application of OOP's, Procedural Programming Vs OOP

Classes and Objects: Specifying a Class, Creating Objects, Private & Public Data Members and Member Functions, Defining Inline Member Functions, Static Data Members and Member Functions. Arrays within Class, Arrays of Objects, Objects as Function Arguments, Returning Objects.

Constructors, Destructors, Operators Overloading and Inheritance. Constructors and Destructors: Introduction, Parameterized Constructors, Multiple Constructors in A Class, Constructors With Default Arguments, Dynamic Initialization of Objects, Copy Constructors, Dynamic Constructors, Const Objects, Destructors Operators Overloading: Definition, Unary and Binary Overloading, Rules for Operator Overloading.

Inheritance: Defining Derived Classes, Types of Inheritance, Constructors and Destructors in Derived Classes.

Pointers Virtual & Friend functions and file handling Pointers: Pointer to Objects, this Pointer, New and Delete Operators, Virtual Function, Friend Functions. Opening, Closing a File, File Modes, File Pointers and their Manipulation, Sequential Input and Output Operations: Updating a File, Random Access, and Error Handling During File Operations, Command Line Arguments.

Single linked lists, double linked list, circular list, sparse table, stack, queue, dqueue list, priority queue, graph, prefix, postfix, infix, sorting, insertion, selection, bubble, algorithm of quick, merge

Duration: 3 hours **Max Marks: 80**

mca-204 Visual Programming

Introduction to .NET, .NET Framework features & architecture, CLR, Common Type System, MSIL,Assemblies and class libraries. Introduction to visual studio, Project basics, types of project in .Net, IDE of VB.NET- Menu bar, Toolbar, Solution Explorer, Toolbox, Properties Window, Form Designer, Output Window, Object Browser. The environment: Editor tab, format tab, general tab, docking tab. visual development.

Variables -Declaring variables, Data Types, Forcing variables declarations, Scope & lifetime of a variable, Control flow statements: conditional statement, loop statement. Constants, Arrays, types of arrays, Collections.

Subroutines, Functions, Passing variable number of arguments,Optional Arguments, Returning value from function, Msgbox&Inputbox, Class , overloading, constructor ,inheritance,overriding,interfaces.

Working with Forms : Loading, showing and hiding forms, controlling one form within another.Textbox, Label, Button, Listbox, Combobox, Checkbox,PictureBox, RadioButton, Panel, scroll bar, Timer, ListView, TreeView, toolbar, StatusBar.. OpenFileDialog, SaveFileDialog, FontDialog, ColorDialog, PrintDialog.Link Label.Designingmenus :ContextMenu, access & shorcut keys.

Database programming with ADO.NET – Overview of ADO, from ADO to ADO.NET, Accessing Datausing Server Explorer. Creating Connection, Command, Data Adapter and Data Set with OLEDB andSQLDB. Display Data on data bound controls, display data on data grid.Generating reports using CrystalReportViewer

Duration: 3 hours **Max Marks: 80**

mca-205 Web Programming

Cascading Style Sheets, introduction, levels of style sheets, style specification formats, selector forms, property value forms, font properties, list properties, color, alignment of text, the box model, background images, the and tags, conflict resolution.

Overview of JavaScript, object orientation and JavaScript, syntactic characteristics, primitives, operations, and expressions, screen output and keyboard input, control statements, object creation and modification, arrays, functions, constructors, pattern matching using regular expressions, errors in scripts.

JavaScript execution environment, the Document Object Model, elements access in JavaScript, events and event handling, handling events from body elements, handling events from text box and password elements, the DOM2 event model, the navigator object, DOM tree traversal and modification, positioning elements, moving elements, element visibility, changing colors and fonts, dynamic content, stacking elements, locating the mouse cursor, reacting to a mouse click, slow movement of elements, dragging and dropping elements.

Browser Management and Media Management,classes, constructors, object-oriented techniques in JavaScript,object constructor and prototyping,sub classes and super classes –JSON –jQueryand AJAX.

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TEACHING AND EXAMINATION SCHEME

Master of Computer Applications

Semester III

Paper Name (Theory)	Lec	Tut	Exam Hours	MAX MARKS	
				Sess-ional	Sem Exam
mca-301 Data Warehouse & Data Mining	5	1	3	20	80
mca-302 Advance Java Programming	5	1	3	20	80
mca-303 Computer Graphics	5	1	3	20	80
mca-304 Advance Database Management Systems	5	1	3	20	80
Elective I					
mca-305a Bluetooth Technology	5	1	3	20	80
mca-305b Wireless Protocols					
Total of Theory (Sessional & Semester Exam Marks)					**500**

Paper Name (Practical)	Pract Hours	Exam Hours	Max Marks
mca-306 Lab-Advance Java Programming	4	3	50
mca-307 Lab-Computer Graphics	4	3	50
mca-308 Lab-ADBMS & Data Mining	4	3	50
mca-309 Lab-Wireless Networking	4	3	50
Total of Practical Marks			**200**
Total of Theory & Practical Marks			**700**

Duration: 3 hours **Max Marks: 80**

mca-301 Data Warehouse& Data Mining

Introduction of data warehousing, basic concepts, data warehousing architecture , data characteristics, Reconciled data layers. Data transformation function, tools to support data reconciliation.

Data Modeling Techniques and Options: Dimensions and Query Hierarchies, Star Schema and Variants, Spatial Data: A Very Special Dimension, Storage Concerns and Planning Physical Database Design, Exploiting Parallel Technology, Indexes

Introduction to data mining, DM techniques, issues and challenges in Dm, Applications, association rules, Prior, Partition, Pincer-Search, Dynamic Itemset counting, FP-tree growth, Incremental, Boder Algorithm

Clustering Techniques, portioning, k-Medoid algorithm, Hierarchical, categorical clustering algorithm, Decision tree, best split, splitting indices and criteria,

decision tree construction algorithm, CART, ID3, C4.5, CHAID, Decision tree construction with presorting, rain Forest, approximate methods, Boat, Pruning Technique

Data mining using NN, web mining, temporal and spatial data mining.

Duration: 3 hours **Max Marks: 80**

mca-302 Advance Java Programming

Introduction to Java, characteristics, Object oriented programming, data types, variables, arrays

Control statements: selection, iteration, jump statements, operators, Introduction to classes, class fundamentals, constructor, methods, stack class, inheritance, creating multilevel hierarchy, method over riding, Packages and interfaces, exception handling, multi-threaded programming, I/O applets Java Library, string handling, string comparison, string buffer

Servlet Structure, Servlet packaging, HTML building utilities, Lifecycle, Single Thread model interface, Handling Client Request: Form Data, Handling Client Request: HTTP Request Headers. Generating server Response: HTTP Status codes, Generating server Response: HTTP Response Headers, Handling Cookies, Session Tracking.

Overview of JSP Technology, Need of JSP, Benefits of JSP, Advantages of JSP, Basic syntax, invoking Java code with JSP scripting elements, creating Template Text, Invoking java code from JSP, Limiting java code in JSP, using JSP expressions, comparing servlets and JSP, writing scriptlets. Using Scriptlets to make parts of JSP conditional, using declarations, declaration example. Controlling the Structure of generated servlets: the JSP page directive, import attribute, session attribute, isElignore attribute, buffer and auto flush attributes, info attribute ,errorPage and is errorPage attributes, is Thread safe Attribute, extends attribute, language attribute, Including files and applets in JSP Pages, using java beans components in JSP documents

Java Beans & Annotations: Creating Packages, Interfaces, JAR files and Annotations. The core java API package, New Java Lang Sub package, Built-in Annotations.Working with Java Beans. Introspection, Customizers, creating java bean, manifest file, Bean Jar file, new bean, adding controls, Bean properties, Simple properties, Design Pattern events, creating bound properties, Bean Methods, Bean an Icon, Bean info class, Persistence, Java Beans API. .

Duration: 3 hours **Max Marks: 80**

mca-303 Computer Graphics

Interactive graphics, passive graphics, advantage of interactive graphics, classification of application, hardware and software requirement of computer graphics

Point, line, DDA algorithm, Bresenham's line algorithm, circle, circle generating algorithm, midpoint circle algorithm, ellipse generating algorithm, mid-

point ellipse algorithm, polynomial and spline curves, parallel curve algorithms, curve function, filled area primitives, line attributes, curve attributes, area fill attributes, clippings, clipping lines.

2D transformation, matrix representation of 2D, composite transformation, translation, rotation, scaling, general pivot-point rotation, general fix scaling, other transformations, reflection, shear, affine transformations and transformation functions, window-to-view port transformation, clipping operation, point, line, Cohen-Sutherland line clipping, polygon clipping.

3D display method, parallel projection, perspective projection, visible line identification, depth cueing, surface rendering, polygon surface, table, equation, mashes, splines, representation, cubic spline interpolation, Bezeir Curves and surfaces, B-spline and surfaces, Beta-spline, 3D transformation, rotation, scaling, composite transformation, 3D transformation function.

Duration: 3 hours **Max Marks: 80**

mca-304 Advance Database Management Systems

Object Oriented modeling, class, different types of attributes, generalization, inheritance, aggregation, encapsulation, complex objects, object definition language, object query language, object technology in RDBMS, primary, secondary, multi-level files, dynamic multi-level index using B & B+ tree,

Distributed database design, architecture of distributed processing system, data communication concept, data placement, placement of DDBMS, and other components, concurrency control techniques, recovery, transaction management, need of recovery, recovery techniques, serializability, two-phase locking.

Query optimization and processing, algorithm for external sorting, select and join, object and set operations, heuristics in query optimization, temporal database concept, multi-media database, Security and integrity of databases, security specifications in SQL, access control, flow control.

SQL*PLUS Data types, Constraints, Operators, DDL, DML, PL/SQL syntax, Data types, PL/SQL functions, Error handling in PL/SQL, package functions, package procedures, Oracle transactions. Stored procedures & functions, creation and execution of procedures

Database Triggers: Introduction, Use & type of database Triggers, Triggers Vs. Declarative Integrity Constraints, BEFORE Vs. AFTER Trigger Combinations, Creating a Trigger, Dropping a Trigger.

Duration: 3 hours **Max Marks: 80**

mca-305a Bluetooth Technology

Introduction to wireless technologies: WAP services, Serial and Parallel Communication, Asynchronous and synchronous Communication, FDM,TDM, TFM, Spread spectrum technology Introduction to Bluetooth: Specification, Core protocols, Cable replacement protocol

Bluetooth Radio: Type of Antenna, Antenna Parameters, Frequency hopingBluetooth Networking: Wireless networking, wireless network types, devices roles and states, adhoc network, scatternet Connection establishment procedure, notable aspects of connection establishment, Mode of connection, Bluetooth security, Security architecture, Security level of services, Profile and usage model: Generic access profile (GAP), SDA, Serial port profile, Secondary Bluetooth profile

Hardware: Bluetooth Implementation, Baseband overview, packet format, Transmission buffers, Protocol Implementation: Link Manager Protocol, Logical Link Control Adaptation Protocol, Host control Interface, Protocol Interaction with layers

Duration: 3 hours **Max Marks: 80**

mca-305b Wireless Protocols

Overview of Third Generation (3G) in wireless

Universal Mobile Telecommunication Service (UMTS), UMTS Service and Air interface, 3GPP network architecture, CDMA2000, TD-CDMA and TDSCDMA Technologies.

Evolution of 2.5G

Enhancement over 2G, GPRS and EDGE network services and architectures, traffic dimensioning, CDMA2000 (1XRTT), WAP and SMS, migration path from 2G to 2.5G to 3G

UMTS

UMTS basics, WCDMA interface, UTRAN architecture, establishment of UMTS speech cells, UMTS packet data (R99), high speech packet data handover and UMTS core network evolution

CDMA2000

Radio components, network structure packet data transport flow, radio network (IS-2000, 1XRTT), EVDO

TD-SCDMA

Architecture and code network, radio network, interface migration technique RAN Traffic planning.

TD-CDMA

Generic TD-CDMA architecture, code networks, radio network, interface migration technique RAN traffic planning

VoIP Technology

Basis of IP transport, VoIP challenge, H-323, session invitation protocol, distributed architecture and media gateway control, VoIP and SS7 VoIP quality of service.

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TEACHING AND EXAMINATION SCHEME

Master of Computer Applications

Semester IV

Paper Name (Theory)	Lec	Tut	Exam	MAX	
MARKS				**Hours**	**Sess**
Sem				**-ional**	**Exam**
mca-401 Programming in Python	5	1	3	20	80
mca-402 Advance Internet Technology	5	1	3	20	80
mca-403 Object Oriented Software Engineering	5	1	3	20	80
mca-404 Artificial Intelligence	5	1	3	20	80
Elective I					
mca-405a Computer Vision & Human Computer Interface	5	1	3	20	80
mca-405b Image Processing & Pattern Recognition					
Total of Theory (Sessional & Semester Exam Marks)					
500					

Paper Name (Practical)	Pract Hours	Exam Hours	Max Marks
mca-406 Lab-AI	4	3	50
mca-407 Lab-Cognitive Science	4	3	50
mca-408 Lab-Advance Internet Technology	4	3	50
mca-409 Lab-Python	4	3	50
Total of Practical Marks			**200**
Total of Theory & Practical Marks			**700**

Duration: 3 hours **Max Marks: 80**

mca-401 Programming In Python

Programming basics and strings, numbers and operators, variables, making decisions

Functions, classes and objects, organizing programs, files and directories

Building modules, text processing,

Writing a GUI with Python, Accessing Databases

Python with XML, Network Programming, Programming with C, Numerical Programming,

Web Application and Web Services, Integrating Java with Python

Duration: 3 hours **Max Marks: 80**

mca-402 Advance Internet Technology

Role Of XML - XML and The Web - XML Language Basics - SOAP - Web **Services** - Revolutions Of XML - Service Oriented Architecture (SOA).

XML TECHNOLOGY - XML - Name Spaces - Structuring With Schemas and DTD - Presentation Techniques - Transformation - XML Infrastructure.

SOAP, Overview Of SOAP - HTTP - XML-RPC - SOAP: Protocol - Message Structure - Intermediaries - Actors - Design Patterns And Faults - SOAP With Attachments.

WEB SERVICES: Overview - Architecture - Key Technologies - UDDI - WSDL - ebXML - SOAP And Web Services In E-Com - Overview Of .NET And J2EE.

XML Security: Security Overview – Canonicalization – XML Security Framework – XML Encryption – XML Digital Signature – XKMS Structure – Guidelines for Signing XML Documents – XML in Practice

Duration: 3 hours **Max Marks: 80**

mca-403 Object Oriented Software Engineering

Concepts of Software Engineering, Software Characteristics, components applications, software Metrics and Models; Process and Product Metrics, Size metric, Complexity metric, McCabe's Cyclometic Complexity, Halsted Theory, Function Point Analysis.

System Development Life Cycle (SDLC) Steps, Water fall model, Prototypes, Spiral model.Planning and Software Project: Cost Estimation, Project Scheduling, Quality Assurance Plans, Project Monitoring Plans.

Software Development& Software Design : System design, detailed design, function oriented design, object oriented design user Interface design, Design level metrics: Phases, Process Models, Role of Management, Role of Metrics and Measurement, Software Quality factors

Coding and Testing: Programming Practices, verification, Monitoring and Control.Testing level metrics Software quality and reliability Clean room approach, software reengineering.

Testing & Reliability: Testing Fundamentals, Test case design, Functional Testing, Structural Testing, Test Plan activities during testing, Unit System , Integration Testing. Concept of Software Reliability, Software Repair and Availability, Reliability Models (JM, GO, MUSA Markov) Limitations of Reliability Models

Object-oriented analysis and design using UML

Duration: 3 hours **Max Marks: 80**

mca-404 Artificial Intelligence

Definition of AI, Application of AI, knowledge-based systems, representation of knowledge organization and acquisition of knowledge

Introduction of prolog, variable, object, domain, clauses, recursion basic list manipulation function, predicates, input, output, local variables, iteration,

recursion, arrays, database in prolog, rule order, goal order, cut trial prolog query. Syntax, semantics of propositional logic, syntax and semantics of FOPL, conversion to clausal form, inference rule, resolution principles, non-deductive inference methods, representation using rules, truth maintenance system, predicate completion and circumscription, modal and temporal logics Bayesian probabilistic inference, possible word representation, Dempster-Shafer Theory, Ad-Hoc methods, Expert system, natural language processing, machine learning

Duration: 3 hours **Max Marks: 80**

mca-405a Computer Vision & Human Computer Interface

Structure from motion, Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, Constrained structure and motion, Dense motion estimation, Parametric motion, Spline-based motion , Optical flow, Layered motion, Image stitching, Motion models, Global alignment, Compositing Stereo correspondence , Sparse correspondence , Dense correspondence, Local methods, Global optimization, Multi-view stereo, 3D reconstruction, Active range finding, Surface representations, Point-based representations, Image-based rendering,

View interpolation, Layered depth images, Light fields and Lumi graphs, Environment mattes, Video-based rendering, Recognition, Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding, Recognition databases and test sets.

Duration: 3 hours **Max Marks: 80**

mca-405b Image Processing & Pattern Recognition

Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images,Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing,Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening FrequencyDomain, Filters, Homomorphic Filtering.

Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Inverse Filtering,Minimum Mean Square Error (Wiener) Filtering,Constrained Least Square Filtering, Geometric Mean Filter.

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TEACHING AND EXAMINATION SCHEME

Master of Computer Applications

Semester V

Paper Name (Theory)	Lec	Tut	Exam Hours	MAX MARKS Sessional	MAX MARKS Semester Exam
mca-501 Cloud Computing	5	1	3	20	80
mca-502 Theory of Computation	5	1	3	20	80
mca-503 Advance Web Programming	5	1	3	20	80
Elective I					
mca-504a Information Security	5	1	3	20	80
mca-504b Soft Computing					
Elective II					
mca-505a Spatial Database Management System	5	1	3	20	80
mca-505b Grid Computing					
Total of Theory (Sessional & Semester Exam Marks)					**500**

Paper Name (Practical)	Pract Hours	Exam Hours	Max Marks
mca-506 Lab-Minor Project	4	3	50
mca-507 Lab-Elective I & Cloud Computing	4	3	50
mca-508 Lab-Elective II & Theory of Computation	4	3	50
mca-509 Lab-Windows Programming	4	3	50
Total of Practical Marks			**200**
Total of Theory & Practical Marks			**700**

Duration: 3 hours Max Marks: 80

mca-501 Cloud Computing

Introduction: Business and IT perspective, Cloud and virtualization, Cloud services requirements, cloud and dynamic infrastructure, cloud computing characteristics, cloud adoption.

Cloud models: Cloud characteristics, Measured Service, Cloud models, security in a public cloud, public verses private clouds, cloud infrastructure self-service.

Cloud at a service: Gamut of cloud solutions, principal technologies, cloud strategy, cloud design and implementation using SOA, Conceptual cloud model, cloud service demand.

Cloud solutions: Cloud ecosystem, cloud business process management, cloud service management, cloud stack, computing on demand, cloud sourcing.

Cloud offerings: Cloud analytics, Testing under cloud, information security, virtual desktop infrastructure, Storage cloud.

Cloud management: Resiliency, Provisioning, Asset management, cloud governance, high availability and disaster recovery, charging models, usage reporting, billing and metering.

Cloud virtualization technology: Virtualization defined, virtualization benefits, server virtualization, Hypervisor management software, Logical partitioning, VIO server, Virtual infrastructure requirements. Storage virtualization, storage area networks, network attached storage, cloud server virtualization, virtualized data center.

Cloud and SOA: SOA journey to infrastructure, SOA and cloud, SOA defined, SOA defined, SOA and IAAS, SOA based cloud infrastructure steps, SOA business and IT services.

Duration: 3 hours **Max Marks: 80**

mca-502 Theory of Computation

Definition of Automation, finite automata, transition system, Finite State Systems, Basic definitions, Finite Automata, Regular Expressions, Deterministic Finite Automation (DFA), Non-deterministic Finite Automation (NFA), regular languages and regular sets, equivalence of DFA and NFA, minimizing the number of states of a DFA, NFA with E transitions, equivalence of DFA and NFA with E Transaction, Finite Automata with output, Equivalence of Moore and Mealy machine.

Regular Expression Formalism, Equivalence of regular expressions and finite automata, regular sets and their closure properties, pumping lemma for regular expressions, Application of regular expression.

Turing Machine: Elements, formalism, Transition graph for Turing machine, Complexity, Composite and iterative, Universal, multi-tape, multi-stack, multi-track Turing machine, Halting problem, recursively enumerable and recursive languages, function, TM Church's hypothesis,

Grammars: definition, notations, derivation process, derivation tree, context free language, ambiguous context free languages , simplification of context free grammar, normal forms, Chomsky hierarchy, Equivalence of right- linear and left – linear grammars, Equivalence of regular grammars and finite automata, pumping lemma for context free languages, Kuroda normal form.

Push down stack memory machine: Elements of PDM, Push down automata, finite automata vs. PDA, PDA accepting CFLs, DPDA vs. NPDA, Equivalence of CFG and PDA

Parsing Techniques: Parsing, top down parsing, bottom-up parsing, automatic construction of bottom up parsers

Duration: 3 hours **Max Marks: 80**

mca-503 Advance Web Programming

Introduction to .NET Framework: Genesis of .NET – Features of .NET–.NET binaries –Microsoft Intermediate Language – Meta Data –.NET types and .NET name spaces – CommonLanguage Runtime – Common Type System – Common LanguageSpecification –.NET Applications using command line compiler and visual studio .NET IDE.

Basics of ASP.NET: Introducing ASP .NET – Creating and deploying ASP .NETapplications – Web forms – web controls – working with events – rich web controls –custom web controls – validation controls – debugging ASP.NET pages.

Advanced ASP.NET: ASP.NET configuration – Business objects – HTTP Handlers –Caching in ASP.NET – ASP.NET security – localizing ASP.NET applications – deployment projects

Building Web Services: Introduction to web services – web services infrastructure – SOAP – building a web service – deploying and publishing web services – finding web services – consuming web services

ADO.NET: Basics of ADO.NET – Changes from ADO – Data Table – Data Views – DataSet – Data Relation Type – ADO.NET Managed Providers – OLEDB and SQL ManagedProviders – OLEDB Data Adapter Type.

Duration: 3 hours **Max Marks: 80**

mca-504a Information Security

Introduction to Cryptography: Introduction To Security: Attacks, Services & Mechanisms, Security, Attacks, Security Services

Conventional Encryption: Classical Techniques, Conventional Encryption Model, and Steganography, Classical Encryption Techniques.

Modern Techniques: Simplified DES, Block Cipher Principles, DES Standard, DES Strength,Differential & Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation.

Conventional Encryption Algorithms: Triples DES, Blowfish, International Data EncryptionAlgorithm, RCS, CAST-128, RC2 Placement & Encryption Function, Key Distribution,Random Number Generation, Placement of Encryption Function.

Public Key Encryption: Public-Key Cryptography: Principles of Public-Key Cryptosystems,RSA Algorithm, Key Management, Fermat's & Euler's Theorem,

Primality, The Chinese Remainder Theorem.

Hash Functions: Message Authentication & Hash Functions: Authentication Requirements,Authentication Functions, Message Authentication Codes, Hash Functions, Birthday Attacks,Security of Hash Function & MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm, (SHA), Digital Signatures: Digital Signatures, Authentication Protocol, Digital Signature

Standard (DSS), Proof Of Digital Signature Algorithm.

Network & System Security: Authentication Applications: Kerberos X.509, DirectoryAuthentication Service, Electronic Mail Security, Pretty Good Privacy (PGP), S / Mime,Security: Architecture, Authentication Header, Encapsulating Security Payloads, CombiningSecurity Associations, Key Management, Web Security: Secure Socket Layer & Transport Layer Security, Secure Electronic Transaction (Set), System Security: Intruders, Viruses, Firewall Design Principles, Trusted Systems.

Duration: 3 hours **Max Marks: 80**

mca-504b Soft Computing

Basic of neural Networks, inference and learning, classification of models, association of models, optimization and self-organization models, definition of learning, supervised and unsupervised learning. AI learning, neural network learning, knowledge based neural network, rule based, decision tree based, constraint based neural network.

Incremental learning, symbolic methods, neural network approaches, applications of neural networks, neural networks as mathematical models, expert system heuristic, hierarchical models, hybrid, parallel, control network discovery, symbolic methods, neural network methods.

Genetic Algorithm, evolutionary programming, classifier system, genetic programming parse tree, mathematical foundation of GA variant of GA (Hybrid and fuzzy GA enhancement of genetic programming application

Duration: 3 hours **Max Marks: 80**

mca-505a Spatial Database Management System

Basic of neural Networks, inference and learning, classification of models, association of models, optimization and self-organization models, definition of learning, supervised and unsupervised learning. AI learning, neural network learning, knowledge based neural network, rule based, decision tree based, constraint based neural network.

Incremental learning, symbolic methods, neural network approaches, applications of neural networks, neural networks as mathematical models, expert

system heuristic, hierarchical models, hybrid, parallel, control network discovery, symbolic methods, neural network methods.

Genetic Algorithm, evolutionary programming, classifier system, genetic programming parse tree, mathematical foundation of GA variant of GA (Hybrid and fuzzy GA enhancement of genetic programming application

Introduction to GIS, history, definition, hardware and software, raster based GIS, data acquisition, nature of spatial data, geo-referencing.

GIS functionality, data models, raster, vector, object oriented, coordinate system and geo-coding, data structures

Introduction to ArcView, creating maps, adding tabular data, choosing map projection, attribute features, aggregating data, creating and editing spatial data.

Introduction to VBA / .NET, data types, string, numbers, geo-coding, script writing, loops, interacting with views and themes, graphics, creating layout.

Spatial data overview, data mining primitives, generalization and specialization, spatial rules, classification algorithms, classification, clustering algorithms.

Duration: 3 hours **Max Marks: 80**

mca-505b Grid Computing

Introduction: Grid Computing & Key Issues – Applications – Other Approaches – Grid Computing Standards – Pragmatic Course of Investigation.

Grid Benefits & Status of Technology: Motivations – History of Computing, Communications and Grid Computing – Grid Computing Prime Time – Suppliers and Vendors – Economic Value – Challenges.

Components of Grid Computing Systems and Architectures: Basic Constituent Elements-A Functional View – A Physical View – Service View.

Grid Computing Standards-OGSI: Standardization – Architectural Constructs – Practical View – OGSA/OGSI Service Elements and Layered Model – More Detailed View.

Standards Supporting Grid Computing-OGSA: Functionality Requirements – OGSA Service Taxonomy – Service Relationships – OGSA Services – Security Considerations.

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TEACHINGAND EXAMINATION SCHEME

Master of Computer Applications

Semester VI

Paper Name (Theory)	Lec	Tut	Exam Hours	MAX MARKS	
				Sess-ional	Sem Exam
mca-601 Information Retrieval	5	1	3	20	80
mca-602 Service Oriented Architecture	5	1	3	20	80
mca-603 Mobile Application Development	5	1	3	20	80
mca-604 Dissertation	5	1	3	50	200
Total of Theory (Sessional & Semester Exam Marks)					**550**

Paper Name (Practical)	Pract Hours	Exam Hours	Max Marks
mca-605 Mobile Application Development	4	3	50
mca-606 Seminar	4	3	100
Total of Practical Marks			**150**
Total of Theory & Practical Marks			**700**

Duration: 3 hours **Max Marks: 80**

Mca-601 Information Retrieval

Introduction: Motivation, Basic concepts, past, present, and future, the retrieval process.

Modeling: Introduction, A taxonomy of information retrieval models, retrieval: ad hoc and filtering, a formal characterization of IR models, classic information retrieval, alternative set theoretic models, alternative algebraic models, alternative probabilistic models, structured text retrieval models, models for browsing.

Retrieval Evaluation: Introduction, retrieval performance evaluation, reference collections. query

Languages: Introduction, keyword-based querying, Pattern matching, Structural queries, Query protocols.

Query Operations: Introduction, user relevance feedback, automatic local analysis, automatic global analysis.

Text and multimedia languages and Properties: Introduction, metadata, text, markup languages,

Multimedia Text Operations: Introduction, document preprocessing, document clustering, text compression, comparing text compression techniques.

Indexing and searching: Introduction; inverted files; other indices for text; Boolean queries; sequential searching; pattern matching; structural queries; compression.

Parallel and Distributed IR: Introduction, Parallel IR, Distributed IR.

User Interfaces and Visualization: Introduction, Human-Computer interaction, the information access process, starting pints, query specification, context, using relevance judgments, interface support for the search process.

Searching the Web: Introduction, challenges, characterizing the web, search engines, browsing, meta searchers, finding the needle in the haystack, searching using hyperlinks.

Duration: 3 hours **Max Marks: 80**

mca-602 Service Oriented Architecture

SOA BASICS: Software Architecture, types of IT Architecture SOA, evolution, key components, perspective of SOA, enterprise-wide SOA architecture, enterprise applications, solution architecture for enterprise application, software platforms for enterprise applications, patterns for SOA, SOA programming models.

SOA analysis and design: Service-Oriented Analysis and Design, design of activity, data, client and business process services, technologies of SOA, SOAP, WSDL, JAX, WS, XML WS for .NET, service integration with ESB, scenario, business case for SOA, stakeholder objectives, benefits of SPA, cost savings.

SOA Governance: SOA implementation and governance, strategy, SOA development, SOA governance, trends in SOA, event-driven architecture, software s a service, SOA technologies, proof-of concept, process orchestration, SOA best practices.

SOA Implementation: SOA based integration, integrating existing application, development of web services, integration – SOA using REST, RESTful services, RESTful services with and without JWS, Role of WSDL,SOAP and Java/XML mapping in SOA, JAXB Data binding.

Application Integration: JAX, WS 2.0 client side/server side development packaging and deployment of SOA component, SOA shopper case study, WSDL centric Java WS with SOA-J, related software, integration through service composition (BPEL), case study – current trends.

Duration: 3 hours **Max Marks: 80**

mca–603 Mobile Application Development

Introduction to mobile communication and computing: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications

Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator, The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control.

The Android Debug Bridge (ADB), basic widgets understanding the role of Android Application Components, event handling, displaying messages through toast, creating and starting an activity, using the Edit ext Control Building Blocks for Android Application Design, Laying Out Controls in Containers, utilizing resources and media

Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments Advanced, Android Programming: Internet, Entertainment, and Services, Implementing drawing and animations, displaying web pages and maps, communicating with SMS and emails, creating and using content providers: creating and consuming services, publishing android applications

MANUAL FOR PREPARATION OF DISSERTATION THESIS

1. GENERAL

The manual is intended to provide broad guidelines to the MCA candidates in the preparation of the thesis. In general, the thesis shall report, in an organized and scholarly fashion, an account of original research work of the candidate leading to the discovery of new facts or techniques or correlation of facts already known (analytical, experimental, hardware oriented, etc.)

2. NUMBER OF COPIES TO BE PREPARED

At least four copies are to be prepared, one each for External Examiner, Guide, Departmental Library and self. The copies should be submitted to the Controller of Examination through the Head of the Department before the due date.

3. ARRANGEMENT OF CONTENTS OF THESIS

The sequence in which the thesis material should be arranged and bound should be as follows:

1. Title page
2. Bonafide Certificate
3. Abstract
4. Acknowledgement
5. Table of Contents
6. List of Tables
7. List of Figures
8. List of Symbols, Abbreviations or Nomenclature (Optional)
9. Chapters
10. References
11. Appendices

The Tables and Figures shall be introduced in the appropriate places.

4. PAGE DIMENSIONS AND MARGIN

The thesis should be prepared on good quality white paper preferably not lower than 80gsm. Standard A4 size paper should be used for preparing the copies. The final thesis should have the following page margins:

Top edge	: 30 to 35 mm
Left side	: 35 to 40 mm
Bottom edge	: 25 to 30 mm
Right side	: 20 to 25 mm

Tables and figures should conform to the margin specifications. Large size figures should be photographically or otherwise reduced to the appropriate size before insertion.

5. MANUSCRIPT PREPARATION

The headings of all items 2 to 11 listed in section 3 should be typed in capital letters without punctuation and centered 50mm below the top of the page. The text should commence 4 spaces below this heading.

5.1 Title Page – A specimen copy of the title page is given in Appendix 1.

5.2 Bonafide Certificate – A specimen copy of the bonafide certificate is

given in Appendix 2.

5.3 Abstract – Abstract should be an essay type of narrative not exceeding 600 words, outlining the problem, the methodology used for tackling it and a summary of the findings.

5.4 Acknowledgement – It should be brief and preferably should not exceed one page when typed double spacing.

5.5 Table of Contents – The table of contents should list all material following it as well as any material which precedes it. The title page, bonafide certificate and acknowledgement will not find a place among the items listed in the table of contents. One and a half spacing should be adopted for typing the matter under this head.

5.6 List of Tables – The list should use exactly the same captions as they appear above the tables in the text. One and a half spacing should be adopted for typing the matter under this head.

5.7 List of Figures – The list should use exactly the same captions as they appear below the figures in the text. One and a half spacing should be adopted for typing the matter under this head.

5.8 List of Symbols, Abbreviations and Nomenclature – One and a half spacing should be adopted for typing the matter under this head. Standard symbols and abbreviations should be used.

5.9 Chapters – The chapters may be broadly divided into 3 parts:

i. Introductory chapter,

ii. Chapters developing the main theme of the thesis,

iii. Results, Discussions and Conclusions.

The main text will be divided into several chapters and each chapter may be further divided into several divisions and sub-divisions.

- Each chapter should be given an appropriate title.
- Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they are cited.
- Footnotes should be used sparingly. They should be typed single space and placed directly underneath in the very same page which refers to the material they annotate.

5.10 List of References – When works of other researchers are used either directly or indirectly the origin of the material thus referred to as appropriate places in the thesis should beindicated. A paper, a monograph or a book may bedesignated by the name of the first author

followed by the year of publication,placed inside brackets at the appropriate place of reference. The citation may assume any one of the following forms:

Examples of citation

i. An improved algorithm has been adopted in literature (Tsychiya 1980)

ii. Jankins and Walts (1968) have dealt at length with this principle.

iii. The problem of mechanical manipulators has been studied by Shin et al (1984) and certain limitations of the method used has been pointed out by Shin et al (1984 a)

The listing should be typed 4 spaces below the heading REFERENCES inalphabeticalorder in single spacing left-justified. The reference material should be listed in the alphabetical order of the first author. The name(s) of the author(s) should beimmediately followed by the year and other details. A typical illustrative list is given below.

REFERENCES

1. Ariponnammal S. and Natarajan S. (1994) 'Transport Phonomena of SmSel-x Asx', Pramana Journal of Physics, Vol. 42, No.5, pp.421-425.

2. Barnard R.W. and Kellogg C. (1980) 'Applications of Convolution Operators to Problems in Univalent Function Theory', Michigan Mach. J., Vol 27, pp 81-94.

3. Jankins G.M. and Walts D.G. (1968) 'Spectral Analysis and its Applications', Holder Day, San Francisco.

4. Shin K.G. and McKay N.D. (1984) 'Open Loop Minimum Time Control of Mechanical Manipulations and its Applications', Proc. Amer. Contr. Conf., San Diego, CA, pp.1231-1236.

5.11 Appendices – Appendices are provided to give supplementary information, which if included in the main text may serve as a distraction and cloud the central theme under discussion.

- Appendices should be numbered using Arabic numerals, e.g. appendix 1, Appendix 2, etc.
- Appendices, tables and references appearing in appendices should be numbered and referred to at appropriate places just as in the case of chapters.

5.12 Tables and Figures – The word table means tabulated data in the body of the thesis as well as in the appendices. All other material used in the body of the thesis and appendices such as charts, graphs, maps, photographs and diagrams may be designated as figures.

- A table or figure including caption should be accommodated within the prescribed margin limits and appear on the page following the page where their first reference is made.
- Tables and figures half page or less in length may appear on the same page along with the text. However, they should be separated from the text both above and below by triple spacing.
- All tables and figures should be prepared on the same paper or material used for the preparation of the rest of the thesis.
- Two or more small tables or figures may be grouped if necessary in a single page.
- Photographs, if any, should be included in colourxerox form or as colour printouts of scanned images. More than one figure can be included in a page.

6. TYPING INSTRUCTIONS

6.1 General Uniformity of the font (say, Times New Roman) in the entire thesis shall be observed. A sub-heading at the bottom of a page must have atleast two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen. Double spacing should be used for typing the bonafide certificate and acknowledgement. One and a half spacing should be used for typing the general text. Single spacing should be used for typing:

i. Long Tables
ii. Long quotations
iii. Foot notes
iv. Multiline captions
v. References All quotations exceeding one line should be typed in an indentedspace - the indentation being 15mm from either margins.

6.2 Chapters:

The format for typing chapter headings, division headings and sub divisionheadings are explained through the following illustrative examples.

Chapter heading: CHAPTER 1
INTRODUCTION
Division heading : 1.1 OUTLINE OF THESIS
Sub-division heading: 1.1.2. Literature review

The word CHAPTER without punctuation should be centered 50mm down from the top of the page. Two lines below, the title of the chapter should be typed centrally in capital letters. The text should commence 4 lines below this title. The division and sub-division captions along with their numberings should be left-justified. The typed material directly below division or sub-division heading should commence 2 spaces below it. Within a division or sub-division paragraphs are permitted. Every paragraph should commence 3 spaces below the last line of the preceding paragraph.

7. NUMBERING INSTRUCTIONS

7.1 Page Numbering

All page numbers (whether Roman or Arabic) should be typed without punctuation on the upper right hand corner 20mm from top with the last digit inline with the right hand margin. The preliminary pages of the thesis (such as title page, acknowledgement, table of contents, etc.) should be numbered in lower case Roman numerals. The title page will be numbered as (i) but this should not be typed. The page immediately following the title page shall be numbered (ii)and it should appear at the top right hand corner as already specified. Pages of main text, starting with Chapter 1 should be consecutively numbered using Arabic numerals.

7.2 Numbering of Chapters, Divisions and Sub-8 Divisions. The numbering of chapters, divisions and sub-divisions should be done using Arabic numerals only and decimal notation should be used for numbering the divisions and sub-divisions within a chapter. For example, sub-division 4 under division 3 belonging to Chapter 2 should be numbered as 2.3.4. The caption for thesub-division should immediately follow the number assigned to it. Every chapterbeginning with

the first chapter should be serially numbered using Arabic numerals.

7.3 Numbering of Tables and Figures Tables and figures appearing anywhere in the thesis should bear appropriate numbers. The rule for assigning such numbers is illustrated through an example. Thus, if a figure in Chapter 3, happens to be the fourth then assign Fig. 3.4 to that figure. Identical rules apply for tables except that the word Fig. is replaced by the word Table. If figures (or tables) appear in appendices then figure 3 in Appendix 2 will be designated as Fig. A2.3. A table may be continued into the next page, but no line should be drawn underneath anunfinished table. The top line of the table continued into the next page should, for example, read Table 2.1 (continued) placed centrally and underlined.

7.4 Numbering of Equations: Equations appearing in each chapter or appendix should be numbered serially, the numbering commencing afresh for each chapter or appendix. Thus, for example, an equation appearing in Chapter 2, if it happens to be the eighth equation in that chapter should be numbered (2.8) thus: ... (2.8) while referring to this equation in the body of the thesis it should be referred to as Eqn. 2.8.

8. BINDING SPECIFICATIONS

The thesis should be bound using flexible cover of thick white or blue art paper. The cover should be printed in black letters and the text for printing should be identical to what has been prescribed for the title page.

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