

SYLLABUS FOR MASTER OF COMPUTER APPLICATIONS (MCA)

(Semester: I & II)

Session: 2018-19



DIRECTORATE OF OPEN AND DISTANCE LEARNING (ODL)

GURU NANAK DEV UNIVERSITY, AMRITSAR

(ESTABLISHED UNDER STATE LEGISLATURE ACT NO. 21 OF 1969)

Accredited by National Assessment and Accreditation Council (NAAC) At 'A++' Grade (Highest Level) As Per Modified Criteria Notified On 27/07/2017 And Conferred 'University With Potential For Excellence' Status And 'Category-I University' As Per University Grants Commission (F.No. 1-8-2017/(CPP-II) Dated 12/02/2018)

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**MASTER OF COMPUTER APPLICATIONS (SEMESTER SYSTEM) under Directorate of
Open & Distance Learning, Guru Nanak Dev University, Amritsar**

Eligibility:

BBA/B. Com/B.Sc. (Hons.) Economics or Graduate in any stream with Mathematics/ Statistics/Computer Science/Computer Applications/ IT/ Computer Maintenance/ Quantitative Techniques as one of the elective subjects with 50% marks (45% for SC/ST) in aggregate or any equivalent degree there to.

OR

Bachelor's degree in any stream with 50% marks (45% for SC/ST) in aggregate with Mathematics as an elective subject at +2 level.

Semester-I

Paper Code	Subject	Marks			Credits
		Internal Assessment	End Term	Total	
ODMCA-101T	Computer Fundamentals	20	80	100	4
ODMCA-102T	Introduction to Programming	20	80	100	4
ODMCA-103T	Computer Oriented Numerical & Statistical Methods	20	80	100	4
ODMCA-104P	Programming Laboratory-I	20	80	100	4
ODMCA-105T	Communication Skills*	10	40	50	2
Total Marks & Credits		90	360	450	18

Note: * Credits not to be counted towards SGPA.

Semester-II

Paper Code	Subject	Marks			Credits
		Internal Assessment	End Term	Total	
ODMCA-201T	Data & File Structures	20	80	100	4
ODMCA-202T	Computer Organization & Architecture	20	80	100	4
ODMCA-203T	Computer Based Optimization Techniques	20	80	100	4
ODMCA-204T	Computer Networks	20	80	100	4
ODMCA-205P	Programming Laboratory-II	20	80	100	4
Total Marks & Credits		100	400	500	20

ODMCA-101T: Computer Fundamentals**Time: 03 Hours****Max. Marks: 100 Marks****Internal Assessment: 20 Marks****End Term: 80 Marks****Instructions for the Paper-Setter/examiner:**

1. Question paper shall consist of **Four sections**.
2. Paper setter shall set **Eight questions** in all by selecting **Two questions** of equal marks from each section. However a question may have sub-parts (not exceeding four sub-parts) and appropriate allocation of marks should be done for each sub-part.
3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
4. The question paper should be strictly according to the instructions mentioned above. In no case a question should be asked outside the syllabus.

Section-A

Introduction to Computer: Computer System Characteristics, Hardware–CPU, Memory, Input, Output & Storage devices, Organization of Secondary Storage Media, Software – System & Application, Types of processing Batch and On–line.

Programming Paradigms and Development Tools: –Problem Analysis, Program Constructs (Sequential, Decision, Loop), Algorithms, Flowcharts, Pseudocode. Decision table, Modular Programming, Top–down and Bottom–up Approaches, functional, Procedural object–oriented, and logic programming, Programming Languages – Syntax & Semantics.

Section-B

Operating System Concepts: Role of an Operating System, Types of operating systems, Batch processing, Multiprogramming, timesharing, real time, mobile, portable etc, Booting procedure and its types, Components and functions of operating system.

Data Communication: Introduction to Data Communication, Types of Networks, Transmission Media, Network level threats, Classification of threats

Section-C

Internet: Internet and its applications, Working knowledge of Search engines and use of electronic mail, Virus, Information level threats, Hacking Prevention Mechanism: Anti – Viruses, Firewalls, Biometrics Controls for security, cryptography and encryption.

Introduction to Cloud Computing: Overview of distributed computing; Trends of computing, introduction to parallel/distributed computing, Introduction to Cloud Computing including benefits, challenges, and risks, Different types of clouds, Security and Privacy issues in the Cloud.

Section-D

Introduction to DBMS: Database models, fundamental of relational model, 3-Level architecture, query languages, query optimization, normalization, DBA: security, recovery, concurrency. Introduction to distributed and Object Oriented database.

Introduction to Big data: Introduction to database, introduction to data mining, structural/unstructural data, Define and describe Big Data and its characteristics, Critique, Applications in different areas, Tools & Techniques of implementation.

References:

1. Computers Today: Suresh K. Basandra, Galgotia, Updated Edition, 2012.
2. Gurvinder Singh & Rachhpal Singh: A Test Book on Windows Based Computer Courses, Kalyani Publishers, 10th Edition 2008.
3. Norton, Peter: Introduction to Computers, McGraw Hill
4. Martin, James: Telecommunications and the Computer, PHI
5. Distributed and Cloud Computing, 1st edition, Morgan Kaufmann, 2011 by Hwang & Dongarra & Fox
6. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl Published May 2013.
7. Rajaraman, A., Ullman, J.D., Mining of Massive Datasets, Cambridge University Press, United Kingdom, 2012.
8. <http://swayam.gov.in/>
9. <http://edx.org> formerly <http://mooc.org/>

ODMCA-102T: INTRODUCTION TO PROGRAMMING**Time: 03 Hours****Max. Marks: 100 Marks****Internal Assessment: 20 Marks****End Term: 80 Marks****Instructions for the Paper-Setter/examiner:**

1. Question paper shall consist of **Four sections**.
2. Paper setter shall set **Eight questions** in all by selecting **Two questions** of equal marks from each section. However a question may have sub-parts (not exceeding four sub-parts) and appropriate allocation of marks should be done for each sub-part.
3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
4. The question paper should be strictly according to the instructions mentioned above. In no case a question should be asked outside the syllabus.

Section-A**Introduction to Program Development:** Problem Analysis, Designing a solution.**Overview of C:** Brief history of C, introduction to different versions of C. General Structure of a C program, stages in the development of a C program.**Data Types, Operators & Expressions:** Constants and variables, data types, declaring variables, storage classes, different types of expressions and their evaluation, conditional expression, assignment statement, enumerated data type, redefining/creating data types, type casting.**Console Input/Output:** Standard input/output devices, unformatted input/output functions (character I/O functions and string I/O functions), formatted input/output functions (*scanf()* function and *printf()* function).**Control Statements:** Decision making using *if*, *if-else*, *elseif* and *switch* statements, Looping using *for*, *while* and *do-while* statements, transferring program control using *break* and *continue* statements**Section-B****Arrays & Strings:** Introduction to arrays, declaring arrays, initializing arrays, processing of arrays, introduction to strings.**Structures & Unions:** Introduction to structures, declaring structures, initializing structures, accessing elements of structures, array of structures, nested structures, passing structures as arguments to a function, introduction to unions.

Functions: Defining a function, local variables, *return* statement, invoking a function, specifying and passing arguments (including arrays, strings) to a function, function prototyping and use of header files, building own library, recursion.

Pointers: Why pointers? Declaring pointers, accessing values via pointers, pointer arithmetic, pointers to arrays, Array of pointers, pointers to strings, pointers to structures, self-referential structures.

Section-C

Program Structure: Program structure revisited, managing multi-file programs using traditional approach of separate compilations and project facility of Turbo C compiler, storage classes revisited.

File I/O: Introduction to files, different ways of file processing (standard I/O & system I/O), description of various library functions for file handling, updating files, programming examples to illustrate the processing of files.

Introduction to Object Oriented Paradigm –Object Oriented programming and C++, Structured Programming methodology, its shortcomings, advantages of OOPS (Object Oriented Programming Style).

OOP concepts: Abstraction, Encapsulation, Data Hiding, Inheritance, Polymorphism.

Section-D

Overview of C++ –Data types, Input/output statements, Flow of control–looping statements, branching statements, Pointers & references, namespaces.

Class design: constructors, destructors, operator overloading, reuse through inheritance, virtual functions, exception handling.

I/O with stream classes, memory management

The Standard Template Library (STL): containers, algorithms, iterators, adaptors, function objects.

References:

1. Stephan G. Kochan, Programming in C, Addison–Wesley Professional, 2013.
2. Walter Savitch, Absolute C++, Fifth Edition, Addison Wesley, 2013
3. Ellis Horowitz, Satraj Sahni and Susan Anderson–Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
4. R. G. Dromey, How to Solve it by Computer, Prentice–Hall of India.
5. Cohoon and Davidson, C++ Program Design: An introduction to Programming and Object–Oriented Design, 3rd Edition, Tata McGraw Hill.
6. Byron Gotterfried, Programming in C, Tata McGraw Hill Publishing Company Ltd., Delhi.
7. Yashvant Kanetkar, Let Us C, BPB Publications, Delhi.
8. R.S. Salaria, Applications Programming in C, Khanna Book Publishing Co. (P) Ltd., Delhi.
9. <http://swayam.gov.in/>
10. <http://edx.org> formerly <http://mooc.org/>

ODMCA-103T: COMPUTER ORIENTED NUMERICAL & STATISTICAL METHODS**Time: 03 Hours****Max. Marks: 100 Marks****Internal Assessment: 20 Marks****End Term: 80 Marks****Instructions for the Paper-Setter/examiner:**

1. Question paper shall consist of **Four sections**.
2. Paper setter shall set **Eight questions** in all by selecting **Two questions** of equal marks from each section. However a question may have sub-parts (not exceeding four sub-parts) and appropriate allocation of marks should be done for each sub-part.
3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
4. The question paper should be strictly according to the instructions mentioned above. In no case a question should be asked outside the syllabus.

Section-A

Floating-Point Numbers: Floating-point representation, Rounding, Chopping, Error analysis.

Non-Linear Equations: Generalized Newton Raphson method, Secant method, Rate of convergence of secant method, Muller's method.

Linear Systems of equations: Gauss Elimination and LU-decomposition methods, solution of tridiagonal system, Jacobi and Gauss-Seidel methods.

Section-B

Central Difference Interpolation: Gauss forward, Gauss Backward, Stirling Interpolation methods.

Numerical Differentiation and Integration: Numerical differentiation using Interpolation method, Boole's Rule, Weddle's rule of numerical integration, Romberg Integration.

Numerical Solution of Ordinary Differential Equations: Euler's method, Runge-Kutta method, Predictor-Corrector method.

Section-C

Dispersion: Meaning, Characteristics for an ideal measure of dispersion. Measures of dispersion (Mean deviation, Standard Deviation and variance.)

Principle of least Square: correlation and regression coefficients (two variables only).

Analysis of Statistical Data: Frequency distribution; Frequency curve and histogram; Measure of central tendency and dispersion.

Section-D

Random Variables and probability distributions: Basic concepts of probability and its properties, Conditional probability and independent events; Random variable, Notion of sample space; distribution functions; Mathematical expectation, Poisson, Rectangular, Exponential and Normal distributions.

Sampling distributions: Notion of random sample and sampling distributions; Parameter and statistics; Standard error; Chi-square, t, F distributions; Basic ideas of testing of hypothesis; Testing of significance based on normal, Chi-square, t and F distributions.

Recommended Books:

1. Hogg, Robert V, Elliot A Tanis and Rao, Jagan M., Probability and Statistical Inference, Pearson Education (2009).
2. Meyer P. L., Introductory Probability and Statistical Applications, Oxford and IBH (2008).
3. Conte, S. D. and Boor, C. D., Elementary Numerical Analysis: An Algorithmic Approach, (Third Edition), Tata McGraw Hill, New York (2006).
4. Jain, M. K., Iyengar, S.R.K. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, New Age International Publishers (2008).
5. <http://swayam.gov.in/>
6. <http://edx.org> formerly <http://mooc.org/>

ODMCA-104P : Programming Laboratory-I**Time: 03 Hours****Max. Marks: 100 Marks****Internal Assessment: 20 Marks****End Term: 80 Marks**

- Practical Exercises on Programming in C/C++
- Implementation of numerical & statistical methods using C/C++ language
- File management using Linux/Unix/ Windows based operating system

*Master of Computer Applications (Semester – I)***ODMCA-105T: Communications Skills****Time: 03 Hours****Max. Marks: 50 Marks****Internal Assessment: 10 Marks****End Term: 40 Marks****Instructions for the Paper-Setter/examiner:**

1. Question paper shall consist of **Four sections**.
2. Paper setter shall set **Eight questions** in all by selecting **Two questions** of equal marks from each section. However a question may have sub-parts (not exceeding four sub-parts) and appropriate allocation of marks should be done for each sub-part.
3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
4. The question paper should be strictly according to the instructions mentioned above. In no case a question should be asked outside the syllabus.

Section-A

Theories of communication, Goals- Organizational and Personal, Psychology of communication, Channels, Cost and Barriers to communication, Informal and Formal communication

Section-B

Listening and Speaking Skills, Familiarizing to different tones and accents, Oral communication practice, Public speaking, Grammar and Vocabulary, Speech, Extempore

Section-C

Basics of Telephone Etiquette in Business communication, Practice of Interview skills and Group Discussions

Section-D

Students must carry out Group discussions and Mock interviews during the lab session.

Books Recommended:

1. Simon Sweeney, "English for Communication", 2nd Edition, CUP, 2003.
2. Leo Jones and Richard Alexander, "New International Business English", CUP, 2000.
3. Essentials of Business Communication, Rajendra Pal. JS Korlahhi
4. <http://swayam.gov.in/>
5. <http://edx.org> formerly <http://mooc.org/>

ODMCA-201T: DATA & FILE STRUCTURES**Time: 03 Hours****Max. Marks: 100 Marks****Internal Assessment: 20 Marks****End Term: 80 Marks****Instructions for the Paper-Setter/examiner:**

1. Question paper shall consist of **Four sections**.
2. Paper setter shall set **Eight questions** in all by selecting **Two questions** of equal marks from each section. However a question may have sub-parts (not exceeding four sub-parts) and appropriate allocation of marks should be done for each sub-part.
3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
4. The question paper should be strictly according to the instructions mentioned above. In no case a question should be asked outside the syllabus.

Section-A

Preliminaries: Various data structures, common operations on data structures, algorithm complexity, big O notation, time-space tradeoff between algorithms.

Arrays: Arrays defined, representing arrays in memory, various operations on linear arrays, Multi-dimensional arrays, Records.

Linked Lists: Types of linked lists, representing linked lists in memory, advantage of using linked lists over arrays, various operation on linked lists

Section-B

Stacks: Description of stack structure, implementation of stack using arrays and linked lists. Applications of stacks – converting arithmetic expression from infix notation to polish and their subsequent evaluation, quicksort technique to sort an array, parenthesis checker.

Queues: Description of queue structure, implementation of queue using arrays and linked lists, description of priorities queues. Applications of queues – Operating system simulations

Trees: Description of tree structure and its terminology, binary search tree, implementing binary search tree using linked lists, various operations on binary search trees, AVL Trees, Threaded Binary Trees, B-Trees, B+ trees, Greedy Method: Knapsack Problem, Prim's and Kuruskal's Algorithm to find MSTs.

Section-C

Heaps: Description of heap structure, implementing heaps using arrays, various operations on heaps, Applications of heaps – heapsort technique to sort an array, implementation of priority queues.

Graphs: Description of graph structure, implementing graphs in memory using adjacency matrix

or adjacency lists, various graphs traversing algorithms, finding shortest path between two nodes, Dijkstra's shortest path algorithm., finding biconnected component, strongly connected component and finding cycles in the graphs.

Section-D

Searching and Sorting: Sorting Types, External and Internal sort Linear Search, Binary search, Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Shell Sort, Quick sort, Radix Sort. **Hash Tables:** Direct address tables, hash tables, collision resolution by chaining, hash functions, open addressing – linear probing, quadratic probing, double hashing.

References:

1. Seymour Lipschutz: Theory and Problems of Data Structures, Schaum Outline Series, McGraw–Hill Book Company. Third Edition
2. Jeffery Esakov: Data Structures – An Advanced Approach Using C, Tom Weiss, Prentice–Hall International, Inc. 2007
3. Trembley and Sorenson: An Introduction to Data Structures with Application, Tata–McGraw Hill Company, Delhi. 2003
4. Tanenbaum: Data Structures and C. Second Edition
5. <http://swayam.gov.in/>
6. <http://edx.org> formerly <http://mooc.org/>

ODMCA-202T: COMPUTER ORGANIZATION AND ARCHITECTURE**Time: 03 Hours****Max. Marks: 100 Marks****Internal Assessment: 20 Marks****End Term: 80 Marks****Instructions for the Paper-Setter/examiner:**

1. Question paper shall consist of **Four sections**.
2. Paper setter shall set **Eight questions** in all by selecting **Two questions** of equal marks from each section. However a question may have sub-parts (not exceeding four sub-parts) and appropriate allocation of marks should be done for each sub-part.
3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
4. The question paper should be strictly according to the instructions mentioned above. In no case a question should be asked outside the syllabus.

Section-A

Basic computer Organisation and design: Register Transfer and Micro-operations: Register Transfer Language, various Arithmetic, Logic & Shift micro-operations, instruction codes, computer registers, timing & control, instruction cycle, design of a complete basic computer & its working.

Section-B

Programming & controlling the basic computer: Machine & Assembly Language, hardwired & Micro-programmed control, Design of a control unit.

CPU Architecture: General register & stack organization, instruction formats and addressing modes, ALU & Control unit architecture.

Section-C

Memory Organisation: Memory hierarchy, main, auxiliary, cache memory, virtual memory, paging and segmentation.

I/O Organization: Peripheral Devices, input-output interface, Modes of data transfer, programmed & interrupt initiated I/O, DMA, I/O Processors.

Section-D

Parallel & Multiprocessing Environment: Introduction to parallel processing, pipelining, RISC Architecture, vector & array processing, Multiprocessing concepts, memory & resource sharing, interprocessor communication & synchronisation.

References:

1. Morris Mano: Computer System Architecture, Pearson, 3rd Edition, 2007.
2. Hayes J.P.: Computer Architecture & Organisation, McGraw Hill, 3rd Edition, 2012.
3. Tanenbaum: Structured Computer Organisation, Pearson, 5th Edition, 2012.
4. Morris Mano: Computer System Architecture, PHI, 3rd Edition, 1993.
5. Stone: Introduction to Computer Architecture: Galgotia, 2nd Edition, 1990.
6. <http://swayam.gov.in>
7. <http://edx.org> formerly <http://mooc.org/>

ODMCA-203T: COMPUTER BASED OPTIMIZATION TECHNIQUES**Time: 03 Hours****Max. Marks: 100 Marks****Internal Assessment: 20 Marks****End Term: 80 Marks****Instructions for the Paper-Setter/examiner:**

1. Question paper shall consist of **Four sections**.
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3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
4. The question paper should be strictly according to the instructions mentioned above. In no case a question should be asked outside the syllabus.

Section-A

Linear Programming: Mathematical formulation of linear programming problems, Canonical and standard forms of linear programming problems, Solution by Graphical & Simplex method, Revised simplex method, Two phase & Big-M method, Duality, Primal-Dual Relationship, Dual Simplex method, Economic Interpretation of Optimal simplex Solution. Sensitivity Analysis: Changes in RHS values, Objective Function Coefficients, Constraint Coefficients, Addition of a new constraint/variable.

Section-B

Special Types of LPP: Transportation and Assignment Problems, Optimality, Special cases in Transportation and Assignment Problems, Game Theory: Two-person zero sum games, maximin-minimax principle, games without saddle points (Mixed strategies), graphical solution of $2 \times n$ and $m \times 2$ games, dominance property, arithmetic method of $n \times n$.

Section-C

Integer & Dynamic Programming: Integer programming problem, Branch and Bound Techniques. Characteristics, Deterministic DP Problems, Recursive Approach and Tabular method.

PERT / CPM: Project Planning, Scheduling, Activity cost

Section-D

Evolutionary Techniques: Introduction to Evolutionary Computing & Genetic Algorithms, GA as a search and optimization technique. Implementation of SGA using MATLAB/Scilab. **Advanced Computing Techniques:** Introduction to Neural Networks, Fuzzy Systems and other Soft Computing techniques. Introduction to Swarm Intelligence and Optimization.

Recommended Books:

1. Gass, S. L.: Linear Programming
2. Rao S.S.: Optimization Theory and Applications, Wiley Eastern.
3. Manmohan, Gupta P.K.: Operation Research, Sultan Chand & Co., New Delhi.
4. Swrup, Kanti: Operation Research, Sultan Chand & Co., New Delhi.
5. Hadley, G.: Linear Programming, Narosa, 1994.
6. Genetic Algorithms in Search Optimization and Machine Learning by David E. Goldberg, Pearson Education, 2004.
7. Introduction to Neural Networks using MATLAB, S N Sivanandam S Sumathi S N Deepa Mc GrawHill, 2015.
8. <http://swayam.gov.in>
9. <http://edx.org> formerly <http://mooc.org/>

ODMCA-204T : COMPUTER NETWORKS**Time: 03 Hours****Max. Marks: 100 Marks****Internal Assessment: 20 Marks****End Term: 80 Marks****Instructions for the Paper-Setter/examiner:**

1. Question paper shall consist of **Four sections**.
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3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
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Section-A

Introduction to networks and its Components: Transmission media–Guided media Twisted pair (Architecture of RJ–45 Connector), Co–axial cable (architecture of BNC), unguided media. **Analog and Digital Transmission and their conversions:** composite signals and Fourier analysis. Switching, ISDN services, Transmission in ATM networks. **Layered Architecture:** OSI and TCP/IP reference models.

Section-B

Data Link layer: Framing, Error detection and correction, Elementary data link and sliding window protocols, Channel allocation in LAN and WAN, Multiple access protocols. **Design issues of network layer:** Routing algorithms, Congestion control algorithms, internetworking, Repeaters, Routers.

Section-C

Services and elements of transport protocols

IEEE standards used in Computer networks. Introduction to wireless networks: IEEE 802.11, Wireless sensor networks, Ad-hoc networks.

Section-D

Wireless System Architecture: wireless system components, Network Architecture.

Types of wireless networks: WPAN, WLAN, WWAN, Cellular telephony.

Network Security and Privacy: Fundamentals of data Compression techniques and Cryptography.

Recommended Books:

1. Forouzon Behrouz: Data Communication & networking 5E, Tata McGraw Hill.
2. Jm Geier, Wireless Networks First Step, CISCO Press
3. William Satllings, Wireless Communication & Networks, Pearson Education
4. <http://swayam.gov.in/>
5. <http://edx.org> formerly <http://mooc.org>

ODMCA-205P : Programming Laboratory-II**Time: 03 Hours****Max. Marks: 100 Marks****Internal Assessment: 20 Marks****End Term: 80 Marks****Practical will be based on:**

- Implementation of Data and File Structures using C/C++
- Implementation of Computer Oriented Optimization Techniques
- Network Administration – User management, File & Resource Sharing