

Syllabus for  
***Master of Computer  
Applications  
(MCA)***

Semester: 1 - IV

Session: 2023-24



**Directorate of Open & Distance  
Learning  
Guru Nanak Dev University**

(ESTABLISHED UNDER STATE LEGISLATURE ACT NO. 21 OF 1969)  
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(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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- (ii) Subject to change in the syllabi at any time. Please visit the University website time to time

**Directorate of Open & Distance Learning (ODL)**

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

**Eligibility:**

BBA/ B.com. / B.Sc. (Regular/ Hons.) Economics or Graduate in any stream with Mathematics/ Statistics/ Computer Sciences/ 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 thereto.

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**

Sr. No.	Sub Code	Subject	Marks			Credits
			Internal Assessment	End Term	Total	
1.	ODMCA101T	Design And Analysis Of Algorithms	20	80	100	4
2.	ODMCA102T	System Software	20	80	100	4
3.	ODMCA103T	System Simulation	20	80	100	4
4.	ODMCA104T	Design of Programming Languages	20	80	100	4
5.	ODMCA105P	Programming Lab-I	20	80	100	4
		General Elective-I (Choose any one from the below subject)				
6.	ODMCA106T	Secure software development	20	80	100	4
7.	ODMCA107T	Computer Graphics	20	80	100	4
		<b>Grand Total:</b>	<b>120</b>	<b>480</b>	<b>600</b>	<b>24</b>

**SEMESTER-II**

Sr. No.	Sub Code	Subject	Marks			Credits
			Internal Assessment	End Term	Total	
1.	ODMCA201T	Open Source Software	20	80	100	4
2.	ODMCA202T	Distributed Systems	20	80	100	4
3.	ODMCA203T	Theory of Computation	20	80	100	4
4.	ODMCA204T	Web Technologies	20	80	100	4
5.	ODMCA205P	Programming Lab-II	20	80	100	4
		General Elective-II (Choose any one from the below subject)				
6.	ODMCA206T	Information Systems and Security	20	80	100	4
7.	ODMCA207T	Digital Image Processing	20	80	100	4
		<b>Grand Total</b>	<b>120</b>	<b>480</b>	<b>600</b>	<b>24</b>

## Directorate of Open &amp; Distance Learning (ODL)

## SEMESTER-III

Sr. No.	Sub Code	Subject	Marks			credits
			Internal Assessment	End Term	Total	
1.	ODMCA301T	Advanced Software Engineering	20	80	100	4
2.	ODMCA302T	Soft Computing	20	80	100	4
3.	ODMCA303T	Data Warehousing and Data Mining	20	80	100	4
4.	ODMCA304T	Advanced Computer Architecture	20	80	100	4
5.	ODMCA305T	Cloud Native Application development	20	80	100	4
6.	ODMCA306P	Programming Lab-III	20	80	100	4
<b>Grand total</b>			<b>120</b>	<b>480</b>	<b>600</b>	<b>24</b>

SEMESTER-IV						
Sr. No.	Sub Code	Subject	Credits			Marks
			Internal Assessment	End Term	Total	Marks
1.	ODMCA401P	Major Project/Industrial Training/Dissertation	120	480	600	24

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – I)****ODMCA101T: DESIGN AND ANALYSIS OF ALGORITHMS**

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 **5<sup>th</sup> 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**

**A Revision of Algorithm concepts:** Asymptotic notation, Design of efficient algorithms, complexity analysis of sorting and searching Algorithms, Complexity analysis of Iterative and Recursive algorithm.

**Design Strategies:** Brute Force Method, Divide-and-conquer.

**SECTION–B**

**Greedy Method:** Knapsack problem, Huffman coding, Job Sequencing with Deadline, Optimal Merge Pattern, Prim's Algorithm and Kruskal's Algorithm.

**Dynamic Programming:** Matrix Chain multiplication, 0/1 knapsack problem, Longest Common Subsequence, Travelling Salesman problem, Multistage Graph, All pair shortest path, optimal binary search trees.

**SECTION–C**

**Back-tracking:** 8 Queen's problem, Hamiltonian Circuit, Graph Coloring, Sum of subset.

**Branch-and-bound:** Assignment Problem, Knapsack problem, Travelling Salesman problem.

**SECTION–D**

**Algorithms on Graphs:** Depth/Breadth First search, Dijkstra Algorithm and Bellman Ford Algorithm

**Problem Classes:** P, NP, NP-Hard and NP- Complete.

**Directorate of Open & Distance Learning (ODL)****References:**

1. Cormen T.H., Leiserson C.E., Rivest R.L., Introduction to Algorithms, PHI, 2000.
2. Horowitz E., Sahni S., Rajasekaran S., Computer Algorithms, Galgotia Publications, 1999.
3. Aho A.V., Hopcroft J.E. Ullman J.D., The Design and Analysis of Computer Algorithms, Pearson Education Asia, 1998, 1974
4. Knuth D.E., The Art of Computer Programming, Volume 1 (Fundamental Algorithms), Narosa Publishing House, 1973
5. Knuth D.E., The Art of Computer Programming, Volume 3 (Sorting and Searching), Addison–Wesley, 1973.
6. <http://swayam.gov.in/>
7. <http://edx.org> formerly <http://mooc.org/>
8. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – I)****ODMCA102T: SYSTEM SOFTWARE**

Time: 03 Hours

Max. Marks: 100 Marks

Internal Assessment: 20 Marks

End Term: 80 Marks

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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 **5<sup>th</sup>** 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 System Software** Evolution of System Software, components of system software, Translators, loaders, interpreters, compiler, assemblers.

**Assemblers** Overview of assembly process, design of one pass and two assemblers.

**SECTION B**

**Macroprocessors** Macro definition and expansion, concatenation of macro parameters, generations of unique labels, conditional macro expansion, Recursive macro expansion.

**SECTION C**

**Compilers** Phases of compilation process, lexical analysis, parsing, storage management optimisation. Incremental compilers, cross compilers, P code compilers.

**SECTION D**

**Loaders and Linkage editors** Basic loader functions. Relocation, program linking, linkage, editors, dynamic linking, bootstrap loaders.

Operating System, Text Editor, Interactive debugging systems.

**Other System Software**

**References :**

1. Leland L. Beck : System Software, An introduction to system programming, Addison Wesley.
2. D.M. Dhamdhare : Introduction to System Software, Tata McGraw Hill.
3. D.M. Dhamdhare : System Software and Operating System, Tata McGraw Hill, 1992.
4. Madrich, Stuarde : Operating Systems, McGraw Hill, 1974.
5. Stern Nancy Assembler Language Programming for IBM and IBM compatible computers, John Wiley, 1991.
6. <http://swayam.gov.in/>
7. <http://edx.org> formerly <http://mooc.org/>
8. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)**  
**Master of Computer Applications (SEMESTER – I)**

**ODMCA103T: SYSTEM SIMULATION**

Time: 03 Hours

Max. Marks: 100 Marks  
 Internal Assessment: 20 Marks  
 End Term: 80 Marks

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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 **5<sup>th</sup>** 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** : Concept of a system, stochastic activities, continue and discrete system, system modeling, mathematical modeling, principle used in modeling.

**Simulation of Systems** : Concepts of simulation of continuous systems with the help of two examples; use of integration formulas; concepts of discrete system simulation with the help of two examples, Generation of random numbers, Generation of non-uniformly distributed numbers.

**SECTION-B**

**Simulation of Queuing Systems** : Rudiments of queuing theory, Simulation of Single-Server queue, two-server queue, general queues.

**SECTION-C**

**Simulation in Inventory Control and Forecasting:** Elements of inventory theory, inventory models, Generation of Poisson and Erlang variants, forecasting and regression analysis.

**Design and Evaluation of Simulation Experiments:** Experimental layout and validation.

**SECTION-D**

**Simulation Languages:** Continuous and discrete simulation languages, Block-Structured continuous simulation languages, expression based languages, discrete system simulation languages, Simgen, GPSS, SIMULA, factors in selection of a discrete system simulation languages.

**References :**

1. Narsingh Deo, "System Simulation with Digital Computer", Prentice-Hall of India Pvt. Ltd. - 1993.
2. Gordon, "System Simulation", Prentice Hall of India Pvt. Ltd. – 1993
3. <http://swayam.gov.in/>
4. <http://edx.org> formerly <http://mooc.org/>
5. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – I)****ODMCA104T: Design of Programming Languages**

Time: 03 Hours

Max. Marks: 100 Marks

Internal Assessment: 20 Marks

End Term: 80 Marks

**Instructions for the Paper-Setter/examiner:**

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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 **5<sup>th</sup>** 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**

Study of Programming Languages: Brief History, Feature of a good language

Programming Language Processor: Translator and software simulator computer, syntax semantics and virtual computers.

Specifications and Implementation of Elementary and Structured Data Types. Type equivalence, checking and conversion. Vectors and Arrays, Lists, Structures, Sets, Files.

**SECTION–B**

Abstraction, encapsulation and information hiding subprograms, type definitions, abstract data types Sequence control with Expressions, Conditional Statements, Loops, Exception handling. Subprogram definition and activation, simple and recursive subprogram, subprogram environment.

**SECTION–C**

Scope – Static and Dynamic, Block structures, Local Data and Shared Data, Parameters and Parameter Transmission. Local and Common Environments, Tasks and Shared Data.

Static and Stack-Based Storage management. Fixed and Variable size heap storage management, Garbage Collection.

**SECTION–D**

Syntax and Translation: Syntactic elements of a language, stages in translation, formal definition of syntax

Operating and Programming Environment: Batch processing, interactive, embedded, programming environments

**Text/References:**

1. Programming languages: design and implementation, Terrence W. Pratt., Pearson
2. Programming languages: concepts and constructs, Ravi Sethi, ISBN 9780201590654.
3. Programming Language Pragmatics, Scott, ELSEVIER
4. <http://swayam.gov.in/>
5. <http://edx.org> formerly <http://mooc.org/>
6. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)**

**Master of Computer Applications (SEMESTER – I)**

**ODMCA105P: PROGRAMMING LAB-I**

Time: 03 Hours

Max. Marks: 100 Marks

Internal Assessment: 20 Marks

End Term: 80 Marks

Practical based on Design and Analysis of Algorithms.

Examples on: Sorting and Searching Algorithm, Brute Force Method, Divide and Conquer Technique, Greedy Method, Dynamic Programming, Backtracking method, Branch and Bound Method, Graph Problems.

Programming Languages

System Software

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – I)  
ODMCA106T: Secure Software Development**

Time: 03 Hours

Max. Marks: 100 Marks

Internal Assessment: 20 Marks

End Term: 80 Marks

**Instructions for the Paper-Setter/examiner:**

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3. Candidates shall attempt Five questions in all, by at least selecting One question from each section and the 5<sup>th</sup> 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**

Fundamentals and requirement level analysis: Introduction, background, How Does Software Fail, Characteristics of Secure and Resilient Software, Software security life cycle, Software quality attributes, Security requirement gathering principles and guidelines, A case Study.

**SECTION–B**

Vulnerabilities during implementation, consequences, and prevention: The Evolution of Software Attacks , Buffer overflow, Format string bug SQL Injection, Data Validation vulnerabilities mitigation techniques, Cross-site Scripting, Cross-site Request Forgery, Session management, Replication of vulnerabilities and exploitation, Secure programming for preventing BOF, FSB, SQLI, XSS, session.

**SECTION–C**

Mobile application security: Mobile application security, Security and cryptographic techniques, Malware classification and analysis.

**SECTION–D**

Design and testing for security, best practices: Secure software design principles, Static analysis techniques, Security testing of Software Applications.

**Course Outcome:**

- Analyze issues related secure software development methodologies.
- Apply a thorough understanding of secure coding principle.
- Select the most appropriate approach to secure software development.
- Judge and craft appropriate adaptations to the development process to make sure a secure deployment.
- Evaluate the implications and impact of secure architecture design.

**References:**

1. Secure and Resilient Software, Mark Merkow and LakshmikanthRaghavan, CRCPress, ISBN:9781439826973.
2. Software Security Engineering: A Guide for Project Managers , by Julia H. Allen, Sean J. Barnum Robert J. Ellison, Gary McGraw, Nancy R. Mead, Pearson Education ISBN13:9780321509178.
3. Iron-Clad Java: Building Secure Web Applications, Jim Manico and August Detlefsen, Oracle Press, ISBN-13:978-0071835886.
4. Security for Software Engineers, James N. Helfrich, Chapman and Hall/CRC, ISBN-13: 978-1138583825.
5. <http://swayam.gov.in/>
6. <http://edx.org> formerly <http://mooc.org/>
7. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – I)  
ODMCA107T: COMPUTER GRAPHICS**

Time: 03 Hours

Max. Marks: 100 Marks

Internal Assessment: 20 Marks

End Term: 80 Marks

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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 **5<sup>th</sup>** 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**

**Elements of Computer Graphics:** Introduction to computer graphics; graphics display devices; interactive control devices; output devices; display processors.

**2D Graphics**

**Elementary Drawing Algorithms:** Line drawing using direct method, simple DDA, integer DDA, incremental method, and Bresenham's algorithm; Circle drawing using incremental method and Bresenham's algorithm, drawing arcs, sectors, etc. Flood Fill Algorithms, Boundary Fill Algorithms

**Geometric Transformations:** Translation, rotation, scaling, reflection and shear; concept of homogenous coordinates, Building composite transformations.

**SECTION–B**

**Viewing Transformations:** Concept of windows & viewport, window-to-viewport mapping, clipping operations – point clipping, line clipping algorithms (Cohen – Sutherland, mid-point subdivision, Cyrus – Beck), Sutherland – Hodgman polygon clipping algorithm.

**3D Graphics**

**Drawing 3D Shapes:** Coordinate systems, representation of 3D shapes, designing curves and surfaces (Hermite, Bezier, and B-Spline).

**Geometric Transformations:** Translation, rotation, scaling and reflection.

**SECTION–C**

**Projective Transformations:** Parallel projections–orthographic, axonometric (isometric, diametric and trimetric), oblique projections; and perspective projections (one, two and three vanishing points).

**Viewing Transformations:** Viewing a 3D object, 3D clipping (extension of specified 2D algorithms to handle 3D objects).

**SECTION–D**

**Hidden line/surface Removal:** Back face removal, z-buffer algorithm, Painters (depth sort) algorithm, subdivision algorithms – Warnock's algorithm, scan line algorithms – scan line z-buffer algorithm.

**Rendering:** Introduction, a simple illumination model, shading–Gouraud shading & Phong shading, ray tracing, shadows, textures.

**Directorate of Open & Distance Learning (ODL)****Course Outcome:**

- Introduce students with fundamental concepts related to computer graphics.
- Have a good understanding of important drawing algorithms, clipping, and 2D transformations etc.
- Apply clipping algorithms and transformations on 2D images.
- Understand the problem related to viewing transformation as well as projection concepts.
- Be able to explain concept and problems related to ray tracing algorithm, shadows, and curves.

**References:**

1. David F. Rogers: Procedural Elements for Computer Graphics, McGraw Hill Book Company.
2. Adams & David F. Rogers: Mathematical Elements of Computer Graphics, McGraw Hill Book Company.
3. Roy A. Plastock, Gordon Kalley: Computer Graphics, McGraw Hill Book Company.
4. Donald Hearn & M. Pauline Baker: Computer Graphics, Prentice Hall of India Private Limited.
5. <http://swayam.gov.in/>
6. <http://edx.org> formerly <http://mooc.org/>
7. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – II)****ODMCA201T: Open Source Software**

Time: 03 Hours

Max. Marks: 100 Marks

Internal Assessment: 20 Marks

End Term: 80 Marks

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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 **5<sup>th</sup>** question may be attempted from any of the **Four** sections.
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**Section–A**

Introduction to Free/Libre Open Source Software, Legal Aspects of Open source Software, Free/Libre Open Source Software Business Models, Free/Libre Open source Software Developers & Communities

**Section–B**

Assessment of Free/Libre Open source Projects, Tools and infrastructures for FLOSS Development, Humanitarian and Free Open Source Software, How to participate in Free/Libre Open Source Software Projects, Hands on training on using the Git version control system

**Section–C**

FLOSS Documentation, Free/Libre Open Source Software quality and measures of software quality, Free/Libre Open Source Software security and other issues

**Section–D**

Free/Libre Software Development Processes, Commercial firm support, OSS ecosystems, Mining software repositories, OSS research challenges

**Course Outcome:**

- Can identify the licensing of Open Source Systems (OSS) and make decisions on their use, based on an understanding of the legal, economical and technical issues.
- Develop the knowledge and skills to use a version control system to explore code repositories.
- Build their own or participate in an existing OSS project.
- Knowledge of community dynamics of OSS projects.

**References:**

1. Open Source for Business: A Practical Guide to Open Source Software Licensing, 2nd Edition by Heather Meeker
2. Managing 3rd-Party Software Licenses, by Giles Middleton (2016)

**Directorate of Open & Distance Learning (ODL)**

3. Open Sources: Voices from the Open Source Revolution, O'Reilly Media, by Eric S. Raymond (1999)
4. The Art of Community: Building the New Age of Participation, O'Reilly Media, by Jono Bacon (2012)
5. The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary, O'Reilly Media, by Eric Raymond (1999)
6. The Software Paradox, O'Reilly Media, by Stephen O'Grady (2015)
  - a. The Success of Open Source, by Steven Weber
7. <http://swayam.gov.in/>
8. <http://edx.org> formerly <http://mooc.org/>
9. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – II)  
ODMCA202T: DISTRIBUTED SYSTEMS**

Time: 03 Hours

Max. Marks: 100 Marks

Internal Assessment: 20 Marks

End Term: 80 Marks

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**SECTION–A**

Distributed Systems – Basic characteristics, benefits over centralized systems, challenges, Design Issues, fallacies; System Models – physical, architectural, and fundamental, client-server and peer to peer systems; Role of middleware;

**SECTION–B**

communication - message passing and distributed shared memory; Inter process communication – direct, multicast, indirect, RPC, RMI, IPC in Unix.

**SECTION–C**

Operating System support; Time and Global states; Coordination and agreement; Distributed transactions and concurrency control; Replication;  
Security challenges – perimeter defence, authentication schemes, access control technologies;

**SECTION–D**

Reliable distributed computing – why do systems fail, how to overcome failures; Computing in the clouds, Google as a case study.

**Prescribed Text:**

Distributed Systems, Concepts and Design, by Coulouris, Dollimore, and Kindberg, 5th ed., 2012.

**References:**

1. Andrew S. Tanenbaum, Distributed Operating Systems, ACM Press.
2. Jie Wu, Distributed Systems, CRC Press.

**Directorate of Open & Distance Learning (ODL)**

3. Hagit Attiya, Jennifer Welch, Distributed Computing: Fundamentals, Simulations and Advanced Topics, McGraw-Hill.
4. Kai Hwang, Geoffrey Fox, Jack Dongarra, Distributed Computing and Cloud Computing – from parallel processing to Internet of Things, Morgan Kaufmann, Elsevier, 2012.
5. Kenneth P. Birman, Guide to Reliable Distributed Systems, Springer, 2012.
6. Mukesh Singhal and Niranjana Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill.
7. Nancy Lynch, Distributed Algorithms, Morgan Kaufmann.
8. Sape Mullender (ed.), Distributed Systems, Addison-Wesley.
9. <http://swayam.gov.in/>
10. <http://edx.org> formerly <http://mooc.org/>
11. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – II)  
ODMCA203T: THEORY OF COMPUTATION**

Time: 03 Hours

Max. Marks: 100 Marks

Internal Assessment: 20 Marks

End Term: 80 Marks

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**SECTION–A****Basic Definitions**

**Operations on Languages:** Closure properties of Language classes, Context Free Language: Chomsky & Greibach Normal forms, Linear Grammars and Regular Language, Regular Expressions, Context Sensitive Languages

**SECTION–B**

The Kuroda normal Form, One sided context Sensitive Grammars, LR (k) Grammars

**Unrestricted Languages:** Normal form and Derivation Graph, Automata & their Languages

**SECTION–C**

Finite Automata , Pushdown Automata, 2-pushdown Automata

Turing machines, the equivalence of the automata and appropriate grammars, the Dyck Language.

**SECTION–D**

**Undecidability:** Recursive and Recursively Enumerable Languages, Rice Theorem, Post's Correspondence Problem.

**References:**

1. A.V. Aho, J.E. Hopcroft and J.D. Ullman, Introduction to Automata Languages and Computations. Addison Wesley, 1980.
2. Mishra Kolop: Ahandrasekaran, Theory of Computer Science (Automata, Languages & Computation); PHI, 2002.
3. H.R. Lewis and C.H. Papdimitrou, Elements of the Theory of Computation, Prentice Hall Inc., 1981.
4. V.J. Rayward Smith, 'A First Course on Computability, Blackwell Scientific Publications, Oxford, 1986.
5. M.Davis and E.J. Weyuker, Computability, Complexity and Languages, Academic Press, 1982.
6. D.Gries, Science of Programming, Springer Verlag, New York, 1981.
7. <http://swayam.gov.in/>
8. <http://edx.org> formerly <http://mooc.org/>
9. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)**

**Master of Computer Applications (SEMESTER – II)  
ODMCA204T: WEB TECHNOLOGIES**

Time: 03 Hours

Max. Marks: 100 Marks  
Internal Assessment: 20 Marks  
End Term: 80 Marks

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3. Candidates shall attempt **Five** questions in all, by at least selecting **One** question from each section and the **5<sup>th</sup>** 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**

Web Essentials, Markup languages, CSS

Basics of Client side programming, Java script language, java script objects, host objects, Browsers and DOM

**SECTION–B**

Basics of Server side programming, Java servlets- Life cycle, Servlet API, Reading Servlet parameters, Handling HTTP requests and responses, Cookies and Session Tracking ASP/JSP, Basics of ASP/JSP objects, simple ASP and JSP pages

**SECTION–C**

Representing Web data, Data base connectivity, JDBC, Dynamic web pages, XML, DTD, XML schema, DOM, SAX, XQuery, Building web applications, cookies, sessions, open source environment

Introduction to PHP, basics, PHP File handling, file upload, cookies, error handling, PHP MySQL introduction

**SECTION–D**

Middleware technologies, Ecommerce architecture and technologies, Ajax, Advanced web technologies and tools

**Case Studies:** PHP and MySQL case studies.

**References:**

1. Jeffery C Jackson, “Web Technology-A Computer Science Perspective”, Pearson Education, 2007.
2. Chris Bates, “Web Programming- Building Internet Applications”, Wiley India, 2006.
3. <http://swayam.gov.in/>
4. <http://edx.org> formerly <http://mooc.org/>
5. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)**

**Master of Computer Applications (SEMESTER – II)**  
**ODMCA205P: PROGRAMMING LAB-II**

Time: 03 Hours

Max. Marks: 100 Marks  
Internal Assessment: 20 Marks  
End Term: 80 Marks

- Programming Exercises based on Machine Learning
- Web technologies

**Directorate of Open & Distance Learning (ODL)**

**Master of Computer Applications (SEMESTER – II)  
ODMCA206T: Information Systems and Security**

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 5<sup>th</sup> 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**

**An Introduction to Information System:** Information Concepts, System Concepts, Business Information Systems, Information Systems in society, business and Industry, Information Systems in Organizations

**Management Information System**

**Decision Support Systems (DSS):** Conceptual Foundations of DSS, Concepts of DSS, DSS Software, Strategies for DSS, Group Support Systems, Executive Support System (ESS)

**SECTION–B**

**Knowledge Management systems:** Fundamentals of Knowledge Based Decision Support; Artificial Intelligence and Expert systems, Expert System & its integration with DSS.

**Other Information Systems** like Supply chain management, Customer Relationship Management (CRM), Electronic Commerce and Mobile Commerce, Distributed Information System (DIS)

**SECTION–C**

**Information Security for Business – threat landscape and risk of information exposure, legal, ethical, and privacy issues**

**Overview of computer security:** threats, vulnerabilities, controls, risk, confidentiality, integrity, availability, security policies, security mechanisms, prevention, detection, deterrence, Malicious code, viruses, Trojan horses, worms

**Network and Computer Security:** Introduction, Network Security, Computer Security (kinds of data, Authentication and Authorization, access control, system vulnerabilities, system security tools), how to track and identify the packets involved in a simple TCP connection. to use networking tools such as WireShark, and network mapping tools, such as NMap

**Biometric Security**

**SECTION–D**

**Cyber Security:** Introduction of cybercrime, the evolution of cybercrime, challenges of cyber Crime, categorizing cybercrime, cyber terrorism, virtual crimes, and perception of Cyber criminals different threats and motivations as well as the types of cyber attacks.

Attacks covered in the course include, malware, protocol based attacks (spoofing, session hijacking, caches poisoning, etc.), Denial-of-Service, and attacks on the web. Also included in this course are psychological aspects of information security, vulnerabilities of computer networks, and cyber warfare.

**Security Management:** Security Management: why security management, Standards, Security Policies and Controls, Risk Management, Legal Regulations, Incident Management

**Course Outcome:**

- An understanding of key principles in the area of Information Systems.
- An understanding of fundamental concepts of Business Information Systems and their integration with organizations
- The skill to examine managerial and organizational matters, apply appropriate comprehension to come up with resolutions, and make commendations.
- The ability to make use of Decision Support Systems concepts in decision making.
- The skill to use knowledge acquired from Distributed Information Systems, Knowledge Management Systems, Customer Relationship Management to improve decision making and business administration.
- The skill to cooperate as a team associate in varying responsibilities in a diverse group and communicate efficiently.
- An understanding of computer, network, and cyber security.

**References:**

1. Principles of Information Systems: A Managerial Approach, Ralph Stair and George Reynolds, Cengage Learning, 2008
2. Management Information Systems, Laudon C. Kenneth & Laudon P. Janes, Pearson Education, 2002
3. Decision Support Systems & Intelligent Systems Turban Ejrani & Aronson E. Jay, Pearson Education, 2001
4. Information Systems, Alter Steven, 3rd Edition, Pearson Education, 2000.
5. An Introduction to Information Security and ISO27001:2013, by Steve G Watkins, by IT Governance Publishing, 2013
6. Computer Security: Principles and Practice, W. Stallings, 2nd Edition, Prentice Hall, ISBN: 0132775069, 2011
7. Introduction to Computer Security, Matt Bishop, Addison-Wesley, 2005
8. Introduction to Information Security Risk Management, Prentice-Hall of India, 2000
9. Handbook of information Security, Bidgoli, John Wiley & sons.

**Directorate of Open & Distance Learning (ODL)**

10. <http://swayam.gov.in/>
11. <http://edx.org> formerly <http://mooc.org/>
12. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)**

**Master of Computer Applications (SEMESTER – II)  
ODMCA207T: Digital Image Processing**

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 **5<sup>th</sup>** 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**

**Fundamentals:** Introduction to Digital Image Processing, Fundamental steps in Digital Image Processing, Components of Image Processing System, Applications of Digital Image Processing, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between Pixels, Distance Measure between Pixels.

**Image Enhancement and Restoration:** Spatial Domain Filtering Techniques, Smoothing spatial filters, Sharpening spatial filters, Histogram Processing, Introduction to Fourier Transformation, low pass filters, high pass filters, Image Restoration: A model of the Image Degradation/ Restoration Process, Noise models, Denoising Techniques.

**SECTION–B**

**Color Image Processing:** Color Models, Conversions between Color Models, Pseudo Color Image Processing, Color Transformation, Color Complements, Color Slicing, Color Image Smoothing and Sharpening, Noise in color Images.

**Wavelets and Multi-Resolution Processing:** Wavelet functions, Wavelet transformations in one and two dimensions, fast wavelet transform.

**SECTION–C**

**Image Compression:** Image Compression Models, Data Redundancies, Lossy Compression Techniques, Lossless Compression Techniques, Image Compression standards.

**Image segmentation:** Point, Line and Edge Detection, Edge linking and boundary detection, Thresholding, region based segmentation.

**SECTION–D**

**Representation and Description:** Image Representation, Boundary and Regional Descriptors, Relational Descriptors.

**Object Recognition:** Pattern and pattern classes, recognition based on Decision Theoretic Methods, Structural Methods.

**References:**

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 2nd Edition.
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI
3. <http://swayam.gov.in/>
4. <http://edx.org> formerly <http://mooc.org/>
5. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – III)  
ODMCA301T: ADVANCED SOFTWARE ENGINEERING**

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 **5<sup>th</sup>** 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****Software Project Management:**

Fundamentals of Software project planning, Conventional Software Management, Evolution of Software Economics, Improvement of Software Economics, Comparison of old and modern ways of Software Management.

**SECTION – B**

**Software Re-engineering:** Introduction Re-engineering, Restructuring and Reverse Engineering, Re-engineering existing systems, Data Re-engineering and migration, Software Reuse and Re-engineering.

**SECTION – C****Object-Oriented (OO) Measurements:**

Introduction, Why metrics ?, Classification of OO metrics, Study of Design Metrics- method size, method internals, class size, class inheritance, Method inheritance, class intervals and class externals.

**Object-Oriented Analysis and Design:**

OOAD Methodologies (Booch, Rumbaugh and Jacobson), Unified Software Development Process (Rational Unified Process)

**SECTION – D****Component Based Software Engineering:**

Component Based Software Engineering: Basic Concepts, Specification of software components, Component Models (COM/COM+/DCOM/.NET, Enterprise JavaBeans)

**References:**

1. Walker Royce, Software Project Management, Pearson Education, ISBN: 9780201309584, 2004.
2. Robert S. Arnold, Software Re-engineering, IEEE Comp. Society, ISBN: 9780818632723, 2003.
3. Lorenz and Kidd, Object Oriented Software Metrics, Prentice Hall, ISBN 978- 0131792920, 2001.
4. Booch, Object-Oriented Analysis and Design with Applications, Addison-Wesley Professional, 3rd Edition, ISBN: 978-0201895513, 2007.
5. Pressman, "Software Engineering" Prentice Hall, ISBN 978-0131792920, 2001.
6. IvicaCrnkKovics Magnus Larsson (eds.) "Building reliable component based software systems" Artech House, 2002 ISBN – 1-58053327-2.
7. <http://swayam.gov.in/>
8. <http://edx.org> formerly <http://mooc.org/>
9. <http://epgp.inflibnet.ac.in/>

**Master of Computer Applications (SEMESTER – III)**  
**ODMCA302T : SOFT COMPUTING**

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 **5<sup>th</sup>** 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 Evolutionary Computing & Genetic Algorithms. Introduction to Genetic Algorithms, Goals of Optimization, How Genetic Algorithms work, A Simple Genetic Algorithm's Computer Implementation highlighting Reproduction by Selection,

**SECTION–B**

Crossover, Mutation. Advanced GA Techniques Mapping Objective Function to Fitness Form, Fitness scaling, discretization, Different types of Selection and Crossover techniques. A case study of Travelling Salesman Problem using GA Techniques. Introduction to other Evolutionary Techniques: PSO, Simulated Annealing and Ant Colony Optimization.

**SECTION–C**

Basics of Neural Networks: Fundamental concept, Model of an Artificial Neuron, Neural Network Architectures, Various types of Learning and Activation Functions. Supervised Learning: Perceptron learning, Linear Separability, Delta Rule or Widrow Hoff Rule, Back Propagation algorithm, ADALINE, MADALINE and Associative Memories.

**SECTION–D**

Un-supervised Learning: Kohonen Self Organization Feature maps and Adaptive Resonance Theory. Introduction to Fuzzy Logic and Fuzzy Sets, Fuzzy Relations, Fuzzyfication, Defuzzyfication. Introduction to Hybrid soft Computing. Applications of Advance Computing in Pattern Recognition, Signal Processing & Image Retrieval.

**References:**

1. David E. Goldberg, Genetic Algorithms in Search Optimization and Machine Learning, Pearson Education.
2. S. N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley Publications.
3. How to Solve It: Modern Heuristics, by Zbigniew Michalewicz, David B. Fogel, Second Edition Springer Verlag-2004, ISBN- 3-540-22494-7.
4. Gallant Stephen I, Neural Network Learning & Expert Systems, MIT Press, 1993.
5. Aleksander & Morton, Neural Computing, Chapman & Hall, 1991.
6. Kosko, Neural Networks & Fuzzy Systems, PHI, 1991
7. <http://swayam.gov.in/>
8. <http://edx.org> formerly <http://mooc.org/>
9. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – III)  
ODMCA303T: DATA WAREHOUSING AND DATA MINING**

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 5<sup>th</sup> 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**

**Data Warehousing:** Concepts of Data Warehousing, Difference between operational database systems and Data warehousing, Need of a separate Data Warehouse. Multidimensional Data Model.

**Data Warehousing Architecture:** Steps for Design and Construction of Data-Warehouses, Three-Tier Data Warehouse Architecture, Characteristics of Data Warehousing Data, Data Marts and its types, OLAP Servers: ROLAP, MOLAP, HOLAP

**Data Warehouse Implementation:** Efficient Computation of Data Cubes, Indexing OLAP Data, Efficient Processing of OLAP Queries, Metadata Repository, Data Warehouse Back-End Tools and Utilities

**SECTION -B**

**Data Mining:** Data Preprocessing, Data Mining Primitives, Data Mining Query Languages. Applications and Trends in Data Mining.

**Data Mining Techniques: Classification and Prediction:** Issues regarding classification and prediction, Classification by Decision Tree induction, Bayesian Classification, Classification by Back propagation, Associative Classification, Other Classification Methods.

**SECTION C**

**Data Mining Techniques: Cluster Analysis:** Types of Data in cluster Analysis, Categorization of Major Clustering Methods, K- means Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid Based Methods, Model-Based Clustering Methods

**Outlier Detection:** Distance Based Outlier Detection, Deviation Based Outlier Detection.

**SECTION D**

**Data Science:** Extracting meaning from data with data science—meaning, the data science process, three basic machine learning algorithms – Linear regression, K-Nearest Neighbours, K-means, spam-filtering, recommendation engines.

**References:**

1. Han, Kamber “Data Mining: Concepts and Techniques” Morgan Kaufmann
2. Romez Elmasri, Shamkant B.Navathe, ‘Fundamentals of Database Systems’ Pearson Education.
3. Education.
4. Silberschatz, Korth, Sudershan “Database System Concepts” 4th Ed. McGraw Hill
5. Connolly & Begg “Database Systems – A Practical Approach to Design, Implementation and Management, 3rd Ed. Pearson Education.
6. Doing Data Science by Rachel Schutt and Cathy O’Neil, Published by O’Reilly Media, 2014.
7. <http://swayam.gov.in/>
8. <http://edx.org> formerly <http://mooc.org/>
9. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – III)  
ODMCA304T: ADVANCED COMPUTER 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 **5<sup>th</sup>** 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 Computers:** Basic Computer Organization: System Buses, Instruction Cycles  
**CPU Organization:** Design specifications for a Simple CPU, Fetching Instructions from Memory, Decoding Instructions, Executing Instructions, Design of a Simple ALU, Designing the Control Unit Using Hardwired Control and Microprogrammed control approach.

Memory Subsystem Organization and Interfacing, Types of Memories I/O Subsystem Organization and Interfacing

**SECTION–B**

**Parallelism in Uniprocessor Systems:** Trends in parallel processing, Basic Uniprocessor Architecture, Parallel Processing Mechanism.

**Parallel Computer Structures:** Pipeline Computers, Array Computers, Multiprocessor Systems **Architectural Classification Schemes:** Multiplicity of Instruction-Data Streams, Serial versus Parallel Processing, Parallelism versus Pipelining

**Pipelining:** An overlapped Parallelism, Principles of Linear Pipelining, Classification of Pipeline Processors, General Pipelines and Reservation Tables

**Principles of Designing Pipelined Processors:** Instruction Prefetch and Branch Handling, Data Buffering and Busing Structures, Internal Forwarding and Register Tagging, Hazard Detection and Resolution

**SECTION–C**

**Directorate of Open & Distance Learning (ODL)**

**Superscalar and Super pipeline Design:** Superscalar Pipeline Design, Super pipelined Design  
**Structures and Algorithms for Array Processors:** SIMD Array Processors, SIMD  
Computer Organizations, Masking and Data Routing Mechanisms, Inter-PE Communications

**SIMD Interconnection Networks:** Static versus Dynamic Networks, Mesh-Connected  
Illiac Network, Cube Interconnection Networks

**SECTION-D**

**System Interconnect Architectures:** Network Properties and Routing, Static  
Connection Networks, Dynamic Connection Networks

**Multiprocessor Architecture:** Functional Structures: Loosely Coupled Multiprocessors,  
Tightly Coupled Multiprocessors

**Interconnection Networks:** Time Shared for Common Buses, Crossbar Switch and  
Multiport Memories.

**References:**

1. Computer Architecture and Parallel Processing, Faye A. Briggs, McGraw-Hill International Editions
2. Computer Systems Organization & Architecture, John d. Carpinelli, Addison Wesley.
3. <http://swayam.gov.in/>
4. <http://edx.org> formerly <http://mooc.org/>
5. <http://epgp.inflibnet.ac.in/>

**Directorate of Open & Distance Learning (ODL)****Master of Computer Applications (SEMESTER – III)  
ODMCA305T : CLOUD NATIVE APPLICATION DEVELOPMENT**

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 **5<sup>th</sup>** 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**

Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing.

**SECTION–B**

A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS, PaaS, SaaS, IDaaS, CaaS, Virtualization technologies: Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D), Hypervisors: Virtual machine technology and types, VMware vSphere.

**SECTION–C**

An introduction to Docker & Container, Docker Architecture, Docker Commands (version, pull, run, ps, exec, stop, kill, commit, login, push, images, rm, rmi, build, etc...), Setting up Docker on Windows, Containerize your application using Docker, Containerizing a MEAN Stack Application, Docker Swarm For Achieving High Availability, Container Network Model.

**SECTION–D**

An Introduction to Kubernetes clusters, Kubernetes Architecture, Installation and Views of Kubernetes Dashboard, Configuration Management using Puppet, Installation of Puppet, Using Puppet modules for infrastructure Automation, Master-Slave Architecture for Chef, Steps for Installation of Chef, Transforming Infrastructure into Code using Chef.

**Directorate of Open & Distance Learning (ODL)****Course Outcomes:**

- This course gives students an insight into the basics of cloud computing along with virtualization.
- Compare the advantages and disadvantages of various cloud computing platforms.
- Understand and analyze the architecture of Cloud
- Use Docker to package an application and distribute it
- Explore Kubernetes resources for an application deployment
- Develop an application in Cloud

**References:**

1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, McGraw Hill Education (India) Private Limited, 2013
2. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
3. Using Docker: Developing & Deploying Software with Containers, by Adrian Mouat, Shroff/O'Reilly; First edition (2016), ISBN-13: 978-9352133024
4. Managing Infrastructure with Puppet, by Loope James, O'Reilly Media, Inc, USA, ISBN: 9781449307639, 9781449307639
5. Cloud Native DevOps with Kubernetes: Building, Deploying, and Scaling Modern Applications in the Cloud, by John Arundel, O'Reilly Media; 1 edition (8 March 2019), ASIN: B07PJ4HM92
6. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013.
7. <https://onlinelibrary.wiley.com/doi/book/10.1002/9780470940105>
8. <http://swayam.gov.in/>
9. <http://edx.org> formerly <http://mooc.org/>
10. <http://epgp.inflibnet.ac.in/>

**Master of Computer Applications (SEMESTER – III)**  
**ODMCA306T: PROGRAMMING LAB III**

Time: 03 Hours

Max. Marks: 100 Marks  
Internal Assessment: 20 Marks  
End Term: 80 Marks

**SOFT COMPUTING**

Practical based on Soft Computing.

**Master of Computer Applications (SEMESTER – IV)**  
**ODMCA401P: MAJOR PROJECT/DISSERTATION/INDUSTRIAL TRAINING**

Max. Marks: 600 Marks  
Internal Assessment: 120  
Marks  
End Term: 480 Marks

**MAJOR PROJECT/INDUSTRIAL TRAINING:**

A candidate should work on the project for 5 months and 6-8 hours on each working day.

1<sup>st</sup> synopsis (containing mainly literature survey corresponding to the problem taken up for the project work and line of attack to solve the problem) within one month of joining the training is to be submitted and will be evaluated for 4 credits.

2<sup>nd</sup> synopsis (containing essentially the progress of work in comparative details) within three months of joining the training is to be evaluated will be evaluated for 4 credits.

Credits for Final Project Report & Viva Voce: 14

The evaluation shall be done as per the common ordinances for courses under Credit Based Continuous Evaluation Grading System

**DISSERTATION:**

The students opting for dissertation has to submit an exhaustive research based proposal incorporating the following:

1. Literature View
2. Research Objectives
3. Research Methodology
4. Experimental Setup
5. Analysis of the Findings