

UTKAL UNIVERSITY

***Syllabus with
Objectives and outcomes***

for

**Master of Computer Applications (MCA)
(2-Year Programme)**



**Department of Computer Science & Applications
Utkal University
Bhubaneswar (Odisha)**

2020-21

UTKAL UNIVERSITY

Syllabus for Masters of Computer Applications (MCA) **(Applicable for Students Taking Admission from the Session 2020-21)**

Objective of the Programme

The objective of the MCA curriculum is to equip the students with the ability to analyze varieties of real-life problems and develop computer based solutions for effectiveness and efficiency. Keeping in view the requirements of the evolving software industry and also to provide a foundation for higher studies in Computer Science, effort has been made in the choice of subjects to balance between theory and practical aspects of Computer Science. On successful completion of this course a student can find a career in software industries, corporate sectors, or Government Organizations as a technical professional or pursue research in the core areas of Computer Science and Applications.

Programme Outcomes

After Completion of the MCA programme, the student will be able to:

- Apply the basic mathematical, scientific and engineering concepts appropriate to the discipline of Computer Science and Engineering.
- Analyze a problem, identify and define the computing requirements appropriate to its solution.
- Use state-of-the-art techniques, tools and skills necessary for computing practice.
- Demonstrate the knowledge of sustainable development considering the impact of computing solutions in a global, economic, environmental, and societal context.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the Computer Science and Engineering practice.
- Function effectively on multi-disciplinary teams to accomplish a common goal.
- Communicate effectively, both written and oral, with a range of audiences.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to his own work, as a member and leader in a team, to manage projects in multidisciplinary environments.
- Recognize the need for and have the preparation and ability to engage in life-long learning and continuing professional development

Syllabus for Masters of Computer Applications (MCA)				
PAPER ID	PAPER TITLE	FULL MARK		CREDIT
		Mid-Term	End-Term	
FIRST SEMESTER				
MCA-1.1	Mathematical Foundations of Computer Science	30	70	4
MCA-1.2	Data and File Structures	30	70	4
MCA-1.3	Computer System Architecture	30	70	4
MCA-1.4	Theory of Computation	30	70	4
MCA-1.5	Computer Network	30	70	4
MCA-1.6	Data and File Structures Lab		50	2
MCA-1.7	Computer Network Lab		50	2
SECOND SEMESTER				
MCA-2.1	Data Base Systems	30	70	4
MCA-2.2	Algorithms Design and Analysis	30	70	4
MCA-2.3	Operating Systems	30	70	4
MCA-2.4	Artificial Intelligence	30	70	4
MCA-2.5	Cryptography and Network Security	30	70	4
MCA-2.6	Data Base Systems Lab		50	2
MCA-2.7	Operating Systems Lab		50	2
THIRD SEMESTER				
MCA-3.1	Java Programming	30	70	4
MCA-3.2	Compiler Design	30	70	4
MCA-3.3	Data Warehousing and Data Mining	30	70	4
MCA-3.4	Software Engineering	30	70	4
MCA-3.5	Elective – 1	30	70	4
MCA-3.6	Java Programming Lab		50	2
MCA-3.7	Software Engineering Lab		50	2
FOURTH SEMESTER				
MCA-4.1	Elective – 2	30	70	4
MCA-4.2	Elective – 3	30	70	4
MCA-4.3	Elective – 4	30	70	4
MCA-4.4	Project Work / Dissertation		300 *	12
Total			2400	96

List of Elective Papers #

Elective-1	
MCA-3.5(1)	Computer Graphics & Animation
MCA-3.5(2)	Distributed System
MCA-3.5(3)	Wireless Sensor Networks
MCA-3.5(4)	Machine Learning
MCA-3.5(5)	Combinatorics and Graph Theory
Elective-2	
MCA-4.1(1)	Intrusion Detection System
MCA-4.1(2)	Mobile Computing
MCA-4.1(3)	Unix Internals
MCA-4.1(4)	Optimization Techniques
MCA-4.1(5)	Human Computer Interaction

Elective-3	
MCA-4.2(1)	Block Chain Technology
MCA-4.2(2)	Cloud Computing
MCA-4.2(3)	Simulation and Modeling
MCA-4.2(4)	Data Science using Python
MCA-4.2(5)	Bioinformatics
Elective-4	
MCA-4.3(1)	Internet of Things
MCA-4.3(2)	Text Analysis
MCA-4.3(3)	Digital Image Processing
MCA-4.3(4)	Network Programming
MCA-4.3(5)	Web Design
MCA-4.3(1)	Internet of Things
* Mark Distribution for Project Work / Dissertation: Report (200), Presentation (50), Viva Voce (50)	
# A student can opt for only one paper from among the papers mentioned under the respective elective groups	

Title of the Paper: **Mathematical Foundations of Computer Science**

Pre-Requisite: None	Paper Code: MCA-1.1	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To introduce the concepts of mathematical logic, sets, relations, and functions and perform the operations associated with sets, functions, and relations.• To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.• To introduce generating functions and recurrence relations.• To use Graph Theory for solving problems. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Apply mathematical logic to solve problems.• Understand sets, relations, functions, and discrete structures.• Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions.• Formulate problems and solve recurrence relations.• Model and solve real-world problems using graphs and trees.			

Title of the Paper: **Data and File Structures**

Pre-Requisite: None	Paper Code: MCA-1.2	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To understand the fundamentals of different data structure.• To provide the knowledge of basic data structures and their implementations• To understand importance of data structures in context of writing efficient programs.• To have a mathematical foundation in analysis of algorithm. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Learn the basic types for data structure, implementation and application.• Know the strength and weakness of different data structures.• Use the appropriate data structure in context of solution of given problem.• Develop programming skills which require solving given problem			

Title of the Paper: **Computer System Architecture**

Pre-Requisite: None	Paper Code: MCA-1.3	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To understand the structure, function and characteristics of computer systems.• To understand the design of the various functional units and components of computers.• To identify the elements of modern instructions sets & their impact on processor design.• To explain the function of each element of a memory hierarchy in order to identify and compare different methods for computer I/O. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Understand the major architectural styles and their features.• Identify outline descriptions of real processors and understand in which way their designs fit into the frameworks described in the course.• Understand the impact of design choices in programming based on architectural design.			

Title of the Paper: **Theory of Computation**

Pre-Requisite: None	Paper Code: MCA-1.4	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To learn the mathematical foundations of computation including automata theory• To learn the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.• To learn about how really computers works and what kind of activities can be computed mechanically within a computer. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Model, compare and analyse different computational models using combinatorial methods.• Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.• Construct algorithms for different problems and argue formally about correctness on different restricted machine models of computation.• Identify limitations of some computational models and possible methods of proving them.• Have an overview of how the theoretical study in this course is applicable of application like designing the compilers.			

Title of the Paper: **Computer Network**

Pre-Requisite: None	Paper Code: MCA-1.5	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To learn about computer network organization and implementation.• To obtain a theoretical understanding of data communication and computer networks.• To gain practical experience in installation, monitoring, and troubleshooting of current LAN systems LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Describe how computer networks are organized with the concept of layered approach.• Describe how signals are used to transfer data between nodes.• Implement a simple LAN with hubs, bridges and switches.• Describe how packets in the Internet are delivered.			

Title of the Paper: **Data and File Structures Lab**

Pre-Requisite: None	Paper Code: MCA-1.6	Duration: 90 Lectures	Credit: 2
OBJECTIVES <ul style="list-style-type: none">• To provide the knowledge of basic data structures and their implementations• To understand importance of data structures in context of writing efficient programs. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Learn the basic types for data structure, implementation and application.• Know the strength and weakness of different data structures.• Use the appropriate data structure in context of solution of given problem.• Develop programming skills which require solving given problems.			

Title of the Paper: **Computer Network Lab**

Pre-Requisite: MCA-1.5	Paper Code: MCA-1.7	Duration: 90 Tutorials	Credit: 2
OBJECTIVES <ul style="list-style-type: none">• To learn how do computers and terminals actually communicate with each other.• To understand the parts of a communication network and how they work together. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Understand network layers, structure/format and role of each network layer.• Able to design and implement various network applications such as data transmission between client and server, file transfer, real-time multimedia transmission.• Understand the various Routing Protocols/Algorithms and Internetworking.			

Title of the Paper: **Database Systems**

Pre-Requisite: MCA-1.2	Paper Code: MCA-2.1	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To learn the fundamental elements of database system.• To learn the basic concepts of relational database management systems.• To learn various SQL commands. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Identify advance database concepts and database models.• Apply and analyze various terms related to transaction management in centralized and distributed database.• Produce data modeling and database development process for object-oriented DBMS.• Analyze and Implement the concept of object- relational database in development of various real time software.			

Title of the Paper: **Algorithms Design and Analysis**

Pre-Requisite: MCA-1.1	Paper Code: MCA-2.2	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To have a mathematical foundation in analysis of algorithm• To expose students to the basic concepts of algorithm design and analyze its complexity.• To develop algorithms for problems relating to sorting, database queries optimization, graph networks, transport network, etc. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Design algorithms for various applications such as Robotics, Artificial Intelligence, Machine learning, Computer Networks, Parallel computing, etc.• Use the appropriate data structure in context of solution of given problem.• Develop programming skills which require solving given problems.			

Title of the Paper: **Operating Systems**

Pre-Requisite: MCA-1.3	Paper Code: MCA-2.3	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To understand Operating system structure and services.• To understand the concept of a Process, memory, storage and I/O management. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Identify the low-level structure and internal mechanism of operating system.• Understanding the performance and design trade-offs in complex software systems.• Describe the main responsibilities of a contemporary operating system (OS).• List the most fundamental subsystems of an OS and the functions that each subsystem is responsible.• Recognize and give examples of conflicting goals and compromises necessary in implementing an OS and configuring its run-time parameters			

Title of the Paper: **Artificial Intelligence**

Pre-Requisite: MCA-1.2, MCA-2.2	Paper Code: MCA-2.4	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To learn the basic concepts of AI principles and approaches.• To develop the basic understanding of the building blocks of AI. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Have fundamental understanding of the basic concepts of artificial intelligence (AI).• Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.• Have fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.• Have knowledge of current scope and limitations, and societal implications of AI.• Have basic foundation of machine learning.			

Title of the Paper: **Cryptography and Network Security**

Pre-Requisite: MCA-1.5	Paper Code: MCA-2.5	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• Learn fundamentals of cryptography and its application to network security.• Understand network security threats, security services, and countermeasures.• Acquire background on well-known network security protocols such.• Understand vulnerability analysis of network security. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Understand various Cryptographic Techniques• Apply various public key cryptography techniques• Implement Hashing and Digital Signature techniques• Implement system level security applications			

Title of the Paper: **Database Systems Lab**

Pre-Requisite: MCA-2.1	Paper Code: MCA-2.6	Duration: 90 Tutorials	Credit: 2
OBJECTIVES <p>To make students aware about the elements of SQL and make them capable to designing the robust queries for exact data extraction that the client wants to perceive.</p> LEARNING OUTCOMES <p>The Students will understand the practical implementation of database and able to create new database and manage them with SQL.</p>			

Title of the Paper: **Operating Systems Lab**

Pre-Requisite: MCA-2.3	Paper Code: MCA-2.7	Duration: 90 Tutorials	Credit: 2
OBJECTIVES <p>To make students aware about the UNIX operating systems and about the different Kernels of the Operating Systems.</p> LEARNING OUTCOMES <p>The Students will learn how to manage the UNIX operating system and able to get fundamental idea how the operating system works.</p>			

Title of the Paper: **Java Programming**

Pre-Requisite: MCA-1.1	Paper Code: MCA-3.1	Duration: 45 Lectures	Credit: 4
OBJECTIVES To Introduce the Paradigm of Object-Oriented Programming and to design efficient programs to solve different types of problems.			
LEARNING OUTCOMES The students will be able to solve the mathematical problems of the <u>paper-1.1</u> with an object-oriented context of programming and also students will be able to design GUI and web-enabled APPLETS.			

Title of the Paper: **Compiler Design**

Pre-Requisite: MCA-1.4	Paper Code: MCA-3.2	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To provide a thorough understanding of the internals of Compiler Design.• To explore the principles, algorithms, and data structures involved in the design and construction of compilers.• Topics include context-free grammars, lexical analysis, parsing techniques, symbol tables, error recovery, code generation, and code optimization.			
LEARNING OUTCOMES Upon Completing the Course, Students will be able to: <ul style="list-style-type: none">• Realize basics of compiler design and apply for real time applications.• Introduce different translation languages• Understand the importance of code optimization• Know about compiler generation tools and techniques			

Title of the Paper: **Data Warehousing and Data Mining**

Pre-Requisite: MCA-2.1	Paper Code: MCA-3.3	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To introduce students to the basic concepts and techniques of Data Mining• To develop skills of using recent data mining software for solving practical problems.• To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems• Develop and apply critical thinking, problem-solving, and decision-making skills which can initiate students about research oriented thinking.			
LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Understand what data mining is all about.• Perform the data preparation tasks and understand the implications.• Demonstrate an understanding of the alternative knowledge representations such as rules, decision trees, decision tables, and Bayesian networks.• Demonstrate an understanding of the basic machine learning algorithmic methods that support knowledge discovery.• Identify alternative data mining implementations and what might be most appropriate for a given data mining task.			

Title of the Paper: **Software Engineering**

Pre-Requisite: MCA-2.3	Paper Code: MCA-3.4	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To learn the way of developing software with high quality and the relevant techniques.• To introduce software engineering principles for industry standard.• To focus on Project management domain and Software risks management. LEARNING OUTCOMES <p>Upon Completing the Course, Students will be able to:</p> <ul style="list-style-type: none">• Identify, formulate, and solve complex problems by applying different principles of software engineering.• Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors• Communicate effectively with a range of audiences and recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.• Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.			

Title of the Paper: **Wireless Sensor Networks**

Pre-Requisite: MCA-1.5	Paper Code: MCA-3.5(3)	Duration: 45 Lectures	Credit: 4
OBJECTIVES <ul style="list-style-type: none">• To understand the basics of Ad-hoc & Sensor Networks.• To learn various fundamental and emerging protocols of all layers.• To study about the issues pertaining to major obstacles in establishment and efficient management of Ad-hoc and sensor networks.• To understand the nature and applications of Ad-hoc and sensor networks.• To understand various security practices and protocols of Ad-hoc and Sensor Networks. LEARNING OUTCOMES <p>After completing the course, students will be able to:</p> <ul style="list-style-type: none">• Explain the basic concepts of wireless sensor networks, sensing, computing and communication tasks.• Describe and explain radio standards and communication protocols adopted in wireless sensor networks.• Describe and explain the hardware, software and communication for wireless sensor network nodes.• Explain the architectures, features, and performance for wireless sensor network systems and platforms.• Describe and analyze the specific requirements of applications in wireless sensor networks for energy efficiency, computing, storage and transmission.			

Title of the Paper: **Java Programming Lab**

Pre-Requisite: MCA-3.1	Paper Code: MCA-3.6	Duration: 90 Tutorials	Credit: 2
OBJECTIVES To make the students aware about the basic concepts and techniques of object oriented programming paradigm and make them able to design practical problem solving programs using different elements of java.			
LEARNING OUTCOMES The Students will be able to do the practical implementation of algorithm and different mathematical problems, which will enable them to design java programs in real world scenario.			

Title of the Paper: **Software Engineering Lab**

Pre-Requisite: None	Paper Code: MCA-3.7	Duration: 90 Tutorials	Credit: 2
OBJECTIVES To make students aware about the different tools of diagram designing and about the Software Testing tools.			
LEARNING OUTCOMES The Students will be able to design the different Architecture of Software Models with the help of diagrams used in System Analysis and Designing.			