



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

MCA (Artificial Intelligence and Machine Learning)

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA201	DCC	Object Oriented Programming using Java	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Students must be able to understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc
2. Students must have the ability to write a computer program to solve specified problems.
3. Students must be able to use the Java SDK environment to create, debug and run simple Java programs.
4. Students must learn the concepts of JDBC and concepts of OOPs using Java.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1 Understand different programming paradigms, Evolution of programming languages, Programming styles.
- CO2 Differentiate and compare structured and object oriented approach. Also understand OO design and analysis concepts.
- CO3 Design efficient solutions for real world problems.
- CO4 Explain the concept of class and objects with access control to represent real world entities.
- CO5 Demonstrate the behaviour of programs involving the basic programming constructs like control structures, constructors, string handling and garbage collection.
- CO6 Use overloading methodology on methods and constructors to develop application

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programs.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2** ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
- ATL2** Activity Based Learning
- ATL3** Midterm Exams
- ATL4** Flip Class
- ATL5** Seminar Presentation
- ATL6** Assignments
- ATL7** Poster
- ATL8** Oral Viva-voce examination

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	OOP concepts: Classes And Objects, Data Abstraction, Encapsulation, Inheritance, Benefits of Inheritance, Polymorphism, Procedural and Object Oriented Programming Paradigm. Java Programming: History of Java, Language Construct of Java	9	ATL1 ATL2 ATL6

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	Including Keywords, Constants, Variables, Looping and Decision Making Construct, Introduction to JVM and its Architecture, Overview of JVM Programming.		
II	Introducing Classes, Objects and Methods: Defining a Class, Adding Variables and Methods, Creating Objects, Constructors, Arrays and String: Creating an Array, One and Two Dimensional Arrays, String Array and Methods, String and String Buffer Classes, Wrapper Classes. Inheritance: Inheritance Hierarchies, Super and Subclasses, Member Access Rules, Super Keyword, Preventing Inheritance: Final Classes and Methods, The Object Class and Its Methods; Polymorphism: Dynamic Binding, Method Overriding, Abstract Classes and Methods;	9	ATL4 ATL8
III	Interface: Interfaces VS Abstract Classes, Defining an Interface, Implement Interfaces, Extending Interface; Packages: Defining, Creating and Accessing a Package, Importing Packages. Exception Handling: Fundamentals Exception Types, Uncaught Exceptions, Throw, Throw, Final, Built in Exception, Creating Your Own Exceptions. Multithreaded Programming: Fundamentals, Java Thread Model: Priorities, Synchronization, Messaging, Thread Classes, Runnable Interface, Inter Thread Communication, Suspending, Resuming and Stopping Threads.	9	ATL8
IV	Input/Output Programming: Basics, Streams, Byte and Character Stream, Predefined Streams, Reading and Writing from Console and Files. JDBC: Introduction to DBMS and JDBC API, Application Architecture, Obtaining a Connection, JDBC Models: Two Tier and Three Tier Model, ResultSet, Prepared Statement, Callable Statement.	9	ATL2 ATL6
V	The Collection Framework: The Collection Interface, Collection Classes, Working with Maps& Sets. Networking: Basics, Networking Classes and Interfaces, Using Java.Net Package, RMI (Remote Method Invocation).	9	ATL2

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	Total Hours	45	
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SUGGESTED READINGS:

Textbooks

1. E. Balagurusawmy, “Programming With Java - A Primer, Fourth Edition, 2010.
2. Daniel Liang, “Introduction to Java Programming”, Seventh Edition, Pearson, 2010.
3. Cay S. Horstmann, “Core Java Volume I-Fundamentals”, Eleventh Edition, Prentice Hall, 2018.
4. Kathy Sierra & Bert, “Head First Java, Second Edition”, Shroff/O’Reilly, 2005.
5. Paul Dietel and Harvey Deitel, “Java How to Program”, PHI, Eighth Edition, 2010.
6. Herbert Schildt, “The complete Reference Java, Seventh Edition, Mc Graw Hills, 2007.

Suggested e- resources (Websites/e- books)

1. <https://www.minds.co.za/wp-content/uploads/2019/06/object-oriented-programming-using-java.pdf>
2. <https://users.dcc.uchile.cl/~nbaloian/OOP-DCC/object-oriented-programming-using-java.pdf>

LIST OF PRACTICAL

	Title	CO Mapping
1.	Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer.	CO1,4
2.	Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome.	CO1,2
3.	Write a Java program to define and demonstrate class and constructors.	CO3,4
4.	Write a Java program for sorting a given list of names in ascending order.	CO3,4

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5.	Write a Java Program to find Reverse of the string.	CO3,4
6.	Write a Java program to sort a given integer array.	CO3,4
7.	Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (use String Tokenizer class).	CO2,5
8.	Write a Java program that reads a file and displays the file on the screen, with a line number before each line.	CO5,7
9.	Write a Java program that displays the number of characters, lines and words in a text file.	CO5
10.	Write a Java program for creating multiple threads a) Using Thread class. b) Using Runnable interface.	CO8
11.	Write a Java program that illustrates how run time polymorphism is achieved.	CO8
12.	Write a Java program that illustrates the following a) Creation of simple package. b) Accessing a package. c) Implementing interfaces.	CO3
13.	Write a Java program that illustrates the following a) Handling predefined exceptions. b) Handling user defined exceptions.	CO7
14.	Write a Java program for TCP/IP client Server using Socket.	CO9
15.	Program to demonstrate event handling.	CO7

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	-	1	-	-	-	-	1	-	2			
CO2	3	3	3	2	2	-	-	-	1	1	1	2			
CO3	3	2	3	-	2	-	-	-	-	1	-	1			

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CO4	3	2	2	1	2	-	-	-	-	1	-	1			
CO5	3	2	3	-	2	-	-	-	1	1	-	1			

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				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA202	DCC	Computer Networks	Max	60	20	20	0	0	3	0	0	3
			Min	24	16							

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COURSE OBJECTIVES:

The student will have ability to:

1. To develop an understanding basics of networking and modern network architecture.
2. To introduce students various data link layer protocols and error detection and correction mechanism.
3. To describe major concepts involved in local-area networks (LANs), and wireless LANs (WLANs).
4. To provide knowledge about wide-area networks (WANs) and TCP/IP.
5. To get introduce security features and mechanisms in networking.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Know and apply basics of networking more efficiently, securely, easier to use, able to transmit several simultaneous messages, and able to interconnect with other networks.
- CO2** Define different protocols and analyse what errors might occur and how to control network errors.
- CO3** Define and differentiate among various types of LAN configurations and apply them to meet the changing and challenging networking needs of organizations.
- CO4** Get familiar with the concept of wide area networks and internet protocols.
- CO5** Analyse why networks need security and how to apply control mechanism of security.

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			Min	24	16							

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TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2** ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
- ATL2** Activity Based Learning
- ATL3** Midterm Exams
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- ATL5** Seminar Presentation
- ATL6** Assignments
- ATL7** Poster
- ATL8** Oral Viva-voce examination

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Computer Network: Data Communication, Computer Network, Network Topologies, Layered Network Architecture-ISO-OSI Model, Transmission Media: Guided and Unguided, Multiplexing, Modem & Modem Types	9	ATL2 ATL3 ATL6
II	Framing – Flow and error control, Data Security and Integrity: Parity	9	ATL3

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MCA202	DCC	Computer Networks	Max	60	20	20	0	0	3	0	0	3
			Min	24	16							

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	Checking Code, Cyclic redundancy checks (CRC), Hemming Code, Protocols for Noise less and Noise Channels, Concepts, Basic flow control, Sliding window protocol-Go-Back-N protocol and selective repeat protocol. Wired LAN, IEEE Standards: Standard Ethernet, Fast Ethernet, Gigabit Ethernet.		ATL6
III	Connecting LANs: Backbone Networks, Virtual LANs, Virtual-Circuit Networks: Architecture and Layers of Frame Relay and Introduction to ATM. Token Ring : 802.5 IEEE standard, Token Bus : 802.4 IEEE standard, FDDI Protocol, DQDB Protocol, Inter-Networking, Layer 1 connections-Repeater, Hubs, Layer 2 connections-Bridges, Switches, Layer 3 connections-Routers, Gateways.	9	ATL6
IV	Wide Area Network: Introduction, Network routing, Routing Tables, Types of routing, Dijkstra's Algorithm, Open shortest path first, Flooding, Broadcasting, Multicasting. Internet Protocols, Overview of TCP/IP, Transport protocols, Elements of Transport Protocol, Transmission control protocol (TCP), User data-gram protocol (UDP).	9	ATL3 ATL6
V	Network Security: Cryptography – Symmetric key and Public Key algorithms - Digital Signature Management of Public keys – Communication Security – Authentication Protocols. Virtual Terminal Protocol, Firewalls, Fire wall policies and rules, Common Problem with Packet Filtering. Overview of DNS- E-mail – FTP – WWW – HTTP – Multimedia. IP Management Protocol, SNMP.	9	ATL3 ATL6
Total Hours		45	

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SUGGESTED READINGS:

Textbooks

1. Andrew S. Tanenbaum, “Computer Network”, 5th Edition, Pearson Education India, 2013
2. Behrouz A. Forouzan, “Data Communications and Networking” 5th Edition, TATA McGraw Hill, 2013

Suggested e- resources (Websites/e- books)

1. Douglas E. Comer, “Internetworking with TCP/IP”, Pearson, 6th Edition, 2013
2. William Stallings, “Data and Computer Communications”, Pearson, 10th Edition, 2013

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcome s	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	3	1	1	-	-	1	-	2			
CO2	3	3	2	2	3	-	-	-	-	1	-	2			
CO3	3	3	3	2	3	1	-	-	1	1	1	2			
CO4	3	2	2	1	3	-	-	-	-	1	-	2			
CO5	3	3	3	2	3	2	1	2	1	1	1	2			

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MCA204N	DCC	Principles of Operating Systems	Max	60	20	20	0	0	3	0	0	3
			Min	24	16							

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COURSE OBJECTIVES:

The student will have ability to:

1. To provide knowledge of the underlying principles, techniques and approaches of designing an operating systems.
2. To provide the knowledge of inherent functionality and processing of program execution.
3. To emphasize on how the various elements that underlie operating system interact and provides services for execution of application software.
4. To make the students aware with the different Operating Systems.
5. To provide introduction to UNIX Operating System and its File System.

COURSE ALIGNMENT WITH UNSDG:

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COURSE OUTCOMES:

After completion of the course, the student will be able to:

- | | |
|------------|---|
| CO1 | Understand the functions, structures and history of operating systems. |
| CO2 | Understand the design issues associated with operating systems. |
| CO3 | Understand and apply various process management concepts including scheduling, synchronization, deadlocks and multithreading. |
| CO4 | Demonstrate the concepts of memory management including virtual memory. |
| CO5 | Master system resources sharing among the users. |

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MCA204N	DCC	Principles of Operating Systems	Max	60	20	20	0	0	3	0	0	3
			Min	24	16							

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2** ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
- ATL2** Activity Based Learning
- ATL3** Midterm Exams
- ATL4** Flip Class
- ATL5** Seminar Presentation
- ATL6** Assignments
- ATL7** Poster
- ATL8** Oral Viva-voce examination

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Introduction: Evolution of OS with the generations of computers. Goals, Objectives, Functions of Operating System, Types of operating systems: Batch Processing, Multitasking, Multithreading, Multiprogramming and Real time operating systems etc. Different views of the operating system, Operating System structure: Layered	9	ATL3 ATL6

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Choice Based Credit System (CBCS) in the light of NEP-2020

MCA (Artificial Intelligence and Machine Learning)

SEMESTER-I (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA204N	DCC	Principles of Operating Systems	Max	60	20	20	0	0	3	0	0	3
			Min	24	16							

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	Operating Systems, Monolithic Systems.		
II	CPU Scheduling: Processes, The Process concept, process states, the process control block. Types of scheduler, scheduling criteria, scheduling algorithms, performance evaluation of scheduling algorithms. Deadlocks: Deadlock, Condition for deadlock, Deadlock Prevention, Deadlock detection, Deadlock avoidance, Deadlock recovery, Starvation.	9	ATL2 ATL3 ATL6
III	Memory Management : Memory management without swapping or paging, Fragmentation, Concept and benefits of Virtual memory, Swapping and Paging, Page replacement algorithms, Design issues for paging system, Segmentation.	9	ATL3 ATL6
IV	Concurrency and Synchronization: The need for inter-process synchronization, Principles of concurrency, Requirement for Mutual Exclusion, Decker's algorithms, Critical section, Semaphore, Classical problems in concurrent programming, Dining Philosopher's problem, Bounded Buffer Problem, Sleeping Barber Problem, Readers and Writers problem,	9	ATL3 ATL6
V	Unix/Linux Operating System: Development of Unix/Linux, Role and Functions of Kernel, System Calls, Elementary Linux command and Shell Programming, Directory Structure, System administration Case study: Linux, Windows Operating System	9	ATL6
	Total Hours	45	

SUGGESTED READINGS:

Textbooks

1. Deitel, H.M., "An Introduction to Operating Systems". Addison Wesley Publishing, Second edition, 2002.
2. Milenkovic, M., "Operating Systems - concepts and Design" McGraw Hill International, ISE Edition, 1992.

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Choice Based Credit System (CBCS) in the light of NEP-2020

MCA (Artificial Intelligence and Machine Learning)

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA204N	DCC	Principles of Operating Systems	Max	60	20	20	0	0	3	0	0	3
			Min	24	16							

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

- Galvin P., J.L. Abraham Silberschatz. "Operating System Concepts". John Wiley & Sons, Seventh edition, 2009.
- Tanenbaum, A.S. "Modern Operating System", Prentice Hall of India Pvt. Ltd, Third edition, 2009.
- Maurice J. Bach "Design of UNIX O.S. ", PHI Learning, 2015.
- Yashavant Kanetkar, "Unix Shell programming", 1stEdition, BPB Publisher, 2010.

Suggested e- resources (Websites/e- books)

- <https://pages.cs.wisc.edu/~remzi/OSTEP/>
- https://www.phindia.com/Books/ShoweBooks/ODY/Operating-Systems?srsId=AfmBOorpnmfBwqnPhlnjIZF5xwE8uCrkK_ewwJp8jB_N8v2NyflwO3hq

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	1	-	-	-	-	1	-	2			
CO2	3	3	2	1	2	-	-	-	-	1	-	2			
CO3	3	3	3	2	2	-	-	-	1	1	-	2			
CO4	3	3	2	1	2	-	-	-	-	1	-	2			
CO5	3	2	2	1	2	1	-	-	1	1	1	2			

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Choice Based Credit System (CBCS) in the light of NEP-2020

MCA (Artificial Intelligence and Machine Learning)

SEMESTER-I (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA205N	AEC	Advanced Python Programming for AI & ML	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. an understanding of advanced concepts of Python Programming
2. an understanding on Mathematical calculations on data of data science & Machine learning.
3. an understanding on data framing and data visualization.
4. an understanding on real world applications using advanced python.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

• Apply NumPy , Pandas and Matplotlib of advanced python concepts. • Apply Web Application frameworks like Django / Flask.

After completion of the course, the student will be able to:

- CO1 Apply the principles of Advanced concepts of Python.
- CO2 Write clear and effective python code for Machine Learning.
- CO3 Create applications using python programming.
- CO4 Apply NumPy , Pandas and Matplotlib of advanced python concepts.
- CO5 Apply Web Application frameworks like Django / Flask.

TEACHING PEDAGOGY:

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Choice Based Credit System (CBCS) in the light of NEP-2020

MCA (Artificial Intelligence and Machine Learning)

SEMESTER-I (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA205N	AEC	Advanced Python Programming for AI & ML	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
T2 ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
ATL2 Activity Based Learning
ATL3 Midterm Exams
ATL4 Flip Class
ATL5 Seminar Presentation
ATL6 Assignments
ATL7 Poster
ATL8 Oral Viva-voce examination

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Database Programming with SQLite / MySQL Python MySQL / SQLite Database Connectivity. Create database, create table, insert data into table, inserting multiple records into table, extracting data from the table, updating table record and delete table data.	9	ATL2 ATL3 ATL6
II	NumPy : Numerical Python Python list vs NumPy arrays, Creating a NumPy Array, Basic ndarray, Shape of NumPy array, Size of NumPy array, Array of zeros, Array of ones, Random numbers in ndarray, The Shape and Reshaping of NumPy Array, Dimensions of NumPy array, Reshaping a NumPy array, Flattening a NumPy array,	9	ATL3 ATL6

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Choice Based Credit System (CBCS) in the light of NEP-2020

MCA (Artificial Intelligence and Machine Learning)

SEMESTER-I (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA205N	AEC	Advanced Python Programming for AI & ML	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	Transpose of a NumPy array, Indexing and Slicing of NumPy Array, NumPy Ufuncs, Maths with NumPy Arrays, Mean, Median and Standard deviation, Min-Max values and their indexes, Sorting in NumPy Arrays, NumPy Arrays and Images.		
III	Pandas (Data Manipulations) Pandas Series, Pandas DataFrames, Common Operations in Pandas, How To Deal With Missing Data in Pandas, How To Merge DataFrames in Pandas, How To Join DataFrames in Pandas, How To Concatenate DataFrames in Pandas. Data Input and Output in Pandas, How To Save Pandas DataFrames. Data visualization.	9	ATL3 ATL6
IV	Matplotlib and Seaborn (Data Visualization) Installing Matplotlib , Line Chart, Scatter Plot ,Bar Graph, Histogram, Subplots , Pie Chart , Matplotlib with Pandas and Numpy. specify color, markings and line styles, adjust thickness, label and legend, save the graph, legend (), title(). Installing Seaborn, Load Datasets To Construct Seaborn Plots, Histogram, Bar Plot, Count Plot, Joint Plot, Regplot, Lm Plot, KDE Plot, Box Plot, Violin Plot, Heatmap, Pair Plot.	9	ATL2 ATL3 ATL6
V	Regular Expressions and Web Programming (Flask / Django) Introduction to re module , Pattern matching, searching, splitting, substitution, Meta characters: . ^ \$ * + ? { } [] () , Groups and capturing , File parsing using regex. Introduction to Flask / Django web framework, Setting up a	9	ATL6

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MCA (Artificial Intelligence and Machine Learning)

SEMESTER-I (2026-28)

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			Marks	THEORY			PRACTICAL					
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MCA205N	AEC	Advanced Python Programming for AI & ML	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	simple web server , Route definitions and request handling , Form submission and templates , Basic CRUD with Flask / Django		
	Total Hours	45	

ADDITIONAL RESOURCES

SUGGESTED READINGS:

Textbooks

1. Luciano Ramalho, Fluent Python, 2nd Edition, O'Reilly Media, 2021
2. David Beazley and Brian K. Jones, Python Cookbook, 3rd Edition, O'Reilly Media, 2013.
3. Brett Slatkin, Effective Python: 90 Specific Ways to Write Better Python, 2nd Edition, Addison-Wesley, 2019.
4. Michal Jaworski and Tarek Ziadé, Expert Python Programming, 4th Edition, Packt Publishing, 2023.
5. Micha Gorelick and Ian Ozsvald, High Performance Python, 2nd Edition, O'Reilly Media,

Suggested e- resources (Websites/e- books)

- 1 https://indico.cern.ch/event/884989/contributions/3732167/attachments/1991200/3331806/Advanced_Programming_with_Python.pdf
- 2 https://www.bioinformatics.babraham.ac.uk/training/Advanced_Python_Manual.pdf

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcome s	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3					1		2			

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Choice Based Credit System (CBCS) in the light of NEP-2020

MCA (Artificial Intelligence and Machine Learning)

SEMESTER-I (2026-28)

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA205N	AEC	Advanced Python Programming for AI & ML	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

CO2	3	3	2	2	3				1	2		2			
CO3	2	2	3	1	3	1			2	2	1	2			
CO4	3	2	1	3	3				1	1		2			
CO5	2	2	3	1	3	1		1	2	2	2	2			

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MCA (Artificial Intelligence and Machine Learning)

SEMESTER-I (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA206 N	DCC	Advanced Data Structures	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. To get a good understanding of applications of Data Structures.
2. The analysis and evaluation of the data structure needs of particular problems;
3. To provide knowledge of the fundamental design, analysis and implementation of data structures and algorithms.
4. Creation of new data structures.
5. To familiarize the students with the analysis and design a particular problem.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- | | |
|------------|---|
| CO1 | Demonstrate familiarity with major algorithms and use of appropriate data structures. |
| CO2 | Analyse performance of algorithms. |
| CO3 | Determine which algorithm or data structure to use in different scenarios |
| CO4 | Be familiar with writing recursive methods. |
| CO5 | Apply programming techniques such as pointers, dynamic memory allocation, structures to developing solutions for particular problems. |

TEACHING PEDAGOGY:

- | | |
|-----------|---|
| T1 | Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching |
| T2 | ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination |

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Choice Based Credit System (CBCS) in the light of NEP-2020

MCA (Artificial Intelligence and Machine Learning)

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				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA206 N	DCC	Advanced Data Structures	Max	60	20	20	30	20	3	0	2	4
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Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

ASSESSMENT TOOLS:

ATL1	Quiz
ATL2	Activity Based Learning
ATL3	Midterm Exams
ATL4	Flip Class
ATL5	Seminar Presentation
ATL6	Assignments
ATL7	Poster
ATL8	Oral Viva-voce examination

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	The Concept of Data Structure, Abstract Data Type, Concept of List and Array, Introduction to Stack, Stack as an Abstract Data Type, Primitive Operations on Stack, Stack's Applications - polish notations Infix, Postfix, Prefix and Recursion, evaluation of post and prefix expressions.. Introduction to Queues, Primitive operations on Queues, Circular Queue, Priority Queue, Applications of Queue.	9	ATL3 ATL6
II	Linked List - Introduction to Linked List, Memory Representations of Linked List, comparison; Operations on Linked List, Linked Representation of Stack and Queue, Doubly Linked List, Applications of Linked List.	9	ATL3 ATL6
III	Trees: Definition, Basic Terminology of Trees, Tree Representations as Array and Linked. Binary Trees, Binary Tree Operations. Traversal of Binary Trees - Inorder, Preorder & Postorder, complete binary tree, Application of Binary Tree, Threaded Binary tree, Height Balanced tree, B-tree.	9	ATL6

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Choice Based Credit System (CBCS) in the light of NEP-2020

MCA (Artificial Intelligence and Machine Learning)

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA206 N	DCC	Advanced Data Structures	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

IV	Searching and Sorting: Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort. Hashing: Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique (CRT), Perfect Hashing	9	ATL3 ATL6
V	Graph: Introduction, Graph, Graph Terminology, Memory Representation of Graph, Adjacency Matrix Representation of Graph, Adjacency List or Linked Representation of Graph, Operations Performed on Graph, Graph Traversal, Applications of the Graph, Reachability, Shortest Path Problems, Spanning Trees.	9	ATL6
Total Hours		45	

SUGGESTED READINGS:

Textbooks

1. Kruse R.L , “Data Structures and Program Design in C” , 2nd edition, Pearson Education, (2006) PHI.
2. Tanenbaum A. M., “Data Structures using C & C++”, Wiley (2019)PHI
3. Yashwant Kanetkar, “Data Structures through”, BPB (2019)
4. Horowitz & Sahni, “Fundamentals of Data Structures in C” , 2nd edition, Universities Press, (2008)
5. Lipschultz Seymour, “Data Structure”, Schaum 's Outline Series, 1st Edition, McGraw Hill publication, 2017
6. Tremblay, Jean-Paul, “An introduction to data structures with applications”, McGraw-Hill
7. Horowitz & Sahni, “Fundamentals of Data Structures”, Galgotia Publishers.

Suggested e- resources (Websites/e- books)

- 1 RHA OLE Platform: RH124 Course



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Choice Based Credit System (CBCS) in the light of NEP-2020

MCA (Artificial Intelligence and Machine Learning)

SEMESTER-I (2026-28)

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA206 N	DCC	Advanced Data Structures	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

LIST OF PRACTICAL

	Title	CO Mapping
1.	Write a program to create a two dimensional array and perform add, subtract and multiplication operations.	CO1,5
2.	Write a program to create a two dimensional array using dynamic memory allocation.	CO1
3.	Write a program to implement stack.	CO2,6
4.	Write a program to convert infix expression into postfix expression.	CO3
5.	Write a program to check balanced parentheses for a given infix expression.	CO5
6.	Write a program to evaluate postfix expression.	CO5,6
7.	Write a program to implement queue.	CO5,6
8.	Write a program to implement circular queue.	CO5,6
9.	Write a program to implement link list with insert, delete, search, view, and delete function.	CO4,6
10.	Write a program to implement ordered link list.	CO4,6
11.	Write a program to add two polynomials.	CO4
12.	Write a program to create doubly link list.	CO3
13.	Write a program to implement tree with insert, delete and search function.	CO1
14.	Write a program for in order, post order and preorder traversal of tree.	CO2
15.	Write a program for binary search and sequential search using recursion.	CO3
16.	Write a program for bubble sort and sequential search.	CO2
17.	Write a program for insertion sort and quick sort.	CO1

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SEMESTER-I (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA206 N	DCC	Advanced Data Structures	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	–	2	–	–	–	–	–	–	1			
CO2	3	3	1	2	2	–	–	–	–	–	–	1			
CO3	3	3	2	1	2	–	–	–	–	–	–	1			
CO4	2	2	1	–	1	–	–	–	–	–	–	1			
CO5	3	2	3	1	3	–	–	–	–	–	–	1			

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MCA206 N	DCC	Advanced Data Structures	Max	60	20	20	30	20	3	0	2	4
			Min	24	16		13.5	9				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

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COURSE CODE	CATEGORY	COURSE NAME	Marks	TEACHING & EVALUATION SCHEME					Credit; *Teacher		
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	T	P
MCA202	DCC	Computer Networks	Max	60	20	20	0	0	3	0	0
			Min	24	16						

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