Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Computer Application

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

MCA (No Branch)

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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				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.

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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			Marks	THEORY			PRACTICAL					
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			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.

	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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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.

	Total Hours	**45**	

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 Grew 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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			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
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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	PO10	PO11	PO12	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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			Marks	THEORY			PRACTICAL					
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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.

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

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

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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*				
MCA202	DCC	Computer Networks	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.

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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			Marks	THEORY			PRACTICAL					
				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							

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	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							

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.

	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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MCA202	DCC	Computer Networks	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.

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, 10thEdition, 2013

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	PO10	PO11	PO12	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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			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.

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:

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 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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			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.

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
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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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				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 (No Branch)

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.

3. Galvin P., J.L. Abraham Silberschatz. "Operating System Concepts". John Wiley & Sons, Seventh edition, 2009.

4. Tanenbaum, A.S. "Modern Operating System", Prentice Hall of India Pvt. Ltd, Third edition, 2009.

5. Maurice J. Bach “Design of UNIX O.S. “, PHI Learning, 2015.

6. Yashavant Kanetkar, “Unix Shell programming”, 1stEdition, BPB Publisher, 2010.

Suggested e- resources (Websites/e- books)

1 https://pages.cs.wisc.edu/~remzi/OSTEP/

2 https://www.phindia.com/Books/ShoweBooks/ODY/Operating-Systems?srsltid=AfmBOorpnmfBwqnPhlnjIZF5xwE8uCrkK_ewwJp8jB_N8v2Nyf1wO3hq

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	PO10	PO11	PO12	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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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*				
MCA205	AEC	Artificial Intelligence and Machine Learning	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.

COURSE OBJECTIVES:

The student will have ability to:

1. Gain a historical perspective of AI and its foundations.
2. Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Experience AI development tools such as an "AI language", expert system shell, and/or data mining tool.
5. Experiment with a machine learning model for simulation and analysis.
6. Explore the current scope, potential, limitations, and implications of intelligent systems.

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 fundamental understanding of the history of artificial intelligence (AI) and its foundations.

CO2 Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

CO3 Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

CO4 Demonstrate proficiency in applying scientific method to models of machine learning.

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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*				
MCA205	AEC	Artificial Intelligence and Machine Learning	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.

CO5 Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining
CO6 tool. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

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	Overview of AI: A historical perspective of Artificial intelligence, The AI problems, AI technique, Characteristics of AI applications. Turing Test, Physical symbol system hypothesis. Applications of Artificial Intelligence.A brief introduction to LISP and PROLOG programming.	9	ATL3 ATL6

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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*				
MCA205	AEC	Artificial Intelligence and Machine Learning	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.

II	Problem Solving: The concept of state space, production systems, control strategies forward and backward chaining; Heuristics. Blind Search: Depth First and Breadth First search. Heuristic Search: Hill climbing, Steepest Ascent Hill Climbing, Best First search, A* and AO* search. Constraint satisfaction problems.	9	ATL3 ATL6
III	Knowledge Representation: First order predicate logic, Skolemization, resolution principle & unification, inference mechanisms. Semantic networks, frame systems and value inheritance, scripts and conceptual dependency.	9	ATL6
IV	Natural Language processing and Neural Networks: NLP: Parsing techniques, Chomsky Hierarchy, Context Free Grammar, case and logic grammars, semantic analysis. A brief overview of Neural Networks and Applications of neural networks.	9	ATL3 ATL6
V	Fuzzy Logic, Machine Learning and Expert Systems: Introduction to expert system and application of expert systems, case studies: MYCIN and DENDRAL. A brief overview of fuzzy logic, machine learning, deep learning and their applications.	9	ATL6
	Total Hours	**45**	

SUGGESTED READINGS:

Textbooks

1.Elaine Rich and Kevin Knight “Artifical Intelligence” -Tata McGraw Hill, Third Edition

2.Dan W. Patterson “Introduction to Artifical Intelligence and Expert Systems”, Prentice Hall of India, 2007

3. Deepak Khemani, “ A first course in Artificial Intelligence”, McGraw Hill Education, 2017.

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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*				
MCA205	AEC	Artificial Intelligence and Machine Learning	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.

Suggested e- resources (Websites/e- books)

1 RHA OLE Platform: RH124 Course

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	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	3	1	-	-	-	1	-	2			
CO2	3	3	2	2	3	-	-	-	-	1	-	2			
CO3	3	2	2	1	3	1	-	-	-	1	-	2			
CO4	2	3	2	3	2	-	-	-	-	1	1	2			
CO5	2	2	3	2	3	-	-	-	1	1	1	2			
CO6	1	2	1	1	1	3	2	3	2	3	1	3			

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									
				THEORY			PRACTICAL		L	T	P	CREDITS
			Marks	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

ASSESSMENT TOOLS:

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

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									
				THEORY			PRACTICAL		L	T	P	CREDITS
			Marks	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.

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
IV	Searching and Sorting: Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge	9	ATL3 ATL6

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
				THEORY			PRACTICAL		L	T	P	CREDITS
			Marks	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.

	sort, selection sort. Hashing: Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique (CRT), Perfect Hashing		
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. Lipschuitz 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

LIST OF PRACTICAL

	Title	CO Mapping

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									
				THEORY			PRACTICAL		L	T	P	CREDITS
			Marks	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.

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

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	–	2	–	–	–	–	–	–	1			
CO2	3	3	1	2	2	–	–	–	–	–	–	1			
CO3	3	3	2	1	2	–	–	–	–	–	–	1			

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				THEORY			PRACTICAL		L	T	P	CREDITS
			Marks	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.

CO4	2	2	1	–	1	–	–	–	–	–	–	1			
CO5	3	2	3	1	3	–	–	–	–	–	–	1			

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				THEORY			PRACTICAL		L	T	P	CREDITS
			Marks	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	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.

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Shri Vaishnav Institute of Computer Application

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

MCA (No Branch)

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.

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Shri Vaishnav Institute of Computer Application

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

MCA (Artificial Intelligence and Machine Learning)

SEMESTER-I (2026-28)

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

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