Anekant Education Society's

TuljaramChaturchand College, Baramati

(Autonomous)

Two Year Post Graduate Degree Program in Computer Science

(Faculty of Science & Technology)

CBCS Syllabus

M.Sc. (Computer Science) Part-I Semester -I

For Department of Computer Science

TuljaramChaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

(Eligibility : B.Sc. Computer Science)

Title of the Programme: M.Sc. (Computer Science)

Preamble

AES's TuljaramChaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Computer Science and related subjects, the Board of Studies in Computer Science at TuljaramChaturchand College, Baramati - Pune, has developed the curriculum for the first semester of M.Sc.(CS) Part-IComputer Science, which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

A degree in Computer Science subject equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Career in Computer Science is considered one of the most high-paying jobs and is full of opportunities; particularly when India's prowess in information technology industry is recognized across the globe. The pool

of talented computer professionals working in IT companies of the USA, Canadaand other countries shows that IT can take a person to higher levels. Numerous IT companies from India employ huge number of computer professionals in their Indian and overseas offices. Students who are interested in programming**,** software development, and have good analytical and reasoning skills may pursue this course. Job opportunities are available for Graduates and Post Graduates in Government as well as Private sector. Graduates may take up the following job posts- Software Engineer, Software Tester, Data Analyst, Project Manager, Network Administrator, database administrator and Application Developer.

Overall, revising the Computer Science syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

ProgrammeOutcomes (POs) for M.Sc.(Computer Science)

After completing M.Sc. Computer Science Program students will be able to:

PSO1: Enrich the knowledge in the areas like Artificial Intelligence, Web Services, Cloud Computing, Paradigm of Programming language, Design and Analysis of Algorithms, Database Technologies Advanced Operating System, Mobile Technologies, Software Project Management and core computing subjects. Choose to study any one subject among recent trends in IT provided in the optional subjects.

PSO2: Students understand all dimensions of the concepts of software application and projects.

PSO3: Students understand the computer subjects with demonstration of all programming and theoretical concepts with the use of ICT.

PSO4: Developed in-house applications in terms of projects.

PSO5: Interact with IT experts & knowledge by IT visits.

PS06: Get industrial exposure through the 6 months Industrial Internship in IT industry.

PS07: To make them employable according to current demand of IT Industry and responsible citizen. PS08: Aware them to publish their work in reputed journals.

Anekant Education Society's

TuljaramChaturchand College, Baramati

(Autonomous)

Board of Studies (BOS) in Computer Science

From 2022-23 to 2024-25

Sr.No.	Name	Designation
1.	Mr. UpendraChoudhari	Chairman
2.	Dr. Vilas Kardile	Member
3.	Mr. AbhijeetMankar	Member
4.	Mr. Vishal Shaha	Member
5.	Mrs. PrajaktaKulkarni	Member
6.	Mrs. AsmitaBhagat	Member
7.	Mr. Rahul Shah	Member
8.	Mr. ShashikantNakate	Member
9.	Mr. Purushottam Dixit	Member
10.	Mr. Swapnil Chemte	Member
11.	Mrs. Kalyani Londhe	Member
12.	Mrs. Poornima Gavimath	Member
13	Dr.Kavita A. Khobragade	Vice-Chancellor Nominee
14	Dr.Sudhakar Bhoite	Expert from other University
15	Dr.Suhas S. Satonkar	Expert from other University
16	Mr. Rohit Shah	Industry Expert
17	Mr. Yogesh More	Meritorious Alumni
18	Mr. Abhijeet Chopade	Student Representative
19	Miss. Rutuja Harihar	Student Representative
20	Mr. Akshada Kulkarni	Student Representative
21	Mr. Prajwal Nimbalkar	Student Representative

Anekant Education Society's

TuljaramChaturchand College of Arts, Science and Commerce, Baramati

(Autonomous)

Credit Distribution Structure for (M.Sc. (Computer Science)) Part-I (2023 Pattern)

Year	Level	Sem.	Major		Research Methodology (RM)	OJT/ FP	RP	Cum. Cr.
			Mandatory	Electives				
I	6.0	Sem-I	COS-501-MJM: PrinciplesofProgrammingLanguage (**Credit 04**)	COS-511-MJE(A): Design and Analysis of Algorithms (**Credit04**)	COS-521-RM: Research Methodology in Computer Science (**Credit 04**)	--	--	**20**
			COS-502-MJM: CryptographyandCyberForensics (**Credit 04**)					
			COS-503-MJM: DatabaseTechnologies (PR) (**Credit 02**)					
			COS-504-MJM: DotNet(Basic) (PR) (**Credit 02**)					
		Sem- II	COS-551-MJM: DigitalImageProcessing (**Credit 04**)	COS-561-MJE (A): Artificial Intelligence(**Credit04**)	--	COS-581-OJT/FP **Credit 04**	--	**20**
			COS-552-MJM:DataMiningandData Warehousing (**Credit 04**)					
			COS-553-MJM: Python Programming-I (Basic) (PR) (**Credit 02**)					
			COS-554-MJM: Dot Net (Advanced) (PR) (**Credit 02**)	*** 1 Credit = 15 Hr.**				
Cum. Cr.			**24**	**8**	**4**	**4**	**--**	**40**

Anekant Education Society's

TuljaramChaturchand College of Arts, Science and Commerce, Baramati (Autonomous)

Course Structure for (M.Sc. (Computer Science) Part-I (2023 Pattern)

Sem	Course Type	Course Code	Title of Course	Theory / Pract.	No. of Credits
I	Major (Mandatory)	COS-501-MJM	PrinciplesofProgrammingLanguage	Theory	4
		COS-502-MJM	CryptographyandCyberForensics	Theory	4
		COS-503-MJM	DatabaseTechnologies	Practical	2
		COS-504-MJM	DotNet(Basic)	Practical	2
	Major (Elective)	COS-511-MJE(A)	DesignandAnalysisof Algorithms	Theory	4
	RM	COS-521-RM	Research Methodology in Computer Science	Theory	4
			Total Credits:		**20**
II	Major (Mandatory)	COS-551-MJM	DigitalImageProcessing	Theory	4
		COS-552-MJM	DataMiningandData Warehousing	Theory	4
		COS-553-MJM	Python Programming–I (Basic)	Practical	2
		COS-554-MJM	DotNet(Advanced)	Practical	2
	Major (Elective)	COS-561-MJE (A)	ArtificialIntelligence	Theory	4
	OJT/FP	COS-581-OJT/FP	On Job Training / Field Projects	------	4
			Total Credits:		**20**
	Cumulative Credits of Semester – I and II				**40**

SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science)

(w. e. from June, 2023)

Name of the Programme	: M.Sc. Computer Science
Program Code	: PSCOS
Class	: M.Sc. (Computer Science)
Semester	: I
Course Type	:Major
Course Name	: Principle of Programming Language
Course Code	: COS-501-MJM
No. of Lectures	: 60
No. of Credits	: 04

A) CourseObjectives:

1. To introduce the various programming paradigms.
2. To understand the evolution of programming languages.
3. To understand the concepts of OO languages, functional languages, logical and
4. scripting languages.
5. To introduce the principles and techniques involved in design and implementation of
6. modern programming languages.
7. To introduce the notations to describe the syntax and semantics of programming
8. languages.
9. To introduce the concepts of concurrency control and exception handling.
10. To introduce the concepts of ADT and OOP for software development
11. Knowledge of, and ability to use, language features used in current programming languages.
12. An understanding of the key concepts in the implementation of common features of programming languages.
13. Increase the ability to learn new programming languages
14. Increase the capacity to express programming concepts and choose among alternative ways to express things

B) CourseOutcomes:

After completing this course, the student must demonstrate the knowledge and able to:

CO1: Evaluate to enhance and express the syntax and semantics of programming language

CO2: Ability to express syntax and semantics in formal notation.

CO3: Ability to apply suitable programming paradigm for the application

CO4: Ability to compare the features of various programming languages

CO5: Able to understand the programming paradigms of modern programming languages.

CO6: Able to understand the concepts of ADT and OOP.

CO7: Ability to program in different language paradigms and evaluate their relative benefits.

Unit	Title and Contents	No. of lectures
Unit-I	**Programming Domains** ✓The Art of Language Design - The Programming Language Spectrum, Why Study Programming Languages? ✓Types of Programming Language Domains # Scientific Applications – Large Number of Floating Point Computations – FORTRAN # Business Applications – Produce Reports, Use decimal numbers and characters – COBOL # Artificial Intelligence – Symbols rather than numbers manipulated – LISP # Systems Programming – Need Efficiency because of continuous use – C # Web Software – Eclectic Collection of Languages: Markup (e.g., XHTML), Scripting (e.g., PHP), General-Purpose (e.g., Java) # Data Analytics Applications – R Programming, Python Programming	**9**
Unit-II	**Names, Scopes and Bindings** ✓Meaning of Names in Scope-Aliases, Object Lifetime and Storage Management: Static Allocation, Stack-based Allocation, Heap-Based Allocation, Garbage Collection ✓The Binding of Referencing Environments - Subroutine Closures, Object Closures, Nested Subroutines, Declaration Order ✓Scope Rules, Static Scoping, Dynamic Scoping ✓Overloading, Polymorphism and related concepts, Macro Expansion	**8**
Unit-III	**Data Types** ✓Primitive Data Types - Numeric Types, Integer, Floating point, Complex, Decimal, Boolean Types, Character Types, Character String Types-Design Issues, Strings and Their Operations, String Length Operations, Implementation of Character String Types. ✓User defined Ordinal types - Enumeration types, Designs, Evaluation, Subrange types, Evaluation, Implementation of User defined ordinal types ✓Array types - Array initialization, Array operations, Rectangular and Jagged arrays, Slices, Evaluation, Implementation of Array Types ✓Associative Arrays – Structure and operations, Implementing Associative arrays ✓Record Type – Definitions of records, References to record fields, Operations on records, Evaluation, Implementation of Record types ✓Union Type – Design issues, Discriminated versus Free unions,	9

	Evaluation, Implementation of Union types ✓Pointer and Reference Types - Design issues, Pointer operations, Pointer problems – Dangling pointers, Lost heap dynamic variables, Pointers in C and C++, Reference types, Evaluation, Implementation of pointer and reference types, Representation of pointers and references, Solution to dangling pointer problem, Heap management	
Unit-IV	**Control Flow** ✓Expression Evaluation-Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions, Short-Circuit Evaluation ✓Structured and Unstructured Flow – Structured Alternatives to GOTO Sequencing ✓Selection – Short Circuited Conditions, Case/Switch Statements ✓Iteration – Enumeration Controlled Loops, Combination, Loops, Iterators, Logically Controlled Loops ✓Recursion-Iteration and Recursion, Applicative and Normal Order Evaluation	9
Unit-V	**Subroutines and Control Abstraction** ✓Subprograms – Fundamentals of Subprograms, Design Issues for subprograms, Overloaded Subprograms, Nested Subprograms ✓Generic Subroutines – Generic Functions in C++, Generic Methods in Java ✓Design Issues for Functions, User Defined Overloaded Operators Coroutines ✓Parameter Passing Methods, Local Referencing Environments, The General Semantics of Calls and Returns	**9**
Unit-VI	**Data Abstraction and Object Orientation** ✓Encapsulation and Inheritance - Modules, Classes, Nesting, Type, Extensions, Extending without Inheritance ✓InitializationandFinalization-ChoosingaConstructor,Referencesand Values, Execution Order ✓Dynamic Method Binding-Virtual and Non-Virtual Methods, Abstract Classes and Interfaces, Member Lookup, Polymorphism, Object Closures ✓Multiple Inheritance-Semantic Ambiguities, Shared Inheritance, Replicated Inheritance, Mix-In Inheritance	**9**

References:

1. Scott, Programming Language Pragmatics, 3e(With CD) ISBN 9788131222560 Kaufmann Publishers, An Imprint of Elsevier, USA
2. Robert W. Sebesta, Concepts of Programming Languages, Eighth Edition, Pearson Education
3. Carl Townsend, Introduction to Turbo Prolog
4. Patrick Henry Winston & Berthold Klaus Paul Horn ,LISP 3rd edition –BPB
5. M. Gabbrielli, S. Martini, , Programming Languages: Principles and Paradigms

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	3	3	2	3	3
CO2	2	2	-	1	2	2	2
CO3	1	2	3	2	2	2	1
CO4	3	2	3	2	2	1	2
CO5	3	3	3	3	3	3	3
CO6	3	2	3	3	3	2	2
CO7	2	3	2	3	2	2	3

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science)

(w. e. from June, 2023)

Name of the Programme	: M.Sc. Computer Science
Program Code	: PSCOS
Class	: M.Sc. (Computer Science)
Semester	: I
Course Type	:Major
Course Name	: CryptographyandCyberForensics
Course Code	: COS-502-MJM
No. of Lectures	:60
No. of Credits	: 4

A) CourseObjectives:

1. To enable students to get sound understanding of Info-Sys-Security, Network Security, Cryptography and cyber forensics.
2. To equip with knowledge and skills necessary to support for their career in Network Security.
3. To encourage them to do further academic studies / research in this area.
4. To develop IT professionals skilled in information/network security and forensic analysis of compromised systems and who are efficient in documentation pertaining to cyber forensic analysis to be provided to the courts of law.
5. Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.
6. Understand key terms and concepts in Cryptography, Governance and Compliance.
7. To make the student learn different encryption techniques along with hash functions, MAC, digital signatures and their use in various protocols for network security and system security.

B) CourseOutcomes:

CO1: Learn the security concepts and techniques.

CO2: In future these experts will be an asset to this country for serving in the fields of

information security and digital forensics.

CO3: Understand and analyze data encryption standard.

CO4: Analyze and evaluate the cyber security needs of an organization.

CO5: Determine and analyze software vulnerabilities and security solutions to reduce the

risk of exploitation.

CO6: Implement cyber security solutions and use of cyber security, information

assurance, and cyber/computer forensics software/tools.

CO7: Implement various networking protocols.

TOPICS/CONTENTS:

Units	Title&Contents	No.of Lectures
Unit–I	**IntroductiontoSecurity,Cryptographyandtechniques:** TheNeedforSecurity, SecurityApproaches, PrinciplesofSecurity,TypesofAttacks. IntroductiontoCryptography,PlainTextandCipherText,SubstitutionTechniques, Transposition Techniques, Encryption and Decryption,SymmetricandAsymmetric keycryptography,Steganography.	**09**
Unit–II	**SymmetricKeyAlgorithmsandAES:** AlgorithmTypesandModes,OverviewofSymmetricKeyCryptography,DES,IDEA, Blowfish	**09**
Unit–III	**AsymmetricKey Algorithms,DigitalSignatureand RSA:**BriefHistory of Asymmetric Key Cryptography, overview, RSA Algorithm,ComparisonbetweenSymmetric&AsymmetricKeyAlgorithms,Digi talSignature	**06**
Unit–IV	**DigitalCertificatesandPublicKeyInfrastructure(PKI):** Introduction,DigitalCertificates,privatekeymanagement.	**04**
Unit–V	**Introduction to Cyber forensics:** Information Security Investigations,CorporateCyberForensics,Scientificmethod in forensicanalysis,investigating large scale Data breach cases. Analyzing malicious software.Types of Computer Forensics Technology, Types of Military ComputerForensic Technology,TypesofLaw Enforcement:ComputerForensicTechnology, Types of Business Computer Forensic Technology, SpecializedForensics Techniques, Hidden Data and How to Find It, Spyware and Adware,Encryption Methods and Vulnerabilities, Protecting Data from BeingCompromised Internet Tracing Methods, Security and Wireless Technologies,AvoidingPitfallswithFirewallsBiometricSecuritySystems.	**12**

Unit–VI	**Types of Computer Forensics Systems:** Internet Security Systems,Intrusion Detection Systems, Storage Area Network Security Systems,NetworkDisasterRecoverySystems, SatelliteEncryptionSecuritySystems,Instant Messaging (IM) Security Systems, Net Privacy Systems,IdentityManagement Security Systems, Identity Theft, Router Forensics.Cyberforensicstoolsandcasestudies.EthicalHacking:EssentialTerminology,WindowsHacking,Malware,Scanning,Cracking.	**10**

References:

1. AtulKahate,"CryptographyandNetworkSecurity",Second/Thirtd/ForthEdition,McGraw HillPublication.
2. JohnR.Vacca,"ComputerForensics:Computer CrimeSceneInvestigation",2ndEdition,Charles RiverMedia,2005
3. Ravi Kumar & B Jain, "Cyber Forensics - Concepts and Approaches", icfai universitypress,2006
4. ChristofPaar, JanPelzl,"UnderstandingCryptography:ATextbookforStudentsandPractitioners",SecondEdition,Springer's,2010
5. "LiveHacking:TheUltimateGuidetoHackingTechniques&CountermeasuresforEthicalHackers&ITSecurityExperts",AliJahangiri,Firstedition,2009
6. Kizza,Springer, "ComputerNetworkSecurity"Harrington,Elsevier,"NetworkSecurity

NOTE: 50LECTURESFORCURRICULUM(TEACHING) &10LECTURES FORLEARNING

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	2	3	1	3	3
CO2	2	3	3	3	2	3	3
CO3	3	3	3	3	2	3	3
CO4	2	3	3	3	1	3	3
CO5	1	3	3	3	2	2	3
CO6	1	2	3	3	1	3	3
CO7	2	3	3	3	2	3	3

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science)

(w. e. from June, 2023)

Name of the Programme	: M.Sc. Computer Science
Program Code	: PSCOS
Class	: M.Sc. (Computer Science)
Semester	: I
Course Type	:Major
Course Name	: Database Technologies
Course Code	: COS-503-MJM
No. of Lectures	:60 Hours (15 Practical)
No. of Credits	: 02 Credits

Prerequisite: Knowledge of RDBMS concepts

A) Course Objectives:

1. Students will gain knowledge about unstructured database and its importance.
2. Students will understand the structure of MongoDB and various operations of it.
3. Students will study and analyze the difference between structured and unstructured database.
4. Students will study aggregation operations in MongoDB.
5. Students will understand the front-end connectivity with MongoDB.
6. Students will gain knowledge about index and its importance in queries.

B) Course Outcomes:

After completing this course, students will be able to

CO1: Solve the problem query by using appropriate command in MongoDB.

CO2: Categorize the different operations into appropriate groups.

CO3: Distinguish between writing query in RDBMS and in MongoDB.

CO4: Choose the proper aggregation operations in query.

CO5: Create the proper index for solving queries in MongoDB.

CO6: Demonstrate how to connect MongoDB with front end.

CO7: Design database for an application with MongoDB as backend.

TOPICS/CONTENTS:

UNIT 1: MongoDB Installation Basics (04 hours) **UNIT 2:** Creating database, collections in MongoDB (04 hours)

UNIT 3: Basic commands in MongoDB (08 hours)

UNIT 4: CRUD Operations (find, insert) (12 hours)

UNIT 5: CRUD Operations (update, delete) (12 hours)

UNIT 6: Indexing (04 hours)

UNIT 7: Aggregation (08 hours)

UNIT 8: Connecting with Front-End (04 hours)

UNIT 9: MongoDB Administration (04 hours)

References:

1. Bradshaw, Brazil, Chodorow(2020).MongoDB: The Definitive Guide. Shroff/O'Reilly. Third Edition.
2. Banker, Bakkum, Verch, Garrett, Hawkins(2016). MongoDB in Action. Dreamtech Press. Second Edition.
3. MongoDB Manual: https://docs.mongodb.com/manual/

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3						
CO2	3						
CO3			2				
CO4	3		2				
CO5	3						
CO6	3						
CO7	3		3				

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science)

(w. e. from June, 2023)

Name of the Programme	: M.Sc. Computer Science
Program Code	: PSCOS
Class	: M.Sc. (Computer Science)
Semester	: I
Course Type	: Major
Course Name	: Dot Net (Basic)
Course Code	: COS-504-MJM
No. of Lectures	:60 Hours (15 Practical)
No. of Credits	: 02 Credits

A) CourseObjectives:

1. Able to understand the DOTNET framework
2. C# language features and Windows application development using C#.Net
3. C# is used to understand, diagram, and implement programming concepts.
4. C# decision structures use iteration, class methods, fields, and properties to find logistical alternatives.
5. Creating Desktop Applications using .Net Controls
6. Able to understand the Entity framework
7. Use of Entity Framework in the programming environment

B) CourseOutcomes:

CO1: Understand the Microsoft .NET Framework and C#.NET structure

CO2: Design application with variety of controls

CO3: Access the data using inbuilt data access tools.

CO4: Use Microsoft ADO.NET to access data in Application

CO5: Configure and deploy C# Application

CO6: Develop secured C# application

CO7: Identify and resolve problems (debug /trouble shoot) in C#.NET window-based application

TOPICS/CONTENTS:

UNIT1: Parameter Modifiers (ref, out, params) **(04 hours)**

UNIT2: Delegate and Events **(04 hours)**

UNIT3: Inheritance and Interface **(04 hours)**

UNIT4: Polymorphism (Method Overloading , Operator Overloadingand MethodOverriding **(04 hours)**

UNIT5: Exception Handling **(04 hours)**

UNIT6: Collections **(04 hours)**

UNIT7: Generics **(04 hours)**

UNIT8: Use of Basics Form Controls **(04 hours)**

UNIT9: Use of Dialogue Boxes **(04 hours)**

UNIT10: Simple Database Operations **(04 hours)**

UNIT11: Advanced Database Operations **(04 hours)**

UNIT12: Simple Crystal Report **(04 hours)**

UNIT13: Advanced Crystal Report **(04 hours)**

UNIT14: Event Handling (Calculator) **(04 hours)**

UNIT15: Entity Framework **(04 hours)**

References:

1. Beginning Visual C#, Wrox Publication
2. Professional Visual C#, Wrox Publication
3. Database Programming with C#, By Carsten Thomsen, Apress
4. Beginning C# Object-Oriented Programming By Dan Clark , Apress
5. Beginning C# Object-Oriented Programming By Dan Clark , Apress

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	1	1	3	1
CO2	3	2	3	1	1	3	1
CO3	3	2	3	1	1	3	1
CO4	3	2	3	1	1	3	1
CO5	3	2	3	1	1	3	1
CO6	3	2	3	1	1	3	1
CO7	3	2	3	1	1	3	1

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science)

(w. e. from June, 2023)

Name of Programme: M.Sc.(Computer science)

ProgramCode **:**PSCOS

Class **:** M.Sc.(Computer science)
Semester **:** I
Course Type **:** Elective
Course Name **:**Design& Analysis of Algorithm
Course Code **:** COS-511-MJE(A)
No. of Lectures **:** 60
No. of Credits **:** 4

A) Course Objectives: Student successfully completing this course will be able to

- Understand Basic Algorithm Analysis techniques and the use o-asymptotic notation
- Understand different design strategies
- Understand the use of data structure proving algorithm performance
- Understand classical problem and solutions
- Learn a variety of useful algorithms
- Understand classification of problems

B) Course Outcomes: At the end of the course, students should be able to:

CO1: Understand Tree Traversal method and Greedy Algorithms

CO2: Understand algorithm design techniques

CO3: Learn how to analyze algorithm and estimate their worst case and average case behaviour.

CO4: Identify and understand various Time and Space complexities of various algorithms.

CO5: Find optimal solution by applying various methods

CO6: Design optimal solution by applying various methods.

CO7: learn how to apply their theoretical knowledge in practice

Units	Title and Contents	No. of Lectures
Unit–I	**Analysis & Design Strategies** Algorithm definition, space complexity, time complexity, worst case–best case–average case complexity, asymptotic notation, sorting algorithms(insertion sort, heap sort) sorting in linear time, searching algorithms, recursive algorithms(Tower of Hanoi,Permutations). **Divide and Conquer**-control abstraction, binary search,merge sort,Quick sort,Strassen's matrix Multiplication	**10**
Unit–II	**Greedy Method** Knapsack problem,job sequencing with deadlines ,minimum-costs Spanning trees**,** Kruskal's and Prim's algorithm, optimal storage on tapes, optimal merge patterns, Huffman coding	**10**
Unit–III	**Dynamic programming** Matrix chain multiplication, single source shortest paths,Dijkstra's algorithm, Bellman-ford algorithm, all pairs shortest path, longest common sub sequence,string editing ,0/1knapsack problem, Traveling salesperson problem.	**10**
Unit–IV	**Decrease and conquer** DFS and BFS, Topological sorting, strongly connected components	**6**
Unit-V	**Backtracking & Branch and Bound Technique** General method, 8 queen's problem, sum of subset problem, graph coloring problem, Hamiltonian cycle.FIFO,LIFO,LCBB,TSP problem, 0/1 knapsack Problem.	**8**
Unit–VI	**Transform and Conquer & Problem Classification** Horner's Rule and Binary Exponentiation– Problem Reduction Non deterministic algorithm, The class of P,NP,NP-hard and NP-Complete problems, significance of Cook's theorem.	**6**

NOTE:50 LECTURES FOR CURRICULUM (TEACHING) &10 LECTURES FOR LEARNING

References:

1. EllisHorowitz,SartajSahni&SanguthevarRajasekaran,ComputerAlgorithms,Galgotia.
2. T.Cormen,C.Leiserson,&R.Rivest,Algorithms,MITPress,19901
3. A.Aho,J.Hopcroft,&J.Ullman,TheDesignandAnalysisofComputerAlgorithms, AddisonWesley,1974
4. DonaldKnuth,TheArtofComputerProgramming(3vols.,variouseditions,1973-81),AddisonWesley
5. StevenSkiena,TheAlgorithmManual,SpringerISBN:9788184898651

6. Jungnickel,Graphs,NetworksandAlgorithms,Springer,ISBN:3540219056

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	2	1	1	2
CO2	3	3	3	1	1	1	2
CO3	3	3	3	1	1	1	1
CO4	3	3	3	1	1	1	1
CO5	3	3	3	1	1	1	1
CO6	3	3	3	1	1	1	1
CO7	3	3	3	1	1	1	1

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science)

(w. e. from June, 2023)

Name of the Programme	**:** M.Sc. Computer Science
Program Code	**:** PSCOS
Class	**:** M.Sc. (Computer Science)
Semester	**:** I
Course Type	**:**RM
Course Name	**:** Research Methodology(Theory)
Course Code	**:** COS-521-RM
No. of Lectures	**:**60
No. of Credits	**:** 4

A) Course Objectives:

1. Identify and discuss the role and importance of research in the social sciences.
2. Identify and discuss the issues and concepts salient to the research process.
3. Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
4. Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.
5. Students should be able to distinguish between the writing structure used for a quantitative study and one used for a qualitative study
6. Develop skills in qualitative and quantitative data analysis and presentation
7. Develop advanced critical thinking skills

B) Course Outcomes:

CO1: Equip themselves with ethical issues related to Research and Publication.
CO2: Build a strong foundation for future research work in a systematic manner by applying notions of Research Methodology.
CO3: Gain ability to apply knowledge of Computer Science to research in real-world issues.
CO4: Get familiar with current research trends in various core areas of Computer Science.

CO5: Know the knowledge, general competence, and analytical skills in Research Methodology and Research & Publication Ethics.
CO6: Build their foundation for research in Computer Science.
CO7: Provide hands-on experience to carry out research work in Computer Science as well as interdisciplinary areas.

TOPICS/CONTENTS:

Units	Title & Contents	No.of Lectures
Unit–I	**Foundations of Research** Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process	06
Unit–II	**Problem Identification & Formulation** Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance	06
Unit–III	**Research Design: Concept and Importance in Research** Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.	06
Unit–IV	**Qualitative and Quantitative Research** Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.	04
Unit -V	**Measurement** Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval,Ratio	04
Unit VI	**Sampling** Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non-Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample –	07

	Practical considerations in sampling and sample size.	
Unit VII	**Data Analysis** Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.	05
Unit - VIII	**Interpretation of Data and Paper Writing** Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.	06
Unit IX	Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.	04
Unit X	Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism	06

Book References:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches by John W. Creswell
2. Research in Education by Best and Kahn
3. Research and methodology byC.R.Kothar
4. Understanding the research problem by Paul Oliver
5. Research Methods by Rashmi Agrawal
6. An Introduction to Qualitative Research by Uwe Flick

Mapping of this course with Programme Outcomes

Course Outcomes	**Programme Outcomes (POs)**						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2			3	2	
CO2	2	3	3		2	2	2
CO3	2	2	3	1	2		
CO4	3	2	3			2	3
CO5	2	3	2		3	1	2
CO6		3	3				2
CO7	3	3	3			2	2

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

Examination Pattern / Evaluation Pattern

Teaching and Evaluation (for Major, Minor, AEC, VEC, IKS courses)

Course Credits	No. of Hours per Semester Theory/Practical	No. of Hours per Week Theory/Practical	Maximum Marks	CE 40 %	ESE 60%
1	15 / 30	1 / 2	25	10	15
2	30 / 60	2 / 4	50	20	30
3	45 / 90	4 / 6	75	30	45
4	60 / 120	4 / 8	100	40	60

Teaching and Evaluation (for VSC, SEC & CC courses)

- Evaluation to be done by Internal & External Experts
- No descriptive end semester written examination
- Evaluation to be done at Department level preferably prior to commencement of Theory /Practical Examinations
- Evaluation to be done on the Skills gained by student