



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 -II

For Department of Computer Science

Tuljaram Chaturchand 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 Tuljaram Chaturchand 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 Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of M.Sc.(CS) Part-I Computer 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, Canada and 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.

Programme Specific Outcomes (PSOs)
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.

PSO6: Get industrial exposure through the 6 months Industrial Internship in IT industry.

PSO7: To make them employable according to current demand of IT Industry and responsible citizen. **PSO8:** Aware them to publish their work in reputed journals.

Anekant Education Society's
Tuljaram Chaturchand College, Baramati
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Board of Studies (BOS) in Computer Science

From 2022-23 to 2024-25

Sr.No.	Name	Designation
1.	Dr. Upendra Choudhari	Chairman
2.	Dr. Vilas Kardile	Member
3.	Mr. Abhijeet Mankar	Member
4.	Mr. Vishal Shaha	Member
5.	Mrs. Prajakta Kulkarni	Member
6.	Mrs. Asmita Bhagat	Member
7.	Mr. Rahul Shah	Member
8.	Dr. Shashikant Nakate	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
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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: Principles of Programming Language (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: Cryptography and Cyber Forensics (Credit 04)					
			COS-503-MJM: Database Technologies (PR) (Credit 02)					
			COS-504-MJM: DotNet (Basic) (PR) (Credit 02)					
		Sem- II	COS-551-MJM: Digital Image Processing (Credit 04)	COS-561-MJE (A): Artificial Intelligence (Credit 04) OR COS-561-MJE (B):Advanced Concepts in Operating System. * 1 Credit = 15 Hr.	--	COS-581-OJT/FP Credit 04	--	20
			COS-552-MJM: Data Mining and Data Warehousing (Credit 04)					
			COS-553-MJM: Python Programming-I (Basic) (PR) (Credit 02)					
			COS-554-MJM: Dot Net (Advanced) (PR) (Credit 02)					
Cum. Cr.			24	8	4	4	--	40

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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	Principles of Programming Language	Theory	4
		COS-502-MJM	Cryptography and Cyber Forensics	Theory	4
		COS-503-MJM	Database Technologies	Practical	2
		COS-504-MJM	DotNet (Basic)	Practical	2
	Major (Elective)	COS-511-MJE(A)	Design and Analysis of Algorithms	Theory	4
	RM	COS-521-RM	Research Methodology in Computer Science	Theory	4
			Total Credits:		20
II	Major (Mandatory)	COS-551-MJM	Digital Image Processing	Theory	4
		COS-552-MJM	Data Mining and Warehousing	Theory	4
		COS-553-MJM	Basic Python Programming	Practical	2
		COS-554-MJM	Advanced Dot Net	Practical	2
	Major (Elective)	COS-561-MJE (A) OR COS-561-MJE (B)	Artificial Intelligence OR Advanced Concepts in Operating System.	Theory	4
	OJT/FP	COS-581-OJT/FP	On Job Training / Field Projects	Practical	4
			Total Credits:		20
	Cumulative Credits of Semester – I and II				40

M.Sc. (Computer Science) – I (Semester – II)

Syllabus

(NEP-2020: 2023 Pattern)

(Wef. Academic Year 2022-2023)

**SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science)
(w. e. f. A.Y 2023-24)**

Name of the Programme	: M.Sc. Computer Science
Program Code	: PSCOS
Class	: M.Sc. (Computer Science)
Semester	: II
Course Type	: Major (Theory)
Course Name	: Digital Image Processing.
Course Code	: COS-551-MJM
No. of Lectures	: 60
No. of Credits	: 04

A. Course Objectives:

1. To Understand and create an ability to use current techniques, skills, and tools necessary for Computing Practice.
2. To provide a detailed approach towards image processing applications like enhancement, segmentation, and compression
3. To study the image fundamentals and mathematical transforms necessary for image process.
4. To study the image enhancement techniques.
5. To study image restoration procedures.
6. To study the image compression procedures.
7. Describe and explain basic principles of digital image processing.

B. Course Outcomes:

After successfully completing the course students will be able to

CO1- Review the fundamental concepts of a digital image processing system

CO2- Develop and implement algorithms for digital image processing.

CO3-Use and Compare, various Linear filtering methods.

CO4- Analyse images in the frequency domain using various transforms.

CO5- Evaluate the techniques for image enhancement and image restoration.

CO6- Categorize various compression techniques.

CO7- Describe digital image representation, manipulation and illustrate the use of histograms.

Unit	Title and Contents	No. of lectures
Unit-I	Introduction to DIP <ul style="list-style-type: none"> • Introduction to Digital Image Processing • The origins of Digital Image Processing • Examples of Fields that use Digital Image Processing • Gamma-Ray Imaging • X-Ray Imaging • Imaging in the Ultraviolet Band • Imaging in the Visible and Infrared Bands 	03

	<ul style="list-style-type: none"> Imaging in the Microwave Band Imaging in the Radio Band 	
Unit-II	D Digital Image Fundamentals <ul style="list-style-type: none"> Motivation and Perspective, Applications Components of Image Processing System Fundamentals Steps in Image Processing, Image Sampling and Quantization Some Basic Relationships like Neighbours, Connectivity, Distance Measures between pixels. 	10
Unit-III	Image Enhancement in the Spatial and Frequency Domain <ul style="list-style-type: none"> Image enhancement point and neighbourhood processing, Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic and Logic Operations, Zooming Basics of Spatial Filters, Smoothing and Sharpening Spatial Filters Combining Spatial Enhancement Methods. Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering. 	10
Unit-IV	Image Restoration <ul style="list-style-type: none"> Models of Image Degradation / Restoration Process, Noise Models, Restoration in presence of Noise using Spatial Filters Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering Constraint Least Square Filtering Geometric Mean Filter and Geometric Transformations 	08
Unit-V	Image Segmentation and Morphological Image Processing <ul style="list-style-type: none"> Discontinuity based Segmentation, similarity-based segmentation Edge linking and boundary detection Threshold, Region based Segmentation Introduction to Morphology, Dilation, Erosion Some basic Morphological Algorithms 	7
Unit-VI	Object Representation and description <ul style="list-style-type: none"> Representation, Boundary Descriptors, Regional Descriptors, Chain Code, Structural Methods. Different Application Areas of Digital Image Processing. 	10

References:

- 1) Rafael C. Gonzalez and Richard E. Woods, "Digital Image processing", 2nd edition, Pearson Education.
- 2) David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", Prentice Hall
- 3) A.K. Jain "Fundamentals of Digital Image processing", PHI.
- 4) W.K Pratt, "Digital Image Processing"

NOTE: Internal Evaluation of this Subject includes Case Studies on different application areas.

NOTE: 48 LECTURES FOR CURRICULUM (TEACHING) &12 LECTURES FOR LEARNING

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

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

**SYLLABUS (CBCS as per NEP 2020) FOR M.Sc.(Computer Science) -I Sem-II
(w. e. from Academic Year 2023-24)**

Name of the Program	: M.Sc. Computer Science
Program Code	: PSCOS
Class	: M. Sc. (Computer Science)
Semester	: II
Course Type	: MJM (Theory)
Course Name	: Data Mining and Warehousing
Course Code	: COS-552-MJM
No. of Lectures	: 60
No. of Credits	: 04

A. Course Objectives

- 1) To make awareness of “Data Mining and Warehousing” among the students
- 2) To introduce to scope and significance of “Data Mining and Warehousing”
- 3) To provide the skill of analyse data, define and design relevant models and algorithms for estimated applications.
- 4) To study various aspects of Data, Web mining.
- 5) To develop innovative aspect towards in data mining.

B. Course Outcomes

CO1: Understand Principles and aspects of Data Mining and Warehouse,

CO2: Introduction data warehouse with dimensional modelling and apply OLAP operations.

CO3: Grasp the ability Define and design appropriate data mining algorithms.

CO4: To provide skills for solve real world problems

CO5: Make awareness of complex data types with respect to spatial and web mining

CO6: Promote attention in research and innovation in data mining and ware house.

CO7: Introduce the career opportunity in Mining and warehouse.

Unit No	Title and Contents	No. of Lectures
Unit-1	Introduction to data mining 1.1 Introduction: Data mining task, Classification (Predictive), Regression (Predictive), Change and Deviation dictation (Predictive), Clustering (Description), Summarization (Description) Dependency modelling (description) 1.2 Data Mining versus Knowledge discovery in database 1.3 Data mining issue: Mining methodology and User interaction issues, Performance Issues, Diversity of data Types 1.4 Data mining matrices 1.5 Social implication of data mining 1.6 Overview of Data mining application	(08)
Unit-2	Introduction to data warehouse 2.1 Introduction 2.2 Architecture of data warehouse 2.3 OLAP and Data cubes 2.4-Dimensional data modelling 2.5 Machine learning 2.6 Pattern matching 2.7 Solved case studies	(06)
Unit-3	Data mining techniques 3.1 Introduction 3.2 Frequent Item-set and association rule mining Apriori Algorithm, Use of Sampling for frequent item-set 3.3 Graph mining: Frequent subgraph mining, Tree mining, Sequence mining	(12)
Unit -4	Classification and prediction 4.1 Introduction 4.2 Decision tree learning 4.2.1 Construction 4.2.2 Performance 4.2.3 Attribute selections 4.2.4 Issues 4.2.5 Classification and regression tree (CART) .3 Bayesian classification 4.3.1 Bayes Theorem 4.3.2 Naïve Bayesian Classifier 4.3.3 Bayesian network 4.3.4 Interface 4.3.5 Parameter learning and structure learning 4.4 Linear classification 4.4.1 Latest sequence 4.4.2 Prescription and SVM classification 4.5 Prediction	(12)

	4.5.1 Linear regression 4.5.2 non-linear regression	
Unit -5	Accuracy measures 5.1 Introduction 5.2 Precision 5.3 Recall 5.4 F- Measures 5.5 Confuse matrix 5.6 Cross validation 5.7 Bootstrap	(08)
Unit -6	Clustering 6.1 Introduction 6.2 K-means 6.3 Expectation maximization algorithm 6.4 Hierarchical clustering 6.5 Correlation clustering 6.7 Solved example	(08)
Unit -7	Brief overview of advance techniques 7.1 Introduction 7.2 Active learning 7.3 Reinforcement learning 7.4 Text mining 7.5 Graphical model 7.6 Web mining	(06)

TEXT BOOKS:

1. Data Mining Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2nd Edition, 2006.
2. Introduction to Data Mining Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.

REFERENCE BOOKS:

1. Data Mining Techniques Arun K Pujari, 2nd edition, Universities Press.
2. Data Warehousing in the Real-World Sam Aanhory & Dennis Murray Pearson Edn Asia.
3. Insight into Data Mining, K.P.Soman, S.Diwakar, V.Ajay, PHI, 2008.
4. Data Warehousing Fundamentals Paulraj Ponnaiah Wiley student Edition
5. Data Mining: Introductory and Advanced Topics by Margaret Dunham, Pearson

Mapping of this course with Program outcome

Course outcome	Program Outcome (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	2	1	2	1	3
CO2	2	1	1	2	1	1	2
CO3	2	1	3	1	-	2	3
CO4	1	2	3	2	1	1	2
CO5	1	2	3	1	2	-	2
CO6	1	2	3	1	-	1	2
CO7	2	3	21	1	-	1	3

Weight: 1-Partially Related

2- Moderately Related

3-Strongly Related

SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science)-I Sem-II
(w. e. f. A.Y 2023-24)

Name of the Program	: M.Sc. Computer Science
Program Code	: PSCOS
Class	: M.Sc. (Computer Science)
Semester	: II
Course Type	: Major (PR)
Course Name	: Basic Python Programming
Course Code	: COS-553-MJM
No. of Lectures	: 60
No. of Credits	: 02

A) Course Objectives:

- 1 - To understand and gain knowledge of all types of programming.
- 2 - To understand and solve the functional and procedural problems.
- 3 - work with common Python data types like integers, floats, strings, lists, dictionaries
- 4 - understand and use variables.
- 5 - use basic flow control, including for loops and conditionals.
- 6 - read data from files.
- 7 - Sending Mail using python programing

B) Course Outcomes:

- CO 1 - To understand why Python is a useful scripting language for developers.
- CO 2 - To learn how to use lists, tuples, and dictionaries in Python programs.
- CO 3 - To learn how to use indexing and slicing to access data in Python programs.
- CO 4 - To learn how to write functions and pass arguments in Python.
- CO 5 - To learn how to build and package Python modules for reusability.
- CO 6 - To learn how to read and write files in Python.
- CO 7 - To learn how to design object-oriented programs with Python classes

Units	Contents and Assignment
Unit 1	<p>Contents -</p> <ul style="list-style-type: none"> • Why Python? • Python Syntax compared to other programming languages • Python Install • The print Statement • Comments • Python Data Structures & Data Types, Dictionary <p>No. of Assignments – 4</p>

Unit 2	Contents - <ul style="list-style-type: none"> • String Operations in Python • Simple Input & Output • Simple Output Formatting • Operators in python • If Statement, Loop Statement, range, Break & Continue Statement No. of Assignments – 4
Unit 3	Contents - <ul style="list-style-type: none"> • Create your own functions • Functions Parameters • Variable Arguments • Scope of a Function • Function Documentations No. of Assignments - 4
Unit 4	Contents - <ul style="list-style-type: none"> • Lambda Functions& map • n Exercise with functions • Create a Module • Standard Modules No. of Assignments - 4
Unit 5	Contents - <ul style="list-style-type: none"> • Errors • Exception handling with try • handling Multiple Exceptions • Writing your own Exception No. of Assignments - 4
Unit 6	Contents - <ul style="list-style-type: none"> • File handling Modes • Reading Files • Writing& Appending to Files • Handling File Exceptions • The with statement No. of Assignments - 4
Unit 7	Contents - <ul style="list-style-type: none"> • Creating Classes • Instance Methods • Inheritance No. of Assignments - 4
Unit 8	Contents - <ul style="list-style-type: none"> • Interface • Polymorphism No. of Assignments - 4

Unit 9	Contents - <ul style="list-style-type: none"> • Exception Classes & Custom Exceptions • Constructor No. of Assignments - 4
Unit 10	Contents - <ul style="list-style-type: none"> • Class and threads • Multi-threading No. of Assignments - 4
Unit 11	Contents - <ul style="list-style-type: none"> • Synchronization • Treads Life cycle • use cases No. of Assignments - 4
Unit 12	Contents - <ul style="list-style-type: none"> • How to Send Mail • How to Send Mail with attachment • How to Schedule the mail No. of Assignments - 4

Reference Books:

1. Bill Lubanovic , Introducing Python- Modern Computing in Simple Packages , O ReillyPublication.
2. Magnus Lie Hetland, Beginning Python: From Novice to Professional, Apress
3. PaulGries, Practical Programming: An Introduction to Computer Science Using Python 3 , Pragmatic Bookshelf, 2/E 2014
4. Charles Dierbach, Introduction to Computer Science Using Python, Wiley Publication
5. John Paul Mueller, Beginning Programming with Python for Dummies Paperback

Online Links:

1. Python Tutorial for Beginner's:

<https://www.w3schools.com/python/>

<https://www.geeksforgeeks.org/python-programming-language/>

<https://www.tutorialspoint.com/python/index.htm>

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

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

SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science) -I Sem-II**(w. e. f A.Y 2023-24)**

Name of the Program	: M.Sc. Computer Science
Program Code	: PSCOS
Class	: M.Sc. (Computer Science)
Semester	: II
Course Type	: Major (PR)
Course Name	: Advanced Dot Net
Course Code	: COS-554-MJM
No. of Lectures	: 60
No. of Credits	: 02

A) Course Objectives:

- 1 - To understand and gain knowledge of ASPDot Net Core.
- 2 - To understand and solve the real-life problems.
- 3 – To understand ASP.Net Core Routing
- 4 – To learn Razor View Engine.
- 5 – To understand MVC Pattern.
- 6 – Use of Bootstrap with MVC.
- 7 – Learn ASP.Net MVC – Web API.

B) Course Outcomes: On completion of the course, student will be able to

- CO 1 - Understand ASP.Net Core project layout.
 CO 2 – Use JSON in web application.
 CO 3 - How to use routing in web application.
 CO 4 – Razor syntax to create view.
 CO 5 – Understand and use MVC Pattern.
 CO 6 - To learn how database in MVC web application.
 CO 7 - To learn how to use Web API.

Units	Contents and Assignment
Assignment 1	Contents – <ul style="list-style-type: none"> ➤ Environment Setup ➤ New Project ➤ Project Layout ➤ Project JSON No. of Programs - 4

Assignment 2	Contents – <ul style="list-style-type: none"> ➤ Configuration ➤ Middleware ➤ Exceptions ➤ Static Files No. of Programs – 4
Assignment 3	Contents – <ul style="list-style-type: none"> ➤ Attribute Routes ➤ Action Results ➤ Views No. of Programs - 4
Assignment 4	Contents – <ul style="list-style-type: none"> ➤ Setup Entity Framework ➤ DB Context No. of Programs - 4
Assignment 5	Contents – <ul style="list-style-type: none"> ➤ Razor View Import ➤ Razor Tag Helpers ➤ Razor Edit Form ➤ Identity Overview ➤ Authorize Attribute No. of Programs - 4
Assignment 6	Contents – <ul style="list-style-type: none"> ➤ MVC Pattern ➤ Environment Setup ➤ Getting Started ➤ Life Cycle No. of Programs - 4
Assignment 7	Contents – <ul style="list-style-type: none"> ➤ Temp Data ➤ View Data ➤ View Bag No. of Programs - 4
Assignment 8	Contents – Database <ul style="list-style-type: none"> ➤ Validation ➤ Security No. of Programs - 4
Assignment 9	Contents – Database <ul style="list-style-type: none"> ➤ Caching ➤ Razor ➤ Data Annotations No. of Programs - 4

Assignment 10	Contents - Web API <ul style="list-style-type: none"> ➤ Scaffolding ➤ Bootstrap No. of Programs - 4
Assignment 11	Contents - Web API <ul style="list-style-type: none"> ➤ Unit Testing ➤ Deployment ➤ Self-hosting No. of Programs - 4
Assignment 12	Contents – <ul style="list-style-type: none"> ➤ Create simple website using ASP.Net MVC ➤ Create Online Shopping website No. of Programs - 4

Reference Books:

1. Programming ASP.NET Core , Dino Esposito , PHI LEARNING PVT. LTD. | MICROSOFT
2. ASP.NET Core for Jobseekers , Kemal Birer , bpb publication
3. Asp.Net Core Application Development :: Building An Application In Four Sprints, David Paquette Simon James Chambers (Author) , PHI Learning
4. Learning ASP.NET Core MVC Programming , (English, Paperback, Ragupathi Mugilan T. S.)

Online Links :

1. ASP.Net MVC Tutorial for Beginner's:

<https://www.w3schools.com/mvc/>

<https://www.geeksforgeeks.org/dotnetcore/>

<https://www.tutorialspoint.com/>

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

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

**SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science) -I Sem-II
(w. e. from Academic Year 2023-2024)**

Name of the Programme	: M.Sc. Computer Science
Programme Code	: PSCOS
Class	: M.Sc. (Computer Science)
Semester	: II
Course Type	: Major (Elective) – TH
Course Name	: Artificial Intelligence
Course Code	: COS-561-MJE (A)
No. of Lectures	: 60 Hours
No. of Credits	: 04

A) Course Objectives:

1. To gain knowledge about AI's fundamental concepts and methods.
2. To understand state space and searching strategies.
3. To gain knowledge about different search algorithms.
4. To know about advanced search methods.
5. To learn about knowledge representation and predicate logic.
6. To gain knowledge about semantic networks, frames and conceptual dependency.

B) Course Outcomes: On completion of the course, the students will be able to:

- CO1: Understand AI's fundamental concepts and methods.
 CO2: Explain state space and searching strategies
 CO3: Analyze various types of standard search algorithms
 CO4: Illustrate advanced search methods and algorithms for game playing
 CO5: Examine knowledge representation and predicate logic
 CO6: Understand semantic networks, frames and conceptual dependency
 CO7: Apply Artificial Intelligence concepts for solving real life problems

Units	Title and Contents	No. of Lectures
Unit-I	Introduction to Artificial Intelligence <ul style="list-style-type: none"> • Definition of AI • Future of AI • Brief Discussion of major topics (Expert System, Natural Language Processing, Speech and Pattern Recognition) of AI • AI & Society • Ethics and Privacy issues 	04

Unit–II	Problem, Problem Spaces & Heuristics Search Techniques <ul style="list-style-type: none"> • State space search • Production Systems • Search & Control Strategies • Problem Characteristics • Heuristics search technique • Generate and test algorithm • Hill climbing and its variations • Simulated annealing • Best First Search(A*algorithm) • AO*algorithm • Constraint Satisfaction • Mean-Ends Analysis • Game playing –Game trees, Mini-Max algorithm, Alpha-Beta pruning 	16
Unit – III	Knowledge Representation <ul style="list-style-type: none"> • Approaches to knowledge representation • Types of knowledge • Propositional Logic • Predicate Logic (FOL) • Logic Programming with Prolog • CNF • Resolution • Forward & Backward chaining system 	12
Unit - IV	Slot & Filler Structures <ul style="list-style-type: none"> • Weak Structure <ul style="list-style-type: none"> ✓ Semantic network ✓ Frames • Strong Structure <ul style="list-style-type: none"> ✓ CD (conceptual dependency) ✓ Script • CYC (CYC Motivation, CYCL) 	08
Unit – V	Natural Language Processing <ul style="list-style-type: none"> • Introduction to NLP • Difficulties in NLU • Stages in NLP • NLP models • Use cases of NLP • Sentiment Analysis 	04
Unit – VI	Neural Network <ul style="list-style-type: none"> • Types of Artificial Neural network <ul style="list-style-type: none"> ✓ Feed forward ✓ Feedback • Deep Neural Network 	04

References:

1. Eberhart, "Computational Intelligence", Elsevier, ISBN9788131217832
2. Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", Morgan Kaufmann Publishers, ISBN9788181471901.
3. Elaine Rich, Kevin Knight, "Artificial Intelligence", Third Edition, Tata McGraw Hill, 2017.
4. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, 2015.
5. Dan Patterson, "Introduction to Artificial Intelligence and Expert System", Prentice Hall of India Pvt. Ltd., 1997.
6. Wolfgang Ertel, "Introduction to Artificial Intelligence", Second Edition, Springer, 2017.
7. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education (India) Pvt. Ltd., 2013.

Mapping of this course with Programme Outcomes

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

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

**SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. (Computer Science)-I Sem-II
(w. e. from June, 2023)**

Name of the Program	: M.Sc. Computer Science
Program Code	: PSCOS
Class	: M.Sc. (Computer Science)
Semester	: II
Course Type	: Major Elective (TH)
Course Name	: Advanced Concepts in Operating System
Course Code	: COS-561-MJE (B)
No. of Lectures	: 60
No. of Credits	: 4

Prerequisites:

- Working knowledge of C programming.
- Basic Computer Architecture concepts.
- Basic algorithms and data structure concepts.

A. Course Objectives:

Students successfully completing this course will be able to:

1. Teaches Advanced Operating Systems Concepts using Unix/Linux and Windows as Representative examples.
2. Strikes a delicate balance between theory and practical applications.
3. In fact, most Units start with the theory and then switches focus on how the concepts are implemented in a C program.
4. Describes the programming interface to the Unix/Linux system - the system call interface.
5. Finally, it includes with an overview of Android Operating System.
6. This course provides an understanding of the functions of Operating Systems. It also provides an insight into functional modules of Operating Systems.
7. To introduce file system structures, file operations, and file organization.

B. Course Outcomes:

CO1: Understand advanced concepts in Operating System

CO2: Understand execution of system calls

CO3: Explore and innovate in the field of advanced operating systems.

CO4: Understand advanced resource management techniques, including CPU and memory allocation, process management, and I/O optimization.

CO5: Understand the working of Threads

CO6: Understand Kernel Structure.

CO7: Understand advanced memory mapping techniques.

Unit	Title and Contents	No. of Lectures
Unit-1	<p>Introduction to UNIX/Linux Kernel</p> <ul style="list-style-type: none"> • Introduction of an Operating System: Objectives of Operating System and Functions of O.S. • Unix as an Operating System: History and Architecture of Unix Operating System • Introduction to kernel, Types of kernels (monolithic, micro) • Concepts of Linux Programming • Files, Filesystem, Processes, Users and Groups Permissions • Signals & Inter-process Communication • System Programming: <ul style="list-style-type: none"> ○ Foundation of System Programming ○ System calls for I/O • User Perspective • Assumptions about Hardware 	04
Unit-2	<p>File and Directory I/O</p> <ul style="list-style-type: none"> • Introduction to File and Directory • Buffer Headers • Structure of the Buffer Pool • Scenarios for retrieval of a buffer • Reading and Writing disk blocks • Inodes (Accessing inodes and releasing inodes) • Structure of Regular File • Directories • Pipes & Dup • Mounting and Unmounting of File Systems • File Sharing • Atomic Operations: stat, fstat, lsat functions, file types, file access permissions • Ownership of new Files and Directories <ul style="list-style-type: none"> ➤ Functions: Access, umask. chmod, fchmod • Sticky Bit • Functions: chown, fchown, lchown • File Size • File Truncation • File Systems <ul style="list-style-type: none"> ➤ Functions: link, unlink, remove, rename ➤ symbolic links, Functions: symlink and readlink ➤ File Times and utime Function • Functions: mkdir and rmdir 	12

	<ul style="list-style-type: none"> ➤ Reading Directories <ul style="list-style-type: none"> ➤ Functions: chdir, fchdir, getcwd • Advanced File I/O • Mapping Files into Memory • Advice for Normal File I/O • I/O Schedulers and I/O Performance • Files and their Metadata • Copying and Moving files • Out of Band Communication 	
Unit-3	<p>Process Environment, Process Control and Process Relationships</p> <ul style="list-style-type: none"> • Introduction • Process States and transitions • Context of a Process • Process Creation • Process Termination • Process Control Block <ul style="list-style-type: none"> ➤ Process Id ➤ Obtaining the Process ID and Parent Process ID ➤ Changing Size of the Process ➤ The Shell ➤ Running a New Process • Environment List <ul style="list-style-type: none"> ➤ Memory layout of a C program ➤ Functions: setjump() and longjump() ➤ Functions: getrlimit() and setrlimit() ➤ Rules for Changing the Resource Limits • System Functions • Launching and Waiting for a New Process • Race Conditions • Changing User IDs and Group IDs • Daemons • Process Scheduling • Classification of Process • Yielding the Processor • Threads • Process Priorities • Processor Affinity 	12
Unit 4	<ul style="list-style-type: none"> • Introduction to Memory Management • Process Address Space <ul style="list-style-type: none"> ➤ Pages and Memory Regions • Allocating Dynamic Memory 	09

	<ul style="list-style-type: none"> ➤ Allocating Arrays ➤ Resizing Allocation ➤ Freeing Dynamic Memory • Alignment • Data Segment • Anonymous Memory Mappings • Advanced Memory Allocation • Debugging Memory Allocations • Stack-Based Allocations • Choosing a Memory Allocation Mechanism • Manipulating Memory • Locking and Unlocking Memory • Locking Limits • Opportunistic Allocation • Swapping and Demand Paging <ul style="list-style-type: none"> ➤ Disk Management- ➤ Disk Structure ➤ Disk Scheduling algorithm ➤ Numerical exercise based on Disk algorithms ➤ Disk management ➤ Swap Space concept and Management ➤ RAID structure ➤ Disk performance issues 	
Unit 5	Signal Handling <ul style="list-style-type: none"> • Introduction to Signal Handling • Signal Concepts and signal Function • Unreliable Signals • Interrupted system calls • Reentrant Functions and SIGCLD semantics • Reliable-Signal Terminology ad Semantic • Functions: kill (), raise (), alarm (), pause () • Process Blocking Signal Mask Using sigpromask() • Signal Sets • Retrieving Pending Signals • sigaction Function and Some More Functions • Nonlocal Branching • Advanced Signal Management • Sending a Signal with a Payload 	06
Unit 6	Windows Thread Management <ul style="list-style-type: none"> • Thread Internals: Birth of a Thread and Examining a ThreadActivity • Worker Factory • Thread Scheduling 	05

	<ul style="list-style-type: none"> ➤ Overview of Windows Scheduling API ➤ Priority Levels ➤ Windows API Function ➤ Relevant Tools ➤ Real Time Priorities ➤ Thread States ➤ Dispatcher Database ➤ Scheduling Scenarios ➤ Preemption • Context Switching <ul style="list-style-type: none"> ➤ Priority Boosts ➤ Job Objects 	
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Note: 48 hours for theory lectures and 12 hours for internal assessment and learning.

References:

1. Operating System Concepts, 8th Edition by GREG GAGNE, PETER BAER GALVIN, ABRAHAM SILBERSCHATZ
2. Linux System Programming, O'Reilly, by Robert Love.
3. Windows Internals, Microsoft Press, by Mark E. Russinovich and David A. Soloman.
4. The Design of the UNIX Operating System, PHI, by Maurice J. Bach.
5. Advanced Programming in the UNIX Environment, Addison-Wesley, by Richard Stevens

Web links:

Kernel: <https://github.com/nul1security/Kernel-and-Types-of-kernels/blob/master/Kernel%20and%20Types%20of%20kernels.md>

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