Deccan Education Society's

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for
Program: Masters of Science
Course: M.Sc Part-II
Subject: Computer Science

Choice Based Credit System (CBCS)
with effect from
Academic Year 2024-2025

PROGRAM OUTCOMES

PO	Description
A student completing Master's Degree in **Science** Program will be able to	
PO1	Demonstrate an in-depth understanding of the relevant science discipline. Recall, explain, extrapolate, and organize conceptual scientific knowledge for execution and application and also to evaluate its relevance
PO2	Critically evaluate, analyze, and comprehend a scientific problem. Think creatively, experiment and generate a solution independently, check and validate it and modify if necessary.
PO3	Access, evaluate, understand, and compare digital information from various sources and apply it for scientific knowledge acquisition as well as scientific data analysis and presentation.
PO4	Articulate scientific ideas, put forth a hypothesis, design and execute testing tools and draw relevant inferences. Communicate the research work in appropriate scientific language
PO5	Demonstrate initiative, competence, and tenacity at the workplace. Successfully plan and execute tasks independently as well as with team members. Effectively communicate and present complex information accurately and appropriately to different groups
PO6	Use an objective, unbiased and non-manipulative approach in the collection and interpretation of scientific data and avoid plagiarism and violation of Intellectual Property Rights. Appreciate and be sensitive to environmental and sustainability issues and understand its scientific significance and global relevance
PO7	Translate academic research into innovation and creatively design scientific solutions to problems. Exemplify project plans, use management skills, and lead a team in the planning and execution of a task
PO8	Understand the cross-disciplinary relevance of scientific developments and relearn and reskill to adapt to technological advancements.

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Kirti M. Doongursee College

(Autonomous) Proposed

Curriculum as per NEP-2020

Year of implementation- 2024-2025

Name of the Department-Computer Science

Semester	Course Code	Course Title	Vertical	Credit
III	K24PSCSMJ311	Web3 Technologies	Major	4
	24PSCSMJP31	Web3 Technologies — Practical	Major	2
	24PSCSMJ312	Security (Cryptography and Cryptanalysis)	Major	4
	24PSCSMJP32	Security (Cryptography and Cryptanalysis) —- Practical	Major	2
	24PSCSMJ313	Data Science (Data Visualization)	Major Elective	4
	24PSCSE321	Ethical & Responsible AI	Elective	2
	24PSCSRM331	Research Paper	RP	4
				22
IV	24PSCSMJ411	Deep Learning	Major	4
	24PSCSMJP41	Deep Learning —-- Practical	Major	2
	24PSCSMJ412	Big Data Analytics	Major	4
	24PSCSMJP41	Big Data Analytics —- Practical	Major	2
	24PSCSE421	Trends in cloud computing	Elective	4
OJT	24PSCSFP44	PROJECT IMPLEMENTATION	Field Project	6
				22

SEMESTER-III

Course Code	Course Title	Credits
K24PSCS3011	Elective-1: Advanced Computing (Web3 Technologies)	04

Course Outcome: -

● To cover the technical aspects of cryptocurrencies, blockchain technologies, and distributed consensus.
● To familiarize potential applications for Bitcoin-like cryptocurrencies
● To Basics of smart contracts, decentralized apps, and decentralized anonymous organizations (DAOs)
● To know Solidity programming

Course Specific Outcome: -

● Understand blockchain technology.
● Develop blockchain-based solutions and write smart contracts using Hyperledger Fabric and Ethereum frameworks.
● Build and deploy blockchain applications for on-premise and cloud-based architecture.
● Integrate ideas from various domains and implement them using blockchain technology from different perspectives.

UNIT 1: Introduction to Web3 Technologies

Blockchain: Growth of blockchain technology, Distributed systems, the history of blockchain and Bitcoin, Blockchain, Consensus, CAP theorem and blockchain, Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Blockchain and full ecosystem decentralization, The consensus problem, Analysis and design, Classification, Algorithms,

Bitcoin: Overview, Cryptographic keys, Transactions, Blockchain Mining, Bitcoin network, Wallets, Bitcoin payments, Innovation in Bitcoin, Advanced protocols, Bitcoin investment, and buying and selling Bitcoin

UNIT 2: Smart Contracts & Ethereum UNIT 3: Serenity, Ethereum, Hyperledger & Tokenization UNIT 4: Solidity Programming (Skill Enhancement)

15L

UNIT 2: Smart Contracts & Ethereum

UNIT 3: Serenity, Ethereum, Hyperledger & Tokenization UNIT 4: Solidity Programming (Skill Enhancement)

TEXTBOOKS:

1. Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition 2020
2. Andreas M. Antonopoulos, Dr.Gavin wood "Mastering Ethereum" O" Reilly Media Inc, 2019
3. Ritesh Modi, "Solidity Programming Essentials: A Beginner" s Guide to Build Smart Contracts for Ethereum and BlockChain", Packt Publishing.

REFERENCE BOOKS:

1. Josh Thompson, „Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming‟ , Create Space Independent Publishing Platform, First Edition - 2017.

Course Code	Course Title	Credits
K24PSCSP 3011	**Practical : Advanced Computing (Web3 Technologies)**	**02**
Note: The following practical can be performed using Solidity, NodeJS. Ethereum and any other suitable platform		
1	Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on Cloud to run.	
2	Create and deploy a block chain network using Hyperledger Fabric SDK for Java	
3	Interact with a block chain network. Execute transactions and requests against a block chain network by creating an app to test the network and its rules	

Course Code	Course Title	Credits
PSCS3021	**Security (Cryptography and Cryptanalysis)**	**04**

Course Outcome: -

- To develop the foundation for the study of cryptography and its use in security.
- To understand the application of Number Theory and Algebra for the design of cryptographic algorithms
- To understand the role of cryptography in communication over an insecure channel.
- To analyze and compare symmetric-key encryption and public-key encryption schemes based on different security models

Course Specific Outcome: -

- Insights related to cryptography and cryptanalysis.
- Analyze and use methods for cryptography.
- Implement some of the prominent techniques for public-key cryptosystems and digital signature schemes
- Understand the notions of public-key encryption and digital signatures and sketch their formal security definitions.

UNIT 1: Classic Cryptography Techniques **Cryptosystems and Basic Cryptographic Tools:** Introduction, Secret-key Cryptosystems, Public-key Cryptosystems, Block and Stream Ciphers, Hybrid Cryptography, Hybrid Cryptography, Message Integrity, Message Authentication Codes, Signature Schemes, Nonrepudiation, Certificates, Hash Functions, Cryptographic Protocols, Security **Classical Cryptography:** Introduction to Some Simple Cryptosystems, Shift Cipher, Substitution Cipher, Affine Cipher, Vigenere Cipher, Hill Cipher, Permutation Cipher, Stream Ciphers, Cryptanalysis, Cryptanalysis of the Affine Cipher, Cryptanalysis of the Substitution Cipher, Cryptanalysis of the Vigenere Cipher, Cryptanalysis of the Hill Cipher, Cryptanalysis of the LFSR Stream Cipher. **Perfect Secrecy:** Introduction, Perfect Secrecy, Entropy, Properties of Entropy, Spurious Keys, and Unicity Distance	**15 L**

UNIT 2: Advanced Encryption, Integrity, and Authentication

UNIT 3: Public-Key Cryptography and Identity Verification

UNIT 4: Key Management (Skill Enhancement)

TEXTBOOKS:

1. Cryptography Theory and Practice Douglas R. Stinson, , Fourth Edition, CRC Press, 2019
2. Applied Cryptanalysis, Breaking Ciphers in Real World, John Wiley, 2015

REFERENCE BOOKS:

1. Implementing Cryptography, Shannon W. Bray, John Wiley, 2020
2. Algorithmic Cryptanalysis, Antoine Joux, CRC Press, 2017
3. Modern Cryptography: Applied Mathematics for• Encryption and Information Security, William Easttom, Springer, 2021

Course Code	Course Title	Credits
K24PSCS P3021	**Practical : Security (Cryptography and Cryptanalysis)**	**02**
Note: The practical can be performed in C/C++/Java/Python		
1	Program to implement password salting and hashing to create secure passwords.	
2	Program to implement various classical ciphers-Substitution Cipher, Vigenère Cipher, and Affine cipher	
3	Program to demonstrate cryptanalysis (e.g., breaking Caesar or Vigener Cipher)	

Course Code	Course Title	Credits
PSCS3041	**Elective-1: Data Science (Data Visualization)**	**04**

Course Outcome: -

- Familiarity with working with data analysis tools.
- Ability to perform data wrangling for practical purposes.
- Ability to solve real-world data analysis problems with thorough, detailed examples.
- Ability to use Tableau to handle data from various sources and perform analysis of data.

Course Specific Outcome: -

- Understands the fundamentals of Visualization.
- Working with different Data Collection Structures.
- Efficiently handle various source data using Tableau.
- Data Visualization and Analysis can be performed using Tableau.
- Handling and customizing Geospatial data using Tableau.
- Creating a story using the dashboard to analyze data

UNIT 1: Preparing and Storing Data **Series**: Creating a Series with index, creating a Series from a Dictionary, Creating a Series from a Scalar Value, Vectorized Operations and Label Alignment with Series, Name Attribute. Accessing Data from a Series with a Position, Exploring and Analysing a Series,	**15 L**

Operations on a Series.

Data Frames: Creating a Data Frame from a Dict of Series or Dicts, Creating Data Frames from a Dict of Ndarrays, Creating Data Frames from a Structured or Record Array, Creating Data Frames from a List of Dicts, Creating Data Frames from a Dict of Tuples, Selecting, Adding, and Deleting Data Frame Columns, Assigning New Columns in Method Chains, Row Selection, Row Addition, Row Deletion, Exploring and Analysing a Data Frame, Indexing and Selecting Data Frames, Transposing a Data Frame, Data Frame Interoperability with Numpy Functions.

Visualizing Data: Data visualization in Business Intelligence, Data visualization techniques. Data visualization libraries in Python

UNIT 2: Data Cleaning and Data Wrangling

UNIT 3: Basics of Tableau
UNIT 4: Data Visualization (Skill Enhancement)

TEXTBOOKS:
1. Dr. Ossama Embarak, Data Analysis and Visualization Using Python, Apress, 2018
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition, 2018.
3. Learning Tableau 2020, Create effective data visualizations, build interactive visual analytics, and transform your organization. Joshua Milligan, Fourth Edition, Packt, 2020.

REFERENCE BOOKS:
1. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017
2. Visual Data Storytelling with Tableau, Linda Ryan, Pearson Addison Wesley Data & Analytics Series, 2018
3. Visual Analytics with Tableau, Alexander Loth, Wiley, 2019

Course Code	Course Title	Credits
PSCSP3041	**Practical Course on Elective-1: Data Science (Data Visualization)**	**02**
Note: Practical can be implemented using Python / R studio.		
1	Create one-dimensional data using series and perform various operations on it.	
2	Create Two-dimensional data with the help of data frames and perform different operations on it.	
3	Write a code to read data from the different file formats like JSON, HTML, XML, and CSV files and check for missing data and outlier values and handle them.	

SEMESTER IV

Course Code	Course Title	Credits
PSCS3041	**Elective-1: Data Science (Data Visualization)**	**04**

Course Outcome: -

- Familiarity with working with data analysis tools.
- Ability to perform data wrangling for practical purposes.
- Ability to solve real-world data analysis problems with thorough, detailed examples.
- Ability to use Tableau to handle data from various sources and perform analysis of data.

Course Specific Outcome: -

- Understands the fundamentals of Visualization.
- Working with different Data Collection Structures.
- Efficiently handle various source data using Tableau.
- Data Visualization and Analysis can be performed using Tableau.
- Handling and customizing Geospatial data using Tableau.
- Creating a story using the dashboard to analyze data

UNIT 1: Preparing and Storing Data **Series**: Creating a Series with index, creating a Series from a Dictionary, Creating a Series from a Scalar Value, Vectorized Operations and Label Alignment with Series, Name Attribute. Accessing Data from a Series with a Position, Exploring and Analysing a Series,	**15 L**
Operations on a Series. **Data Frames: Creating a Data Frame from a Dict of Series or Dicts, Creating Data Frames from a Dict of Ndarrays, Creating Data Frames from a Structured or Record Array, Creating Data Frames from a List of Dicts, Creating Data Frames from a Dict of Tuples, Selecting, Adding, and Deleting Data Frame Columns, Assigning New Columns in Method Chains, Row Selection, Row Addition, Row Deletion, Exploring and Analysing a Data Frame, Indexing and Selecting Data Frames, Transposing a Data Frame, Data Frame Interoperability with Numpy Functions.** **Visualizing Data: Data visualization in Business Intelligence, Data visualization techniques. Data visualization libraries in Python**	

UNIT 2: Data Cleaning and Data Wrangling
UNIT 3: Basics of Tableau
UNIT 4: Data Visualization (Skill Enhancement)

TEXTBOOKS:
4. Dr. Ossama Embarak, Data Analysis and Visualization Using Python, Apress, 2018
5. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition, 2018.
6. Learning Tableau 2020, Create effective data visualizations, build interactive visual analytics, and transform your organization. Joshua Milligan, Fourth Edition, Packt, 2020.

REFERENCE BOOKS:
4. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017
5. Visual Data Storytelling with Tableau, Linda Ryan, Pearson Addison Wesley Data & Analytics Series, 2018
6. Visual Analytics with Tableau, Alexander Loth, Wiley, 2019

Course Code	Course Title	Credits
PSCSP3041	**Practical Course on Elective-1: Data Science (Data Visualization)**	**02**
Note: Practical can be implemented using Python / R studio.		
1	Create one-dimensional data using series and perform various operations on it.	
2	Create Two-dimensional data with the help of data frames and perform different operations on it.	
3	Write a code to read data from the different file formats like JSON, HTML, XML, and CSV files and check for missing data and outlier values and handle them.	

Guide lines for maintenance of journals:

A student should maintain a journal with at least six practical experiments for each part of the practical course. Certified journals need to be submitted at the time of the practical examination.

<u>Guidelines for Project Proposal in Semester - III</u>

- Student should take a topic related to the specialization he or she is planning to take in Semester-IV.
- Should have studied the related topics in the elective he or she has chosen in semester-II and semester- III
- A student is expected to devote at least 2 to 3 months of study as part of topic selection and its documentation.
- The student should be comfortable to implement the proposal in the semester – IV.

<u>Guidelines for Documentation of Project Proposal in Semester –III</u>

Student is expected to make a project proposal documentation which should contain the following:

- **Title:** A suitable title giving the idea about what work is proposed.

- **Introduction:** An introduction to the topic of around 3-5 pages, giving proper back ground of the topic discussed.

- **Related works:** A detailed survey of the relevant works done by others in the domain. Student is expected to refer at least 5 research papers in addition to text books and web-links in the relevant topic. It may be around 7 to 10 pages.

- **Objective:** A detailed objective of the proposal is needed. It may be of 1 to 2 pages.

- **Methodology:** A proper and detailed procedure of how to solve the problem discussed. It shall contain the techniques, tools, software and data to be used. It shall be of around 3 to 5 pages.

The report may be of around 20 pages, which needs to be signed by the teacher in charge and head of the Department. Students should submit the signed project proposal documentation at the time of viva as part of the University examination.

Guidelines for internship in Semester - IV

- Internship should be of 2 to 3 months with 8 to 12 weeks duration.
- A student is expected to find internship by himself or herself. However, the institution should assist their students in getting internship in good organizations.
- The home institution cannot be taken as the place of internship.
- A student is expected to devote at least 300 hours physically at the organization.
- Internship can be on any topic covered in the syllabus mentioned in the syllabus, not restricted to the specialization.
- Internship can be done, in one of the following, but not restricted to,   types of organizations:
    o Software development firms
    o Hardware/ manufacturing firms
    o Any small scale industries, service providers like banks
    o Clinics/ NGOs/professional institutions like that of CA, Advocate etc
    o Civic Depts like Ward office/post office/police station/ punchayat.
    o Research Centres/ University Depts/ College as research Assistant for research projects or similar capacities.

Guidelines for making Internship Report in Semester –IV

A student is expected to make a report based on the internship he or she has done in an organization. It should contain the following:

- **Certificate:** A certificate in the prescribed Performa (given in appendix 1) from the organization where the internship done.

- **Evaluation form:** The form filled by the supervisor or to whom the intern was reporting, in the prescribed Performa (given in appendix 2).

- **Title:** A suitable title giving the idea about what work the student has performed during the internship.

- **Description of the organization:** A small description of 1 to 2 pages on the organization where the student has interned

- **Description about the activities done by the section where the intern has worked**: A description of 2 to 4 pages about the section or cell of the organization where the intern actually worked. This should give an idea about the type of activity a new employee is expected to do in that section of the organization.

- **Description of work allotted and actually done by the intern:** A detailed description of the work allotted and actual work performed by the intern during the internship period. Intern may give a weekly report of the work by him or her if needed. It shall be of around 7 to 10 pages.

- **Self assessment:** A self assessment by the intern on what he or she has learnt during the internship period. It shall contain both technical as well as inter personal skills learned in the process. It shall be of around 2 to 3 pages.

The internship report may be around 15 pages and this needs to be submitted to the external examiner at the time of University examination.

Guidelines for Research Implementation in Semester - IV

- Student should continue with topic proposed and evaluated at the semester – III.
- The topic has to be related with the specialization he or she has chosen in the semester – IV.
- A student is expected to devote at least 3 to 4 months of efforts for the implementation.
- Student should submit a detailed project implementation report at the time of viva.

Guidelines for Documentation of Project Proposal in Semester –IV

A Student should submit project implementation report with following details:

- **Title:** Title of the project (Same as the one proposed and evaluated at the semester II examination).

- **Implementation details:** A description of how the project has been implemented. It shall be of 2 to 4 pages.

- **Experimental set up and results:** A detailed explanation on how experiments were conducted, what software used and the results obtained. Details like screen shots, tables and graphs can come here. It shall be of 6 to 10 pages.

- **Analysis of the results:** A description on what the results means and how they have been arrived at. Different performing measures or statistical tools used etc may be part of this. It shall be of 4 to 6 pages.

- **Conclusion:** A conclusion of the project performed in terms of its outcome (May be half a page).

- **Future enhancement:** A small description on what enhancement can be done when more time and resources are available (May be half a page).

- **Program code:** The program code may be given as appendix.

The report may be of around 20 pages (excluding program code), which needs to be signed by the teacher in charge and head of the Department. Student should submit the signed project implementation report along with evaluated copy of the project proposal documentation (of semester –III) at the time of Project evaluation and viva as part of the University examination.

Appendix 1

This   is   to   certify   that   Mr/Ms＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿   of
＿＿＿＿＿＿＿＿＿＿＿＿＿＿College/Institution worked as an intern as part of her MSc course in
Computer Science of University of Mumbai. The particulars of internship are given below:

Internship starting date: ＿＿＿＿＿＿＿＿＿＿＿

Internship ending date:＿＿＿＿＿＿＿＿＿＿＿

Actual number of days worked:＿＿＿＿＿＿＿＿＿

Tentative number of hours worked:＿＿＿＿＿＿Hours

Broad area of work:＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

A small description of work done by the intern during the period:

Signature:

Name:

Designation:

Contact number:

Email:

(seal of the organization)

Appendix 2

(Proforma for the Evaluation of the intern by the supervisor/to whom the intern was reporting in the organization)

Professional Evaluation of intern

Name of intern:_____

College/institution:_____

[Note: Give a score in the 1-5 scale by putting √ in the respective cells]

Sr No	Particular	Excellent	Very Good	Good	Moderate	Satisfactory
1	Attendance					
2	Punctuality					
3	Adaptability					
4	Ability to shoulder responsibility					
5	Ability to work in a team					
6	Written and oral communication skills					
7	Problem solving skills					
8	Ability to grasp new concepts					
9	Ability to complete task					
10	Quality of work done					

Comments:

_____

_____

_____

Signature:

Name:

Designation:

Contact number:

Email:

(seal of the organization)

Evaluation Scheme for SECOND Year (PG) under NEP (4 credits)

I. Internal Evaluation for Theory Courses – 40 Marks

1) Continuous Internal Assessment(CIA) Assignment - Tutorial/ Case Study/ Project / Presentations/ Group Discussion / Ind. Visit. – 20 marks

2) Continuous Internal Assessment(CIA) ONLINE Unit Test – 20 marks

II. External Examination for Theory Courses – 60 Marks

Duration: 2 Hours

Theory question paper pattern:

Question	Based on	Marks
Q.1	Unit I	15
Q.2	Unit II	15
Q.3	Unit III	15
Q.4	Unit IV	15

● All questions shall be compulsory with internal choice within the questions.

● Each Question may be subdivided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.

III. Practical Examination

● Each core subject carries 50 Marks

● Duration: 3 Hours for each practical course.

● Minimum 80% practical from each core subjects are required to be completed.

● Certified Journal is compulsory for appearing at the time of Practical Exam

NOTE: To pass the examination, attendance is compulsory in both Internal & External (Theory + Practical) Examinations.