

Bachelor of Computer Applications (BCA)

SYLLABUS

Four Year Undergraduate Programme

As per NEP 2020 guidelines

Under Choice based Credit System

**FOR THE STUDENTS TO BE ADMITTED IN THE SESSIONS
2022-23, 2023-24, 2024-25**

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Course Details for Four Year UG Programme

S. NO.	COURSES	DISCIPLINES
1	Computer Applications (CA)- Arts & Science	Natural Science and Arts & Humanities
2	Information Technology (IT)- Arts & Science	Natural Science and Arts & Humanities
3	Bachelor of Computer Applications (BCA)	Computer Applications (for BCA degree)
	BCA (Web Technology)	
	BCA (Data Science)	
	BCA (Software Development)	



Bachelor of Computer Applications (BCA)

DATA SCIENCE SCHEME

Four Year Undergraduate Programme

As per NEP 2020 guidelines

Under Choice based Credit System

**FOR THE STUDENTS TO BE ADMITTED IN THE SESSIONS 2022-23,
2023-24, 2024-25**



COURSES OF STUDY**Semester-I**

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST131	Problem Solving using C	4(3L+1P)	15	60	10	15	100
2	Minor	UMICST132	Data Science Basics	4(3L+1P)	15	60	10	15	100
3	MD	UMDCST133	Data Mining and Data Warehousing	3	15	60	NA	NA	75
4	SEC	USECST104	PC Software: Installation and Troubleshooting	2	10	40	NA	NA	50

Semester-II

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST231	Introduction to Data Science	4(3L+1P)	15	60	10	15	100
2	Minor	UMICST232	Python Programming	4(3L+1P)	15	60	10	15	100
3	MD	UMDCST233	Introduction to Machine Learning	3	15	60	NA	NA	75
4	SEC	USECST204	Cyber Security	2	10	40	NA	NA	50

BCA (Data Science) - FIRST SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-1-0)
Total marks: 100

Course Title: Problem Solving using C
Course Code: UMJCST131
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in Dec 2022, 2023 and 2024

Course objectives & learning outcomes:

1. To learn the fundamentals of programming language.
2. To understand the concept of different control structures.
3. To learn about different data structures
4. To understand the concept of procedural programming.

UNIT – I

Algorithm, Flowcharts, Flowchart Symbols, Flowchart Rules, Assemblers, Compilers and Interpreters, Pseudo Code, Introduction to C programming, Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Format of C program, Arithmetic, Relational & Logical Operators, Assignment Operators, Increment & Decrement Operators, Operator Precedence & Associativity.

15 Hours

UNIT – II

Formatted Input, Formatted Output, escape sequences, Conditional Statements: if Statement, if..... else Statement, Nested if....else Statements, Switch Statement, conditional Operator, Goto Statement, loops- for loop, while loop, do-while loop, break and continue statement.

15 Hours

UNIT – III

Qualifiers, Storage classes, Pointers definition, Declaring Pointer Variables, using pointer variable, Arrays: One, Two and Multi Dimension Arrays, Initialization of one and two dimensional Arrays, Declaring and Initializing String Variables, String Handling Functions.

15 Hours

UNIT – IV

Preprocessor directives, Function Definition, Function Calls (call by value & call by address method) Returning Value, Types of Functions, Recursion, Passing Arrays to Functions, Macros, Defining Structure, Declaring and Accessing Structure Variables, Structures and Unions, Basics of File Handling and operations like open, close, read, write etc. Enumerations.

15 Hours

Suggested readings/ references:

1. E. Balaguruswami, Programming in C, PHI
2. Gottfried. B, Theory and problems of Programming with C Language, Tata Mc Graw Hill.
3. Kenneth. A, C Problem Solving and Programming, PHI.
4. Dan Gookin, C Programming, Wiley Dreamtech.
5. Y. P. Kanetkar, Understanding Pointers in C, BPB Publications.
6. Shubhnandan S. Jamwal, Programming in C, Pearson Publications.
7. H.M. Deitel and P.J. Deitel, C How to Program, PHI.



BCA (Data Science) - FIRST SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-1-0)
Total marks: 100

Course Title: Problem Solving using C
Course Code: UMJCST131
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in Dec 2022, 2023 and 2024

NOTE FOR PAPER SETTERS FOR EXAMINATIONS –

The question paper will be divided into the following two sections. No question will be repeated in the question paper.

Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.

Practical/ tutorial Evaluation

Daily evaluation of practical's/tutorials/Viva voce/Records etc.

10 marks

Final Examination

15 Marks

Pattern for external practical examination

Practical file	5 Marks
Written examination	5 Marks
Viva-Voce	5 Marks
Total	15 Marks

Pattern for external tutorial examination

Assignment file	10 Marks
Viva-Voce	5 Marks
Total	15 Marks



BCA (Data Science) – FIRST SEMESTER

Course: Minor
 Course Credits: (L-P-T)
 (3-1-0)
 Total marks: 100

Course Title: Data Science Basics
 Course Code: UMICST132
 Mid Semester assessment: 15 Marks of 1.5 hours duration
 End Semester assessment: 60 Marks of 3.0 hours duration
 Practical: 25 Marks

For examinations to be held in Dec 2022, 2023 and 2024

Course objectives & learning outcomes:

1. Introduction to basics of data science.
2. Understanding the concepts of data mining.
3. To learn about functioning of machine learning techniques.
4. Understanding the concepts of data visualizations.

UNIT-I

Introduction to Data Science: Definition, benefits and uses of data science and big data.

Facets of Data: Structured data, unstructured data, natural language, machine generated data, network data, audio, images and video streaming data.

Data science process: overview of data science process, defining the goal, retrieving data, data preparation, data exploration, build the models.

15 Hours

UNIT-II

DATA: Definition, characteristics of data, classification of digital data.

The Data Science Fundamentals: Distributed file system, data integration framework, machine learning framework, system deployment, security.

Data Mining: definition, languages for data science, collection data-hunting, logging, scraping, cleaning.

15 Hours

UNIT-III

Machine Learning: Definition, Applications of machine learning in data science, Types of Machine Learning- supervised learning, semi-supervised learning, un-supervised learning, Linear regression, Decision tree classifier, Bayes - Naive bayes

15 Hours

UNIT-IV

Data Visualization: Definition, importance of data visualization in data science, Exploratory Data analysis- confronting new dataset, visualization tools, developing a visualization aesthetic- maximizing data link ratio

Chart Types: Tabular data, dot and line plots, scatter plots, bar plots and pie charts.

15 Hours

Suggested readings/ references:

1. Davy Cielen, Arno D.B. Meysman and Mohamed Ali, "Introducing Data Science", Published by Manning
2. Steven S. Kiernan, "The Data Science Design Manual", Published by Springer Nature.
3. Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk from the Frontline", O'Reilly.
4. Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman, "Mining of Massive Datasets", Cambridge University Press.



BCA (Data Science) – FIRST SEMESTER

Course: Minor
 Course Credits: (L-P-T)
 (3-1-0)
 Total marks: 100

Course Title: Data Science Basics
 Course Code: UMICST132
 Mid Semester assessment: 15 Marks of 1.5 hours duration
 End Semester assessment: 60 Marks of 3.0 hours duration
 Practical: 25 Marks

For examinations to be held in Dec 2022, 2023 and 2024

NOTE FOR PAPER SETTERS FOR EXAMINATIONS –

The question paper will be divided into the following two sections. No question will be repeated in the question paper.

Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.

Practical/ tutorial Evaluation

Daily evaluation of practical's/tutorials/Viva voce/Records etc.

10 marks

Final Examination

15 Marks

Pattern for external practical examination

Practical file	5 Marks
Written examination	5 Marks
Viva-Voce	5 Marks
Total	15 Marks

Pattern for external tutorial examination

Assignment file	10 Marks
Viva-Voce	5 Marks
Total	15 Marks

BCA (Data Science) – FIRST SEMESTER

Course:	Multidisciplinary Foundation Courses (MD)	Course Title: Data Mining and Data Warehousing
Course Credits:	(L-P-T) (3-0-0)	Course Code: UMDCST133
Total marks:	75	Mid Semester assessment: 15 Marks of 1.5 hours duration End Semester assessment: 60 Marks of 3.0 hours duration

For examinations to be held in Dec 2022, 2023, and 2024

Course objectives & learning outcomes:

1. Ability to understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
2. Extract interesting patterns from large amounts of data.
3. Discover the role played by data mining in various fields.
4. Choose and employ suitable data mining algorithms to build analytical applications

UNIT-I

Data Mining: Data and Types of Data, Data Mining Functionalities. Interestingness, Patterns– Classification of Data Mining systems, Data mining Task primitives, Major issues in Data Mining–Data Preprocessing.
10 Hours

UNIT-II

Data Warehouse and OLAP Technology for Data Mining: Introduction to Data Warehouses, Differences between Operational Database Systems and Data Warehouses, Multidimensional Data Model, Three-tier Data Warehouse Architecture, Schemas -Stars, Snowflakes and Fact Constellations.
10Hours

UNIT-III

Classification: Classification and Prediction, Basic concepts, Decision tree induction, Bayesian classification, Rule–based classification, Lazy learner.
10Hours

UNIT-IV

Clustering and Applications: Cluster analysis, Types of Data in Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density–Based Methods, Grid–Based Methods, Outlier Analysis. 15 Hours

Suggested readings/ references:

1. Jiawei Han & Micheline Kamber, "Data Mining–Concepts and Techniques–, 3rd Edition", Elsevier.
2. Margaret H Dunham, "Data Mining Introductory and Advanced topics" PEA.
3. Ian H. Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann.



BCA (Data Science) – FIRST SEMESTER

Course:	Multidisciplinary Foundation Courses (MD)	Course Title: Data Mining and Data Warehousing
Course Credits:	(L-P-T) (3-0-0)	Course Code: UMDCST133
Total marks:	75	Mid Semester assessment: 15 Marks of 1.5 hours duration End Semester assessment: 60 Marks of 3.0 hours duration

For examinations to be held in Dec 2022, 2023, and 2024

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

The question paper will be divided into the following two sections. No question will be repeated in the question paper.

Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.



BCA (Data Science) – FIRST SEMESTER

Course: Skill Enhancement Course (SEC)
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: PC Software: Installation and Troubleshooting
Course Code: USECST104
Mid Semester assessment: 10 Marks of 1.5 hours duration
End Semester assessment: 40 Marks of 2.5 hours duration

For examinations to be held in Dec 2022, 2023, and 2024

Course objectives & learning outcomes:

1. To provide knowledge about the PC Hardware.
2. To brief about different utilities and PC settings.
3. To develop the ability to configure, setup and troubleshoot PC.

UNIT -I

Introduction to PC Hardware: Study of basic I/O systems, Types of Memories- Static RAM and Dynamic RAM, ROM, PROM, EPROM, EEPROM, External Storage Devices, CPU (Central Processing Unit)- ALU and control, Motherboard and Processor :Types of Processor, System performance Monitoring. 10 Hours

UNIT -II

BIOS Configuration: Study of BIOS Set-up- Advance set-up, Boot configuration, Boot Menu, Installation of Operating System (Windows), Control panel, Installation and uninstallation of application software, Setting System Date and Time, Hard Disk: Formatting of Hard disk, Partitioning of Hard disk in different logical drives, Defragmenting Hard disk using defrag, Scan Disk for checking disk space, Disk clean up, Scan disk, Installation of Device Drivers: Different types of Motherboard drivers: Network, Audio, and Graphics, Modem. Display Settings: Resolution, Themes, multiple displays, Projector Set up. 10 Hours

UNIT-III

Configuration of External devices: Physical set-up of Printers- Performing test print out, Printing of document etc, Scanner set-up, Webcam, Bluetooth device, Memory card reader, Diagnostic and troubleshooting of PC: POST (Power on Self Test), Maintenance of PC, Error messages, Task Manager. Concept of compression Compression Utilities: WinZip, PKZIP, files recovery, Antivirus, CD/DVD Writing Software, Concept of Virtual drives and Image files (ISO). 10 Hours

Suggested readings/ references:

1. Mark Minasi, "The complete PC Upgrade & Maintenance Guide", BPB Publications.
2. D Balasubramanian, "Computer Installation and Servicing", Tata McGraw Hill Education.
3. Robert C. Brenner, "Trouble Shooting and Repair Guide", BPB Publications.
4. Scott Mueller, "Upgrading and Repairing PC's", PHI Publications, Fourth Edition.
5. Adane Nega Tarekegn, "A Simple Guide to Computer Maintenance and Troubleshooting", LAP LAMBERT Academic Publishing.
6. James Karney, "Upgrade & Maintain Your PC", M & T Books; 2nd edition.



BCA (Data Science) – FIRST SEMESTER

Course: Skill Enhancement Course (SEC)
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: PC Software: Installation and Troubleshooting
Course Code: USECST104
Mid Semester assessment: 10 Marks of 1.5 hours duration
End Semester assessment: 40 Marks of 2.5 hours duration

For examinations to be held in Dec 2022, 2023, and 2024

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

The question paper will be divided into the following two sections. No question shall be repeated in the question paper.

Section A shall consist Four (4) short answer questions (at least one from each unit). The students are required to attempt all questions. Each question shall be of 2½ Marks.

(4 x 2½ = 10 marks)

Section B shall consist Six (6) long answer questions (two from each unit). The students are required to attempt three questions. Each question shall be of 10 Marks.

(3 x 10 = 30 marks)

Note: The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.



BCA (Data Science) - SECOND SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-1-0)
Total marks: 100

Course Title: Introduction to Data Science
Course Code: UMJCST231
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in May 2023, 2024 and 2025

Course objectives & learning outcomes:

1. Introduction to basics of data science.
2. Understanding the concepts of data mining.
3. To learn about functioning of machine learning techniques.
4. Understanding the concepts of data visualizations.

UNIT-I

Introduction to Data Science: Definition, benefits and uses of data science and big data.

Facets of Data: Structured data, unstructured data, natural language, machine generated data, network data, audio, images and video streaming data.

Data science process: overview of data science process, defining the goal, Retrieving data, data preparation, data exploration, build the models, cleaning and transforming data, presentation and automation.

15 Hours

UNIT-II

DATA: Definition, characteristics of data, classification of digital data.

The Data Science Fundamentals: Distributed file system, data integration framework, machine learning framework, system deployment, security.

Data Mining: definition, languages for data science, collection data-hunting, logging ,scraping, cleaning data-errors. artifacts, data compatibility, dealing with missing values, outlier detection.

15 Hours

UNIT-III

Machine Learning: Definition, Applications of machine learning in data science, Types of Machine Learning-supervised learning, semi supervised learning, un-supervised learning, Linear regression, Decision tree classifier, Bayes - Naive bayes

15 Hours

UNIT-IV

Data Visualization: Definition, importance of data visualization in data science, Exploratory Data analysis-confronting new dataset, visualization tools, developing a visualization aesthetic-maximizing data link ratio, proper scaling and labeling, effective use of color and shading, the power of repetition.

Chart Types: Tabular data, dot and line plots, scatter plots, bar plots and pie charts.

15 Hours

Suggested readings/ references:

1. Davy Cielen , Arno D.B.Meysman and Mohamed Ali, "Introducing Data Science", Published by Manning
2. Steven S. Skiena, "The Data Science Design Manual",Published by Springer Nature.
3. Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk from the Frontline", O'Reilly.
4. Jure Leskovek, Anand Rajaraman and Jeffrey D.Ullman, "Mining of Massive Datasets", Cambridge University Press.



BCA (Data Science) - SECOND SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-1-0)
Total marks: 100

Course Title: Introduction to Data Science
Course Code: UMJCST231
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in May 2023, 2024 and 2025

NOTE FOR PAPER SETTERS FOR EXAMINATIONS –

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Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.

Practical/ tutorial Evaluation

Daily evaluation of practical's/tutorials/Viva voce/Records etc.

Final Examination

10 marks

15 Marks

Pattern for external practical examination

Practical file	5 Marks
Written examination	5 Marks
Viva-Voce	5 Marks
Total	15 Marks

Pattern for external tutorial examination

Assignment file	10 Marks
Viva-Voce	5 Marks
Total	15 Marks



BCA (Data Science)-SECOND SEMESTER

Course: Minor
 Course Credits: (L-P-T)
 (3-1-0)
 Total marks: 100

Course Title: Python Programming
 Course Code: UMICST232
 Mid Semester assessment: 15 Marks of 1.5 hours duration
 End Semester assessment: 60 Marks of 3.0 hours duration
 Practical: 25 Marks

For examinations to be held in May 2023, 2024 and 2025

Course objectives & learning outcomes:

1. Provide in-depth knowledge of developing and debugging Python Programs.
2. Illustrate and manipulate core data structures like Lists, Dictionaries, Tuples, and Strings.
3. Understand the concept of files and exception handling

UNIT-I

Introduction: Basic concepts: Functional Programming, OOPS and Data Structures Getting Started: Running Code in the Interactive Shell, Input, Processing and Output, Editing, Saving and Running a Script, Working of Python. Variables, Expressions and Statements: Values and Data Types, Variables, Keywords, String Literals, Escape Sequences, Operators and Operands, Expressions and Statements, Interactive mode and Script mode, Order of Operations, Comments.

15 Hours

UNIT-II

Conditional Statements and Loops: Modulus Operator, Boolean Expressions, Logical Operators, Conditional Execution "if statement", Alternative Execution "else clause", Chained Conditionals "elif clause", Nested Conditionals, while statement, For loop, Break and Continue Statement.

15 Hours

UNIT-III

Functions Function Calls, Type Conversion Functions, Math Functions, Composition, Adding new functions, Importing modules with "from", Recursion, Stack Diagram for Recursive Functions. String Functions-Traversal, Comparison, Searching, Counting, Pre-defined String Functions.

15 Hours

UNIT-IV

Lists, Dictionaries and Tuples: Lists- List as a Sequence, Traversing a list, List Operations, List Slices, List Methods, Map, filter and Reduce, Deleting Elements, Lists and Strings. Dictionaries-Dictionary as a set of counters, Looping and Dictionaries, Reverse Look Up, Dictionaries and Lists. Tuples-Tuple Assignment, Tuples as return values, Variable Length argument tuples, Lists and Tuples, Dictionaries and Tuples.

15 Hours

Suggested readings/ references:

1. Allen B. Downey, "Think Python", O'Reilly, Sebastopol, California.
2. Aditya Kanetkar and Yashavant Kanetkar, "Let us Python", BPB publications.
3. John Zelle, "Python Programming: An Introduction to Computer Science", Franklin, Beedle & Associates Inc.
4. Martin C. Brown., "Python: The Complete Reference", McGraw Hill.
5. Harsh Bhasin, "Python for beginners", New age international ltd



BCA (Data Science)–SECOND SEMESTER

Course: Minor
 Course Credits: (L-P-T)
 (3-1-0)
 Total marks: 100

Course Title: Python Programming
 Course Code: UMICST232
 Mid Semester assessment: 15 Marks of 1.5 hours duration
 End Semester assessment: 60 Marks of 3.0 hours duration
 Practical: 25 Marks

For examinations to be held in May 2023, 2024 and 2025

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Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.

Practical/ tutorial Evaluation

Daily evaluation of practical's/tutorials/Viva voce/Records etc.

10 marks

Final Examination

15 Marks

Pattern for external practical examination

Practical file	5 Marks
Written examination	5 Marks
Viva-Voce	5 Marks
Total	15 Marks

Pattern for external tutorial examination

Assignment file	10 Marks
Viva-Voce	5 Marks
Total	15 Marks



BCA (Data Science) - SECOND SEMESTER

Course: **Multidisciplinary Foundation Courses (MD)**
Course Credits: (L-P-T)
(3-0-0)
Total marks: 75

Course Title: Introduction to Machine Learning
Course Code: UMDCST233
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration

For examinations to be held in May 2023, 2024 and 2025

Course objectives & learning outcomes:

1. To understand the concepts of Machine Learning.
2. Understanding the real world applications of classification.
3. To understand complexity of Machine Learning algorithms and their limitations.
4. Analyzing various machine learning algorithms.

UNIT-I

Introduction, Types of machine learning: supervised, unsupervised, semi-supervised and reinforcement learning, Machine learning model, Steps in the design of learning system, Challenges in machine learning, Applications of machine learning.

10 HOURS

UNIT-II

Labelled data, Introduction to classification and its types, Statistical summary of data, Data pre-processing, Normalization, Training and Testing, Cross Validation, Steps in building a classifier in python. Classification algorithms: K-nearest neighbor, Support vector machine, Decision tree, etc., Classification evaluation metrics

10 HOURS

UNIT-III

Feature Selection: Introduction and its importance, Feature selection techniques, Principal component analysis. Unlabeled data, Introduction to clustering and its applications, Cluster formation methods, K-means algorithm, Hierarchical clustering, etc.

10 HOURS

UNIT-IV

Overfitting, Underfitting, Bias and Variance, Imbalanced dataset and its handling, Hyper-parameter tuning, Ensemble methods: Bagging and Boosting, Ensemble voting.

15 HOURS

Suggested readings/ references:

1. Manohar Swamynathan "Mastering Machine Learning with Python in Six Steps", Apress.
2. Machine Learning, "A Probabilistic Perspective", MIT Press, 2012 by Kevin Murphy.
3. Shai Shalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms".
4. Mark Summerfield, "Programming in python 3: A Complete Introduction to Python Programming".
5. Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", 2009



BCA (Data Science) - SECOND SEMESTER

Course: Multidisciplinary Foundation Courses (MD)
Course Credits: (L-P-T)
(3-0-0)
Total marks: 75

Course Title: Introduction to Machine Learning
Course Code: UMDCST233
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration

For examinations to be held in May 2023, 2024 and 2025

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

The question paper will be divided into the following two sections. No question will be repeated in the question paper.

Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.



BCA (Data Science) - SECOND SEMESTER

Course: Skill Enhancement Course (SEC)
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: Cyber Security
Course Code: USECST204
Mid Semester assessment: 10 Marks of 1.5 hours duration
End Semester assessment: 40 Marks of 2.5 hours duration

For examinations to be held in May 2023, 2024 and 2025

Course objectives & learning outcomes:

1. To provide knowledge about the PC Hardware.
2. To brief about different utilities and PC settings.
3. To develop the ability to configure, setup and troubleshoot PC.

UNIT -I

Cyberspace, Architecture of cyberspace, Internet, World Wide Web, Advent of internet, Internet infrastructure for data transfer and governance, Internets ociety, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

Classification of cyber crimes, Common cyber crimes-cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks.

10 Hours

UNIT -II

Cybercriminals modus-operandi, Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organizations dealing with Cyber crime and Cyber security in India.

Introduction to Social networks, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media.

10 Hours

UNIT-III

Definition of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices.

Introduction to digital payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in authorized banking transactions

10 Hours

Suggested readings/ references:

1. R. C Mishra, "Cyber Crime Impact in the New Millennium", Auther Press Edition.
2. Sumit Belapure and Nina Godbole, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd.
3. Henry A. Oliver, "Security in the Digital Age: Social Media Security Threats and Vulnerabilities", Pearson.
4. Elias M. Awad, "Electronic Commerce", Prentice Hall of India Pvt Ltd.
5. Kumar K, "Cyber Laws: Intellectual Property & E-Commerce Security", Dominant Publishers.
6. Eric Cole, Ronald Krutz, James W. Conley, "Network Security Bible", 2nd Edition, Wiley India Pvt. Ltd.
7. E. Maiwald, "Fundamentals of Network Security", McGraw Hill.



BCA (Data Science) - SECOND SEMESTER

Course: Skill Enhancement Course (SEC)
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: Cyber Security
Course Code: USECST204
Mid Semester assessment: 10 Marks of 1.5 hours duration
End Semester assessment: 40 Marks of 2.5 hours duration

For examinations to be held in May 2023, 2024 and 2025

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

The question paper will be divided into the following two sections. No question shall be repeated in the question paper.

Section A shall consist Four (4) short answer questions (at least one from each unit). The students are required to attempt all questions. Each question shall be of 2½ Marks.

(4 x 2½ = 10 marks)

Section B shall consist Six (6) long answer questions (two from each unit). The students are required to attempt three questions. Each question shall be of 10 Marks.

(3 x 10 = 30 marks)

Note: The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.



COURSES OF STUDY**Semester-I**

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST131	Problem Solving using C	4(3L+1P)	15	60	10	15	100
2	Minor	UMICST132	Data Science Basics	4(3L+1P)	15	60	10	15	100
3	MD	UMDCST133	Data Mining and Data Warehousing	3	15	60	NA	NA	75
4	SEC	USECST104	PC Software: Installation and Troubleshooting	2	10	40	NA	NA	50

Semester-II

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST231	Introduction to Data Science	4(3L+1P)	15	60	10	15	100
2	Minor	UMICST232	Python Programming	4(3L+1P)	15	60	10	15	100
3	MD	UMDCST233	Introduction to Machine Learning	3	15	60	NA	NA	75
4	SEC	USECST204	Cyber Security	2	10	40	NA	NA	50

Semester-III

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST331	Ethics and Data Science	4(3L+1T)	15	60	10	15	100
2	Major	UMJCST332	Database Management System & SQL	4(3L+1P)	15	60	10	15	100
3	Minor	UMICST333	Database Management System & SQL	4(3L+1T)	15	60	10	15	100
4	MD	UMDCST334	Data Mining and Data Warehousing	3	15	60	NA	NA	75
5	SEC	USECST305	System Analysis and Design	2	10	40	NA	NA	50

Semester-IV

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST431	Python Programming	4(3L+1P)	15	60	10	15	100
2	Major	UMJCST432	Mathematics for Computer Application	4(3L+1T)	15	60	10	15	100
3	Major	UMJCST433	Fundamentals of Algorithms	4(3L+1T)	15	60	10	15	100
4	Major	UMJCST434	Software Engineering	4(3L+1T)	15	60	10	15	100
5	Minor	UMICST435	Business Intelligence	4(3L+1T)	15	60	10	15	100

BCA (Data Science) - THIRD SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-0-1)
Total marks: 100

Course Title: ETHICS AND DATA SCIENCE
Course Code: UMJCST331
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in Dec 2023, 2024 and 2025

Course objectives & learning outcomes:

1. To learn the fundamentals of programming language.
2. To understand the concept of different control structures.
3. To learn about different data structures
4. To understand the concept of procedural programming.

UNIT - I

Overview of ethical issues in data-driven organizations: Overview of data science as an ethical practice, Introduction to the unique ethical challenges of 'big data', Ethical Theory - Philosophical frameworks for assessing fairness, Early theories of fairness, Moving towards contemporary theories of fairness.

15 Hours

UNIT - II

Research ethics for data science: Ethical side effects of the publish or perish system: p-hacking and small sample size, The misapplication of informed consent in dataveillance practices.

Techniques of data ethics: Getting from data to individuals: Internet traces and Geo fingerprints. All data are human data: On the discriminatory trouble with training data.

15 Hours

UNIT - III

The ethics of data scraping and storage, Mosaic data, found data, and designed data.

15 Hours

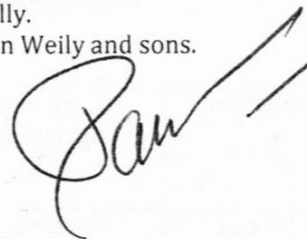
UNIT - IV

Privacy and Surveillance, Special topics in surveillance: Adtech, Special topics in surveillance: Employment, Differential privacy.

15 Hours

Suggested readings/ references:

1. Ethics and Data Science, by DJ Patil, Hilary Mason, and Mike Loukides, 25 July 2018.
2. Data science from scratch, by Joel Grus, second edition, O' Reilly.
3. Data science for dummies, by Lillian Pierson, first edition, John Wiley and sons.



BCA (Data Science) - THIRD SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-0-1)
Total marks: 100

Course Title: ETHICS AND DATA SCIENCE
Course Code: UMJCST331
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in Dec 2023, 2024 and 2025

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

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Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.

Practical/ tutorial Evaluation

Daily evaluation of practical's/tutorials/Viva voce/Records etc.

10 marks

Final Examination

15 Marks

Pattern for external practical examination

Practical file	5 Marks
Written examination	5 Marks
Viva-Voce	5 Marks
Total	15 Marks

Pattern for external tutorial examination

Assignment file	10 Marks
Viva-Voce	5 Marks
Total	15 Marks



BCA (Data Science) – THIRD SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-1-0)
Total marks: 100

Course Title: Database Management System & SQL
Course Code: UMJCST332
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in Dec 2023, 2024 and 2025

Course objectives & learning outcomes:

1. To present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve efficiently, and effectively information from a DBMS.
2. Design ER-models to represent simple database application scenarios and convert them into relational tables
3. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
4. To familiarize students with the basic issues of transaction processing and concurrency control.

UNIT-I

Introduction to Databases and Transactions: What is database system, purpose of database system, view of data, relational databases, database architecture, transaction management, Data models, degree of data abstraction.

15 Hours

UNIT-II

Database Design, ER-Diagram and Unified Modelling Language: Database design and ER Model: Overview, ER-Model, Constraints, ER-Diagrams, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML.

15 Hours

UNIT-III

Relational database model: Logical view of data, keys, integrity rules.

Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).

15 Hours

UNIT-IV

Relational Algebra and Calculus Relational algebra: Introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics.

Constraints, Views and SQL: What are constraints, types of constraints, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views. SQL: DDL, DML, aggregate function, Null Values, nested sub queries, Joined relations.

15 Hours

Suggested readings/ references:

1. Bipin C. Desai, "An Introduction to Database Systems", West-publishing company, 2012.
2. Elmasri, Navathe, Somayajulu, Gupt, "Fundamentals of Database Systems", Pearson Education, 1992
3. Date, C. J., "An Introduction to Database Systems", Addison Wesley Pearson Education, 2014.
4. Narayan S. Umanath, Richard W. Scamell, "Data Modelling and Database Design", Thomson Course Technology India Edition.
5. R. A. Parida, Vinod Sharma, "The power of Oracle 9i", Firewall Media Publications.
6. Deshpande, "SQL/PL for Oracle 8 & 8i".

BCA (Data Science) – THIRD SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-1-0)
Total marks: 100

Course Title: Database Management System and SQL
Course Code: UMJCST332
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in Dec 2023, 2024 and 2025

NOTE FOR PAPER SETTERS FOR EXAMINATIONS –

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Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.

Practical/ tutorial Evaluation

Daily evaluation of practical's/tutorials/Viva voce/Records etc.

10 marks

Final Examination

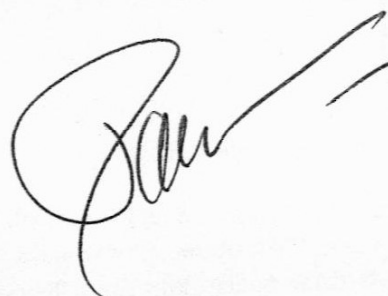
15 Marks

Pattern for external practical examination

Practical file	5 Marks
Written examination	5 Marks
Viva-Voce	5 Marks
Total	15 Marks

Pattern for external tutorial examination

Assignment file	10 Marks
Viva-Voce	5 Marks
Total	15 Marks



BCA (Data Science) – THIRD SEMESTER

Course: Minor
Course Credits: (L-P-T)
(3-0-1)
Total marks: 75

Course Title: Database Management System & SQL
Course Code: UMICST333
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration

For examinations to be held in Dec 2023, 2024 and 2025

Course objectives & learning outcomes:

1. Ability to understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
2. Extract interesting patterns from large amounts of data.
3. Discover the role played by data mining in various fields.
4. Choose and employ suitable data mining algorithms to build analytical applications

UNIT-I

Introduction to Databases: What is database system, purpose of database system, view of data, relational databases, database architecture, transaction management, Data models, degree of data abstraction.

10 Hours

UNIT-II

Database Design, ER-Diagram: Database design and ER Model: Overview, ER-Model, Constraints, ER-Diagrams, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML.

10 Hours

UNIT-III

Relational database model: Logical view of data, keys, integrity rules.

Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).

10Hours

UNIT-IV

Constraints, Views and SQL: What are constraints, types of constraints, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views. SQL: DDL, DML, aggregate function, Null Values, nested sub queries, Joined relations.

10 Hours

Suggested readings/ references:

- 1) A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition McGraw-Hill.
- 2) Bipin C. Desai, "An Introduction to Database Systems", West-publishing company, 2012.
- 3) Elmasri, Navathe, Somayajulu, Gupta, "Fundamentals of Database Systems", Pearson Education.
- 4) Date, C. J., "An Introduction to Database Systems", Addison Wesley Pearson Education, 2014.
- 5) R. A. Parida, Vinod Sharma, "The power of Oracle 9i", Firewall Media Publications.
- 6) Deshpande, "SQL/PL for Oracle 8 & 8i".

BCA (Data Science) - THIRD SEMESTER

Course: Minor
Course Credits: (L-P-T)
(3-0-1)
Total marks: 100

Course Title: Database Management System and SQL
Course Code: UMICST333
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in Dec 2023, 2024 and 2025

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

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(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.

Practical/ tutorial Evaluation

Daily evaluation of practical's/tutorials/Viva voce/Records etc.

10 marks

Final Examination

15 Marks

Pattern for external practical examination

Practical file	5 Marks
Written examination	5 Marks
Viva-Voce	5 Marks
Total	15 Marks

Pattern for external tutorial examination

Assignment file	10 Marks
Viva-Voce	5 Marks
Total	15 Marks



BCA (Data Science) - THIRD SEMESTER

Course: Multidisciplinary (MD)
Course Credits: (L-P-T)
(3-0-0)
Total marks: 75

Course Title: Data Mining and Data Warehouse
Course Code: UMDCST334
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration

For examinations to be held in Dec 2023, 2024, and 2025

Course objectives & learning outcomes:

1. Ability to understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
2. Extract interesting patterns from large amounts of data.
3. Discover the role played by data mining in various fields.
4. Choose and employ suitable data mining algorithms to build analytical applications

UNIT-I

Data Mining: Data and Types of Data, Data Mining Functionalities. Interestingness, Patterns- Classification of Data Mining systems, Data mining Task primitives, Major issues in Data Mining-Data Preprocessing.

10 Hours

UNIT-II

Data Warehouse and OLAP Technology for Data Mining: Introduction to Data Warehouses, Differences between Operational Database Systems and Data Warehouses, Multidimensional Data Model, Three-tier Data Warehouse Architecture, Schemas -Stars, Snowflakes and Fact Constellations.

10Hours

UNIT-III

Classification: Classification and Prediction, Basic concepts, Decision tree induction, Bayesian classification, Rule-based classification, Lazy learner.

10Hours

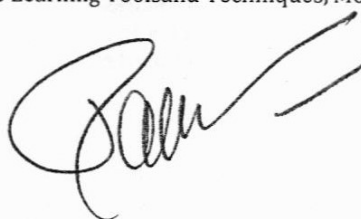
UNIT-IV

Clustering and Applications: Cluster analysis, Types of Data in Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Outlier Analysis.

15 Hours

Suggested readings/ references:

1. Jiawei Han & Micheline Kamber, "Data Mining - Concepts and Techniques - 3rd Edition", Elsevier.
2. Margaret H Dunham, "Data Mining Introductory and Advanced topics" PEA.
3. Ian H. Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann.



BCA (Data Science) – THIRD SEMESTER

Cour Multidisciplinary (MD)
Course Credits: (L-P-T)
(3-0-0)
Total marks: 75

Course Title: Data Mining and Data Warehousing
Course Code: UMDCST334
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration

For examinations to be held in Dec 2023, 2024, and 2025

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

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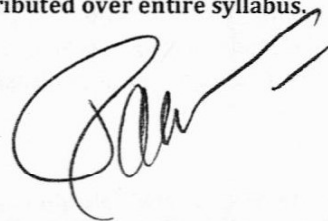
Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.



BCA (Data Science) - THIRD SEMESTER

Course: Skill Enhancement Course (SEC)

Course Credits: (L-P-T)

(2-0-0)

Total marks: 50

Course Title: System Analysis and Design

Course Code: USECST305

Mid Semester assessment: 10 Marks of 1.5 hours duration

End Semester assessment: 40 Marks of 2.5 hours duration

For examinations to be held in Dec 2023, 2024 and 2025**Course objectives & learning outcomes:**

1. To learn the basics of Software and system development life cycle.
2. To learn different SRS and feasibility study.
3. To gain knowledge on DFDs, ER diagrams and tools.

Unit-1

Software Systems Analysis and Design Life Cycle: Requirements determination, requirements specifications, feasibility analysis, final specifications, hardware and software study, Software system design, Software system implementation, Software system evaluation, Software system modification.

15 Hours

Unit-II

Role of Software systems analyst, tools used in Software system analysis Information gathering: strategies, methods, case study Software system requirements specification: classification of requirements as strategic, tactical, operational and statutory. Feasibility analysis: deciding project goals, examining alternative solutions, cost – benefit analysis.

15 Hours

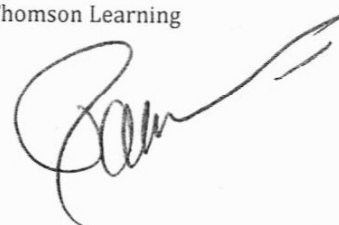
Unit-III

Tools for systems analysts: data flow diagrams, case study for use of DFD, leveling of DFDs, leveling rules, logical and physical DFDs, software tools to create DFDs. Data oriented Software systems design: entity relationship model, E-R diagrams, relationships, cardinality and participation, data base design.

15 Hours

Suggested Readings:

1. Software Engineering by Roger S. Pressman- Tata McGraw Hill.
2. Software Project Management by Bob Hughes and Mike Cotterell- Tata McGraw Hill.
3. Software Project Management by S. Kelkar- PHI.
4. Information Technology Project Management by Kathy and Schwalbe Thomson Learning
5. An Integrated Approach to Software Engineering by P. Jalote- PHI.



BCA (Data Science) - THIRD SEMESTER

Course: Skill Enhancement Course (SEC)
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: System Analysis and Design
Course Code: USECST305
Mid Semester assessment: 10 Marks of 1.5 hours duration
End Semester assessment: 40 Marks of 2.5 hours duration

For examinations to be held in Dec 2023, 2024 and 2025

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

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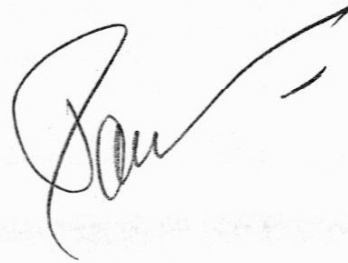
Section A shall consist Four (4) short answer questions (at least one from each unit). The students are required to attempt all questions. Each question shall be of 2½ Marks.

(4 x 2½ = 10 marks)

Section B shall consist Six (6) long answer questions (two from each unit). The students are required to attempt three questions. Each question shall be of 10 Marks.

(3 x 10 = 30 marks)

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BCA (Data Science) – FOURTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-1-0)
Total marks: 100

Course Title: Python Programming
Course Code: UMJCST431
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration

For examinations to be held in May 2024, 2025, and 2026

Course objectives & learning outcomes:

To understand the basic and advanced features of core language built-ins.

- To implement various packages of python library.
- To communicate using sockets, write client and server side scripts.
- To design and implement basic applications with database connectivity.
- Students will gain basic and advanced programming concepts of Python.

UNIT -I

Introduction, Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program.

10 Hours

UNIT -II

Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit().

Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print (), Local and Global Scope, The global Statement, Exception Handling.

10 Hours

UNIT-III

Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods.

10 Hours

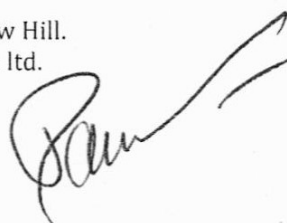
UNIT-IV

Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things.

Manipulating Strings - Working with Strings, Useful String Methods.

Reference Books:

1. Allen B. Downey, "Think Python", O'Reilly, Sebastopol, California.
2. Aditya Kanetkar and Yashavant Kanetkar, "Let us Python", BPB publications.
3. John Zelle, "Python Programming: An Introduction to Computer Science", Franklin, Beedle & Associates Inc.
4. Martin C. Brown., "Python: The Complete Reference", McGraw Hill.
5. Harsh Bhasin, "Python for beginners", New age international ltd.



BCA (Data Science) – FOURTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-1-0)
Total marks: 100

Course Title: Python Programming
Course Code: UMJCST431
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration

For examinations to be held in May 2024, 2025, and 2026

NOTE FOR PAPER SETTERS FOR EXAMINATIONS –

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(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.

Practical/ tutorial Evaluation

Daily evaluation of practical's/tutorials/Viva voce/Records etc.

10 marks

Final Examination

15 Marks

Pattern for external practical examination

Practical file	5 Marks
Written examination	5 Marks
Viva-Voce	5 Marks
Total	15 Marks

Pattern for external tutorial examination

Assignment file	10 Marks
Viva-Voce	5 Marks
Total	15 Marks



BCA (Data Science) - FOURTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-0-1)
Total marks: 100

Course Title: Mathematics for Computer Application
Course Code: UMJCST432
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in May 2024, 2025, and 2026

Course objectives & learning outcomes:

1. To understand basic concepts of set operations and calculus.
2. To gain knowledge on Linear equations and matrices operations.
3. To brief the students about vector spaces concepts.

UNIT-I

Sets, Relations and Functions: Definition of Sets and Subsets; Intersection Union and Complements; Demorgan's Law; Cardinality; Relations - Equivalence relation etc. Mapping One-one Onto etc.

15 Hours

UNIT-II

Calculus: Functions; Limits and Continuity; Differentiation and Integration; Differential Equations of first Order and first degree.

15 Hours

UNIT-III

Linear equations and Matrices: Various types of Matrices, Row/Column operations Solution of linear equations Gaussin Eliminations etc. Properties of determinants; Cramer's Rule; transpose and inverse of a Matrix.

15 Hours

UNIT-IV

Vector Spaces: Definition of Vector, Scalar Product, Vector Product Linear Independence; Bases, Subspace and dimensionality Inner products and Norms.

15 Hours

Suggested readings/ references:

1. Modern Algebra by Prof. M.R. Puri and Dr. Raf Krishan Publisher: Malhotra Brothers
2. Matrices by A.R. Vasishtha Publisher: Krishna Prakashan Mandir
3. Trembley, J.P. and Manohar, R.P.: Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill, 1975.



BCA (Data Science) - FOURTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-0-1)
Total marks: 100

Course Title: Mathematics for Computer Application
Course Code: UMJCST432
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in May 2024, 2025 and 2026

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

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(4 x 3 = 12 marks)

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(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.

Practical/ tutorial Evaluation

Daily evaluation of practical's/tutorials/Viva voce/Records etc.

10 marks

Final Examination

15 Marks

Pattern for external practical examination

Practical file	5 Marks
Written examination	5 Marks
Viva-Voce	5 Marks
Total	15 Marks

Pattern for external tutorial examination

Assignment file	10 Marks
Viva-Voce	5 Marks
Total	15 Marks

BCA (Data Science)–FOURTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-0-1)
Total marks: 100

Course Title: Software Engineering
Course Code: UMJCST434
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in May 2024, 2025 and 2026

Course objectives & learning outcomes:

1. To gain the knowledge of how analysis, design and coding processes are conducted in a software project.
2. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle
3. Demonstrate an ability to use the basic techniques and tools necessary for software development.

UNIT - I

Software Systems Analysis and Design Life Cycle: Requirements determination, requirements specifications, feasibility analysis, final specifications, hardware and software study, Software system design, Software system implementation, Software system evaluation, Software system modification. Role of Software systems analyst, tools used in Software system analysis

Information gathering: strategies, methods, case study. Software system requirements specification: classification of requirements as strategic, tactical, operational and statutory.

15 Hours

UNIT - II

Feasibility analysis: deciding project goals, examining alternative solutions, cost-benefit analysis
Tools for systems analysts: data flow diagrams, case study for use of DFD, leveling of DFDs, leveling rules, logical and physical DFDs, software tools to create DFDs.

15 Hours

UNIT - III

Structured Software systems analysis and design: procedure specifications in structured English, examples and cases, decision tables for complex logical specifications, specification oriented design vs procedure oriented.
Data oriented Software systems design: entity relationship model, E-R diagrams, relationships, cardinality and participation, data base design.

15 Hours

UNIT - IV

Data input methods: coding techniques, requirements of coding schemes, error detection of codes, validating input data, input data controls, interactive data input
Designing outputs: output devices, designing output reports, screen design, graphical user interfaces, interactive I/O on terminals.

15 Hours

Suggested readings/ references:

1. Software Engineering by Roger S. Pressman- Tata McGraw Hill.
2. Software Project Management by Bob Hughes and Mike Cotterell- Tata McGraw Hill.
3. Software Project Management by S. Kelkar- PHI.
4. Information Technology Project Management by Kathey and Schwalbe-Thomson Learning
5. An Integrated Approach to Software Engineering by P. Jalote- PHI.

BCA (Data Science)-FOURTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(3-0-1)
Total marks: 100

Course Title: Software Engineering
Course Code: UMJCST434
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in May 2024, 2025 and 2026

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

The question paper will be divided into the following two sections. No question will be repeated in the question paper.

Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(4 x 3 = 12 marks)

Section B shall consist Eight (8) long answer questions having two questions from each unit. The students are required to attempt one question from each unit. Each question shall be of 12 Marks.

(4 x 12 = 48 marks)

Note: -The paper setter shall ensure that the questions are uniformly distributed over entire syllabus.

Practical/ tutorial Evaluation

Daily evaluation of practical's/tutorials/Viva voce/Records etc.

10 marks

Final Examination

15 Marks

Pattern for external practical examination

Practical file	5 Marks
Written examination	5 Marks
Viva-Voce	5 Marks
Total	15 Marks

**Pattern for external tutorial examination**

Assignment file	10 Marks
Viva-Voce	5 Marks
Total	15 Marks

BCA (Data Science) - FOURTH SEMESTER

Course: Minor
Course Credits: (L-P-T)
(3-0-1)
Total marks: 100

Course Title: Business Intelligence
Course Code: UMICST435
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

For examinations to be held in May 2024, 2025 and 2026

Course objectives & learning outcomes:

1. To understand the fundamentals of Business Intelligence
2. To identify the appropriateness and need for analysis of data.
3. To learn the preprocessing, mining and post processing of the data

UNIT -I

Effective and timely decisions, Data, information and knowledge, Role of mathematical models, Business intelligence architectures: Cycle of a business intelligence analysis, enabling factors in business intelligence projects, Development of a business intelligence system, Ethics and business intelligence

15 Hours

UNIT II

The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis. Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization.

15 Hours

UNIT III

Concepts of Decision Making, Techniques of Decision Support System (DSS), Types of Decision Support System (DSS), Development of Decision Support System (DSS), Applications of DSS, Role of Business Intelligence in DSS

15 Hours

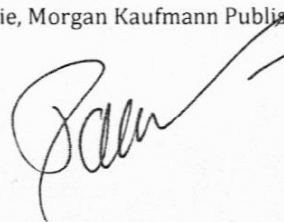
UNIT IV

Discovery, Data preparation, Preprocessing requirements, data cleaning, data integration, data reduction, data transformation, Data discretization and concept hierarchy generation, Model Planning, Model building, Communicating Results & Findings, Operationalizing, Introduction to OLAP. Introduction to BI Applications.

15 Hours

Suggested readings/ references:

1. Business Intelligence and Analytics. Systems for Decision Support - R. Sharda, D. Delen, & E. Turban, 10th Edition. Pearson/Prentice Hall, 2015.
2. Business Intelligence – Data Mining and Optimization for Decision Making – Carlo Vercellis – Wiley Publications.
3. Big Data & Analytics – Seema Acharya & Subhashini Chellappan – Wiley Publications
4. Data mining concepts and techniques, Jawai Han, Michelline Kamber, Jiran Pie, Morgan Kaufmann Publishers.
5. Introduction to business Intelligence and data warehousing, IBM, PHI.



BCA (Data Science) - FOURTH SEMESTER

Course: Minor
Course Credits: (L-P-T)
(3-0-1)
Total marks: 100

Course Title: Business Intelligence
Course Code: UMICST435
Mid Semester assessment: 15 Marks of 1.5 hours duration
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**Pattern for external tutorial examination**

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