UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE' UNIVERSITY)
(Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION
(24/April/Adp./87)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the Syllabi and Courses of Studies of the subject of **Computer Science** of Semester **Vth, VIth, VIIth and VIIIth** for **Four Year Under Graduate Programme** of **Bachelor of Computer Applications (FYUGP-BCA)** as per **NEP-2020 (as given in the annexure)** for the examinations to be held in the years as per the details given below:

S. No.	Branch of BCA	Semester	For the examinations to be held in the year
1.	Web Technology (WT)	Semester-V	December 2024, 2025 and 2026
		Semester-VI	May 2025, 2026 and 2027
		Semester- VII	December 2025, 2026 and 2027
		Semester-VIII	May 2026, 2027 and 2028
2.	Software Development (SD)	Semester-V	December 2024, 2025 and 2026
		Semester-VI	May 2025, 2026 and 2027
		Semester- VII	December 2025, 2026 and 2027
		Semester-VIII	May 2026, 2027 and 2028
3.	Data Science (DS)	Semester-V	December 2024, 2025 and 2026
		Semester-VI	May 2025, 2026 and 2027
		Semester- VII	December 2025, 2026 and 2027
		Semester-VIII	May 2026, 2027 and 2028

The Syllabi of the courses is also available on the University website: www.jammuuniversity.ac.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/24/ 899-938
Dated: 22/4/24

Copy for information and necessary action to:

1. Dean, Faculty of Mathematical Science
2. HOD/Convener, Board of Studies in Computer Science & IT
3. Sr. P.A.to the Controller of Examinations
4. All members of the Board of Studies
5. Confidential Assistant to the Controller of Examinations
6. I/C Director, Computer Centre, University of Jammu
7. Deputy Registrar/Asst. Registrar (Conf. /Exams. UG)
8. Incharge, University Website for Uploading of the notification.

Sumitra Sharma 19/4

Deputy Registrar (Academic)

19/4/24 19/4/24 19/4/24

BCA (Web. Tech.)

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

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)

WEB TECHNOLOGY

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	UMJCST101	Web Designing	4(3L+1P)	15	60	10	15	100
2	Minor	UMICST102	Computer Fundamentals	4(3L+1P)	15	60	10	15	100
3	MD	UMDCST103	World Wide Web and Internet	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	UMJCST201	Scripting Languages	4(3L+1P)	15	60	10	15	100
2	Minor	UMICST202	Web Programming using PHP	4(3L+1P)	15	60	10	15	100
3	MD	UMDCST203	Introduction to Web Designing	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	UMJCST301	Fundamentals of Operating System	4(3L+1P)	15	60	10	15	100
2	Major	UMJCST302	Database Management System	4(3L+1P)	15	60	10	15	100
3	Minor	UMICST303	Digital Electronics	4(3L+1T)	15	60	10	15	100
4	MD	UMDCST304	World Wide Web and Internet	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	UMJCST401	Express Frameworks	4(3L+1P)	15	60	10	15	100
2	Major	UMJCST402	Data Structures using C	4(3L+1T)	15	60	10	15	100
3	Major	UMJCST403	Mathematical Foundation of Computer Science	4(3L+1T)	15	60	10	15	100
4	Major	UMJCST404	Python Programming	4(3L+1T)	15	60	10	15	100
5	Minor	UMICST405	Internet of Things	4(3L+1T)	15	60	10	15	100

Semester-V

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST501	Computer Networks	4(3L+1T)	15	60	10	15	100
2	Major	UMJCST502	Fundamentals of Digital Electronics	4(3L+1T)	15	60	10	15	100
3	Major	UMJCST503	IoT and its applications	4(3L+1T)	15	60	10	15	100
4	Major	UMJCST504	VB.Net	2	10	40	10	15	100
5	Minor	UMICST505	Database Management System	4(3L+1T)	15	60	10	15	100
6	SEC	USECSI506	Summer Internship	2	10	40	NA	NA	50

Semester-VI

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST601	PHP Programming	4(3L+1P)	15	60	10	15	100
2	Major	UMJCST602	Design and Analysis of Algorithm	4(3L+1T)	15	60	10	15	100
3	Major	UMJCST603	Discrete Mathematics	4(3L+1T)	15	60	10	15	100
4	Major	UMJCST604	Computer Graphics	4(3L+1P)	15	60	10	15	100
5	Minor	UMICST605	Free and Open-Source Software	4(3L+1T)	15	60	10	15	100

Semester–VII

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST701	Research Methodology and Research Ethics	4(3L+1T)	15	60	10	15	100
2	Major	UMJCST702	Android programming	4(3L+1P)	15	60	10	15	100
3	Major	UMJCST703	Theory of Computation	4(3L+1T)	15	60	10	15	100
4	Major	UMJCST704	Web Security	4(3L+1T)	15	60	10	15	100
5	Minor	UMICST705	Python Programming	4(3L+1P)	15	60	10	15	100

Semester–VIII (4 Year Honors)

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCSP801	Project Work	12	NA	NA	NA	NA	300
2	Major	UMJCST802	Cloud Computing	4(3L+1T)	15	60	10	15	100
3	Minor	UMICST803	Fundamentals of Cloud Computing	4(3L+1T)	15	60	10	15	100

Semester–VIII (4 Year Honors with Research)

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST804	Statistical Concepts	4 (3L+1T)	15	60	10	15	100
2	Minor	UMICST805	E-Commerce	4(3L+1T)	15	60	10	15	100
3	SEC	USECSP806	Research Project / Dissertation	12	NA	NA	NA	NA	300

BCA (Web Technology) - FIFTH SEMESTER

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

Course Title: Computer Network Concepts
Course Code: UMJCST501
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

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

Course objectives & learning outcomes:

1. To study the basic taxonomy and terminology of the computer networking model and architecture.
2. To study the fundamentals of data communication and protocols.
3. To study network design and performance issues.
4. To explore the basic knowledge of cryptography and network security.

UNIT – I

Introduction to Computer Networking, Applications of Computer network, Network Architecture, Types of computer Networks, Line Configuration – Point to Point, Multi Point; Topology – Mesh, Star, Tree, Bus, Ring, Hybrid; Transmission mode, Categories of Network – LAN, MAN, WAN, Inter Networks.

15 Hours

UNIT - II

Transmission of Digital Data, Analog, and Digital, digital data transmission – parallel transmission, serial transmission, Data Transmission Media: Guided Media and Satellites, switching: Circuit switching, Message switching and Packet switching, Wired LAN: Ethernet Standards, Wireless LAN: IEEE 802.1 lx and Bluetooth Standards, Token Bus, Token Ring, Modems- Transmission rate, Modem standards.

15 Hours

UNIT - III

The OSI Model; ISO organization, The model – Layered architecture, functions of the layers -Physical layer, Data Link layer, Network layer, Transport layer, session layer, Presentation layer, Application layer, IPv4; Classful addressing, Classless addressing, Subnetting and Network Address Translation (NAT), IPv6.

15 Hours

UNIT – IV

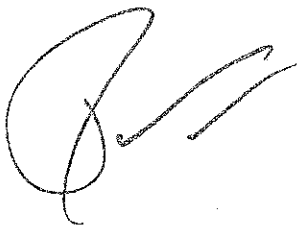
TCP/IP Model & Protocols; The TCP/IP reference model, comparison of TCP/IP & OSI, Client server model, www, IP Address Classes.

Network Security; Introduction of Network Security and its importance. Cryptography: Definitions, Symmetric Key Cryptography; Asymmetric Key Cryptography; Security Services, Digital Signatures.

15 Hours

Suggested readings/ references:

1. Andres & Tanenbaum, "Computer Networking", Fifth Edition.
2. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, Tata McGraw Hills.
3. William Stallings, "Data and Computer Communication," Seventh Edition, Pearson Education Asia.
4. Prakash C. Gupta, "Data Communications and Computer Networks," PHI.



BCA (Web Technology) - FIFTH SEMESTER

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

Course Title: Computer Network Concepts
Course Code: UMJCST501
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 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 (Web Technology) - FIFTH SEMESTER

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

Course Title: Fundamentals of Digital Electronics
Course Code: UMJCST502
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

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

Course objectives & learning outcomes:

1. To understand the fundamentals of digital and binary systems.
2. To have working conceptual knowledge of various fundamental digital modules.
3. Overview of complex digital modules

UNIT – I

Definition and Basics of Digital Electronics, Number Systems and Binary Arithmetic, Boolean Algebra and Logic Gates, Introduction to Combinational Circuits, Simplification Techniques for Boolean Functions

15 Hours

UNIT – II

Multiplexers and De-multiplexers, Encoders and Decoders, Adders and Subtractors, Binary Code Converters, Arithmetic Logic Units (ALUs)

15 Hours

UNIT – III

Flip-Flops and Latches, Analysis and Design of Sequential Circuits, Counters and Registers, Memory Devices: RAM and ROM, Finite State Machines.

15 Hours

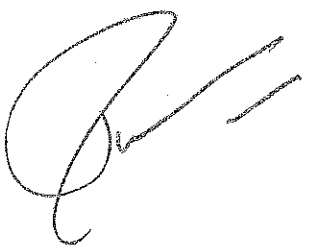
UNIT – IV

Introduction to Microprocessors and Microcontrollers, Programmable Logic Devices (PLDs), Introduction to Field-Programmable Gate Arrays (FPGAs), Digital Communication Systems, Digital Signal Processing Basics

15 Hours

Suggested Readings:

1. John F. Wakerly, "Digital Design: Principles and Practices", Pearson Publications.
2. Thomas L. Floyd, "Digital Fundamentals", Eleventh Edition, Pearson eBook.
3. Anil K. Maini, "Digital Electronics: Principles and Integrated Circuits", John Wiley & Sons Ltd.
4. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with VHDL Design".
5. Ronald J. Tocci, Neal S. Widmer, and Greg Moss, "Digital Systems: Principles and Applications."
6. Charles H. Roth Jr. and Larry L. Kinney, "Fundamentals of Logic Design".
7. Money Harris and Sarah L. Harris, "Digital Design and Computer Architecture."
8. R.P Jain, "Digital Electronics and Microprocessors: Problems and Solutions.



BCA (Web Technology) - FIFTH SEMESTER

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

Course Title: Fundamentals of Digital Electronics
Course Code: UMJCST502
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 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

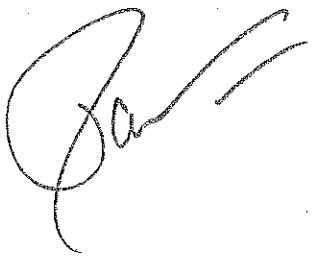
Final Examination 15 Marks

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 (Web Technology) - FIFTH SEMESTER

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

Course Title: IoT and its Applications
Course Code: UMJCST503
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

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

Course objectives & learning outcomes:

1. To explore the fundamental concepts, technologies, and applications of the Internet of Things (IoT).
2. To integrate hardware and software components of IoT to create intelligent, connected systems.
3. To engage students in practical hands-on projects to apply their knowledge and develop IoT solutions.

UNIT – I

Definition, evolution, and key components of IoT, Overview of IoT architecture and communication protocols Introduction to IoT platforms and ecosystems. Understanding common sensors and actuators, their functionalities, and their integration into networks. Exploring Role of cloud computing in IoT and the significance of edge computing.

15 Hours

UNIT – II

Communication protocols used in IoT, such as MQTT, CoAP, and HTTP. Selecting appropriate protocols for different scenarios. Data exchange formats: JSON, XML. Explore wireless technologies like Wi-Fi, Bluetooth, LoRa and Zigbee in the context of IoT. Authentication and authorization mechanisms, understanding the privacy concerns, security and ethical considerations and challenges in IoT communication.

15 Hours

UNIT – III

Hardware Platforms: Overview of popular IoT hardware platforms i.e., Raspberry Pi and Arduino. Setting up and configuring IoT devices. Interfacing sensors and actuators with IoT devices. Software Platforms: Exploring IoT development platforms i.e., AWS IoT, Azure IoT, ThingSpeak, etc. Building and deploying IoT applications, integration with cloud services.

15 Hours

UNIT – IV

Edge Computing: Understanding edge computing and its significance in IoT, edge devices and edge analytics, designing IoT solutions with edge computing capabilities. IoT Analytics: Understanding fundamentals of data analytics for IoT, including data collection, storage, and analysis. Explore tools and techniques for analyzing and visualizing IoT data. Develop skills in interpreting insights derived from IoT data analytics. Big Data concepts in IoT. Applications of IoT: Healthcare and wearables, Smart cities and Infrastructure, Industrial IoT, etc.

15 Hours

Suggested Readings:

1. David Hanes and Gonzalo Salgueiro, "IoT Fundamentals, Networking Technologies, Protocols, and Use Cases for the Internet of Things", Pearson Publications.
2. Tim Pulver, "Mastering Internet of Things: Unlocking the Power of Connected Devices", O'Reilly Media
3. Colin Dow, "Internet of Things Programming Projects: Build modern IoT solutions with the Raspberry Pi 3 and Python", Pack Publishing.
4. Claire Rowland, Elizabeth Goodman, Martin Charlier, and Ann Light, "Designing Connected Products: UX for the Consumer Internet of Things", O'Reilly Media
5. Scott Klein and Matthew Wenz, "IoT Solutions in Microsoft's Azure IoT Suite: Data Acquisition and Analysis in the Real World", ,Apress.

BCA (Web Technology) - FIFTH SEMESTER

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

Course Title: IoT and its Applications.
Course Code: UMJCST503
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 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 (Web Technology) - FIFTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: VB.Net
Course Code: UMJCST504
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 2024, 2025, and 2026

Course objectives & learning outcomes:

1. To gain a solid foundation in VB.Net programming, covering syntax, data types, and control structures to develop a strong programming mindset
2. To Explore advanced topics such as classes, inheritance, file handling, exception handling and polymorphism, equipping students with essential object-oriented programming skills.
3. To interact with databases using ADO.Net, perform data manipulation using SQL commands, carry out efficient database integration within VB.Net applications
4. To apply acquired knowledge to design and develop Windows Forms applications. incorporating GUI elements.

UNIT – I

Understanding the .Net Framework, Overview of Visual Studio IDE, Setting up a VB.Net project, Variables and Data Types, Operators and Expressions, Decision-making structures (If...Then...Else), Select Case statement, Looping constructs (For, While, Do While), Defining and calling functions, Procedures and Subroutines, Scope and lifetime of variables.

15 Hours

UNIT – II

Classes and Objects, Encapsulation, Inheritance, and Polymorphism, Constructors and Destructors, Exception handling (Try, Catch, Finally), Reading and writing to text files, Working with binary files Serialization and deserialization.

15 Hours

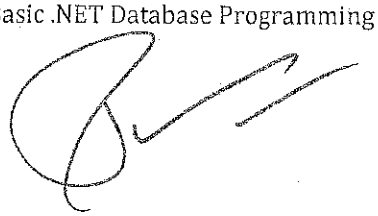
UNIT – III

Database connectivity using ADO.Net, Data manipulation using SQL commands, Reading, and writing data to databases, Introduction to Windows Forms, Designing GUI using Visual Studio, Event-driven programming, Working with DataGridView and ListView, Implementing menus and toolbars, Custom controls, and user controls.

15 Hours

Suggested Readings:

1. Steven Roman, Ron Petrusha, and Paul Lomax, "VB.Net Language in a Nutshell", O'Reilly Media.
2. Francesco Balena, "Programming Microsoft Visual Basic .NET", Microsoft Press.
3. Tim Patrick and Steven Holzner, "Visual Basic .NET Programming Cookbook", O'Reilly Media.
4. Michael Halvorson,"Microsoft Visual Basic .NET Step by Step", Microsoft Press.
5. Evangelos Petroutsos, "Mastering Visual Basic .NET Database Programming ", Sybex.



BCA (Web Technology) - FIFTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: VB.Net
Course Code: UMJCST504
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 2024, 2025, and 2026

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.

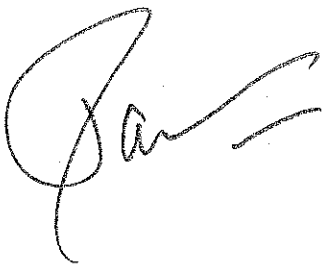
Section A shall consist Four (4) short answer questions (at least one from each unit). The students are required to attempt all questions. Each question shall be of 2½ Marks.

(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 (Web Technology) - FIFTH SEMESTER

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

Course Title: Database Management System
Course Code: UMICST505
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

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

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 table.
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 concepts

UNIT - I

Traditional file-based system, Need of Database Management System, Definition and functions of a database, Types of databases, Database Architecture; Three-tier architecture, Database models (Hierarchical, Network, Relational), Schemas and Instances, RDBMS; Relational model concepts, Entity relationship model, SQL (Structured Query Language).

15 Hours

UNIT - II

Normalization; Concept of keys, Functional dependencies, First, Second, Third Normal Forms, BCNF, ER Model; ER diagrams, Entity, attribute, relationship, Database Design; Functional dependencies, Designing databases using normalization techniques, Transaction Management; ACID properties, Transaction states and their recovery.

15 Hours

UNIT – III

Concurrency Control; Transaction processing, Deadlocks, Locking mechanisms, Two-phase locking protocol, Database Security; Authorization and authentication, Encryption and access control, Database Connectivity; ODBC (Open Database Connectivity), JDBC (Java Database Connectivity).

15 Hours

UNIT – IV

Distributed Databases; Concepts and architectures, Data fragmentation, replication, and allocation, Object-Oriented Database Management System (OODBMS); Concepts and features, Comparison with RDBMS, Data Warehousing and Data Mining; Concepts and applications, Recent Trends; NoSQL databases, Big Data and its impact on databases.

15 Hours

Suggested readings/ references:

1. Bipin C. Desai, "An Introduction to Database Systems", West-publishing company.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education,
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

BCA (Web Technology) - FIFTH SEMESTER

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

Course Title: Database Management System
Course Code: UMICST505
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 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

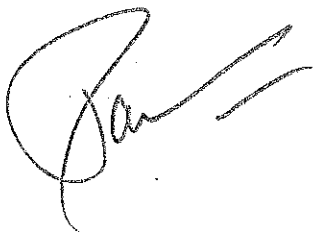
Final Examination 15 Marks

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 (Web Technology) - FIFTH SEMESTER

Course: Skill Enhancement Course
Course Credits: (0-2-0)
Total marks: 50

Course Title: Summer Internship
Course Code: USECSI506
End Semester assessment: 50 Marks

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

It shall be a short-term internship of 15 days duration for a job/professional training in a suitable organization or hands on training or activity-based course at college level in order to gain work experience.

All students will undergo internships/ Apprenticeships in a firm, industry, or organization or Training in labs with faculty and researchers in their own or other HEIs/research institutions during the summer term. Students will be provided with opportunities for internships with local industry, business organizations, health and allied areas, local governments (such as panchayats, municipalities). Parliament or elected representatives, media organizations, artists, crafts persons, and a wide variety of organizations so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability.

Community engagement and service: The curricular component of 'community engagement and service' seeks to expose students to the socio-economic issues in society so that the theoretical learning can be supplemented by actual life experiences to generate solutions to real-life problems. This can be part of summer term activity.

Field-based learning/minor project: The field-based learning/minor project will attempt to provide opportunities for students to understand the different socio-economic contexts. It will aim at giving students exposure to development-related issues in rural and urban settings. It will provide opportunities for students to observe situations in rural and urban contexts, and to observe and study actual field situations regarding issues related to socioeconomic development. Students will be given opportunities to gain a first-hand understanding of the policies, regulations, organizational structures, processes, and programmes that guide the development process. They would have the opportunity to gain an understanding of the complex socio-economic problems in the community., and innovation practices required to generate solutions to the identified problems. This may be a summer term project.

SCHEME OF EXAMINATIONS –

The internship shall be under a college teacher who will be designated as Internship Supervisor. After completion of summer internship, students will have to produce a report related to the work carried out along with a course completion certificate from the concerned organization/industry/ institute. The internship shall be evaluated internally based on presentation and viva-voce by Board of Examiners nominated by the principal of the college.

BCA (Web Technology) - SIXTH SEMESTER

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

Course Title: PHP Programming
Course Code: UMJCST601
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 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Overview of basic constructs of PHP programming and working
2. Implementing basic web concepts using PHP
3. Understanding working of data base connection and their implementation with PHP

UNIT – I

Overview of Web Development Technologies, Introduction to PHP: History and Features, Setting up the PHP Environment (XAMPP, WampServer, etc.), Basic PHP Syntax and Variables, Data Types and Operators in PHP

15 Hours

UNIT - II

Conditional Statements (if, else, switch), Looping Structures (for, while, do-while), Functions and Parameter Passing, Variable Scope and Global Variables, Error Handling and Debugging Techniques

15 Hours

UNIT - III

HTML Forms and Form Handling, Form Validation and Security Measures, Handling Form Data with PHP, File Uploads and Handling, Cookies and Sessions in PHP

15 Hours

UNIT – IV

Introduction to Database Concepts (MySQL), Connecting PHP to MySQL Database, Performing CRUD Operations (Create, Read, Update, Delete), Introduction to Object-Oriented PHP, Web Security Best Practices in PHP

15 Hours

Suggested readings/ references:

1. "PHP and MySQL Web Development" by Luke Welling and Laura Thomson
2. "Learning PHP, MySQL & JavaScript" by Robin Nixon
3. "PHP: The Complete Reference" by Steven Holzner
4. "PHP Programming for Beginners: Key Programming Concepts. How to use PHP with MySQL and Oracle databases" by B.D. Knuckles
5. "PHP Solutions: Dynamic Web Design Made Easy" by David Powers
6. "Learning PHP, MySQL & CSS" by Robin Nixon.
7. "PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide" by Larry Ullman
8. "Modern PHP: New Features and Good Practices" by Josh Lockhart

BCA (Web Technology) - SIXTH SEMESTER

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

Course Title: PHP Programming
Course Code: UMJCST601
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 2025, 2026 and 2027

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

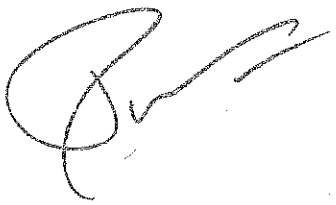
15 Marks

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 (Web Technology) -SIXTH SEMESTER

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

Course Title: Design and Analysis of Algorithms
Course Code: UMJCST602
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Develop a strong foundation in algorithm design techniques.
2. Understand the principles of algorithm analysis and efficiency.

UNIT – I

Basics of Algorithms, Definition and characteristics of algorithms, Importance and applications of algorithmic problem-solving, Algorithm Analysis, Time and space complexity, Asymptotic notation (Big O, Omega, Theta), Worst-case, average-case, and best-case analysis

15 Hours

UNIT - II

Sorting: Sorting Algorithms, Bubble sort, insertion sort, selection sort, Merge sort, quicksort, radix sort, Comparison of sorting algorithms, Searching Algorithms, Linear search, Binary search, Hashing and hash functions

15 Hours

UNIT - III

Advanced Search Structures: Binary search trees, Balanced search trees, AVL, Red-Black trees, B-trees, Basic Graph Algorithms, Breadth-first search, Depth-first search, Shortest path algorithms: Dijkstra, Bellman-Ford. Minimum Spanning Trees, Kruskal's algorithm, Prim's algorithm, Applications in network design

15 Hours

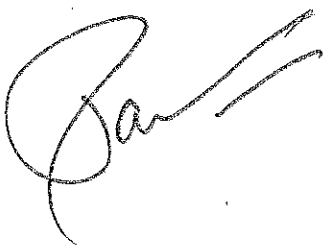
UNIT – IV

Algorithm Design Strategies, Divide and conquer, Greedy algorithms, Dynamic programming, Backtracking. Dynamic Programming, Principles and applications, Examples: Longest Common Subsequence, Matrix Chain Multiplication, NP-Completeness, Introduction to computational complexity, P vs. NP problem, Cook's theorem and NP-complete problems

15 Hours

Suggested readings/ references:

1. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C, "Introduction to Algorithms.", MIT Press.
2. Kleinberg, J., & Tardos, É., Algorithm Design, Addison-Wesley.
3. Dasgupta, S., Papadimitriou, C. H., & Vazirani, U. Algorithms. McGraw-Hill



BCA (Web Technology) - SIXTH SEMESTER

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

Course Title: Design and Analysis of Algorithms
Course Code: UMJCST602
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

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

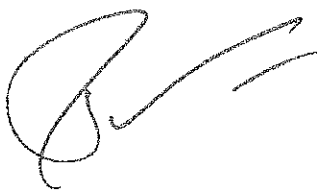
Final Examination 15 Marks

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 (Web Technology) - SIXTH SEMESTER

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

Course Title: Discrete Mathematics
Course Code: UMJCST603
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Establishing fundamental mathematical concepts and structures that form the basis of computer science.
2. Providing a mathematical foundation for understanding and implementing data structures and algorithms in programming.
3. Exploring applications of graph theory in network design, routing algorithms, and optimization problems.
4. Providing a mathematical foundation for understanding and implementing data structures and algorithms in programming.

UNIT – I

Fundamental and Mathematics Logic Fundamental- Sets and Subsets, Operations on Sets, Sequences, Properties of Integers, Matrices. Logic- Proposition and Logical Operations, Conditional Statements, Methods of Proof, Mathematical Induction. Mathematical Logic-Statements and Notation, Connectives

15 Hours

UNIT – II

Counting, Relation and Diagraph, Function Counting- Permutations, Combinations, The Pigeonhole Principle, Recurrences Relations. Relations and Digraphs- Product Sets and Partitions, Relations and Digraphs, Paths in Relations and Digraphs, Properties of Relations, Equivalence Relations, Manipulation of Relations

15 Hours

UNIT – III

Graph Theory; Basic concepts (vertices, edges, paths, cycles), Trees and their properties, Graph traversal algorithms (BFS, DFS), Euler Paths and Circuits, Hamiltonian Paths and Circuits. Other Relations and Structure- Partially Ordered Sets, Lattices, Finite Boolean Algebras, Functions of Boolean Algebras, Trees- Introduction, Undirected Trees, Minimal Spanning Trees.

15 Hours

UNIT – IV

Semi Group and Groups- Binary Operations Revisited Semi Groups, Products and Quotients of Semi Groups, Groups, Products and Quotients of Groups. Introduction to Computability Theory- Languages, Finite-State Machines, Semi Groups, Machines and Languages.

15 Hours

Suggested readings/ references:

1. K H. Rosen, Discrete Mathematics and Its Applications, McGraw Hill Education, 1999.
2. R.L. Graham, D.E. Knuth, O. Patashnik, Concrete Mathematics (2nd ed.), Addison Wesley, 1994.J.P. Tremblay and R. Manohar, "Discrete Mathematical Structure with Applications to Computer Science", TMH, ISBN- 0-07-463113-6
3. Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structure", PHI, ISBN- 978-81-203-3689-6
4. E. Goodaire , "Discrete Mathematics with Graph theory", PHI,ISBN--10: 0131679953

BCA (Web Technology) - SIXTH SEMESTER

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

Course Title: Discrete Mathematics
Course Code: UMJCST603
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

NOTE FOR PAER 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

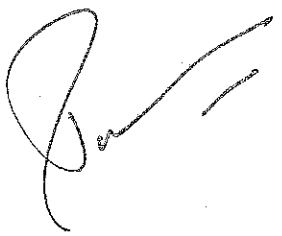
15 Marks

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 (Web Technology) - SIXTH SEMESTER

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

Course Title: Computer Graphics
Course Code: UMJCST604
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 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Develop a comprehensive understanding of computer graphics principles
2. Apply graphics algorithm in various applications

UNIT - I

Definition and importance of computer graphics, Historical overview and evolution, Applications in various domains, Recent advancements in computer graphics, Emerging technologies and applications, Ethical considerations in computer graphics

15 Hours

UNIT - II

Basic two-dimensional Graphics, Coordinate systems and transformations, Drawing lines and shapes, Color models and blending techniques, Three-Dimensional Transformations, three-dimensional coordinate systems and transformations, Homogeneous coordinates, Projection and view transformations

15 Hours

UNIT – III

Overview of graphics hardware components, Introduction to real-time graphic, Graphics software and APIs, Introduction to OpenGL and DirectX, Fundamentals of VR and AR, VR and AR hardware and software, Developing VR and AR applications

15 Hours

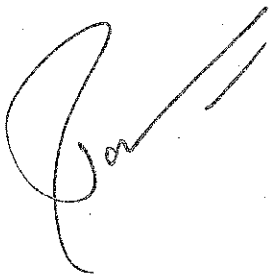
UNIT – IV

Computer Animation, Principles of animation, Key frame and procedural animation, Character animation and rigging, Research Trends and Future Directions, Recent advancements in computer graphics, Emerging technologies and applications, Ethical considerations in computer graphics.

15 Hours

Suggested readings/ references:

1. Hearn, D., & Baker, M. P,Computer Graphics with OpenGL. Pearson,2014.
2. Foley, J. D., van Dam, A., Feiner, S. K., & Hughes, J. F. Computer Graphics: Principles and Practice. Addison-Wesley.
3. Shirley, P., & Marschner, S. R. Fundamentals of Computer Graphics. AK Peters/CRC Press.
4. Akenine-Möller, T., Haines, E., & Hoffman, N. (2008). Real-Time Rendering. A K Peters/CRC Press



BCA (Web Technology)- SIXTH SEMESTER

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

Course Title: Computer Graphics
Course Code: UMJCST604
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 2025, 2026 and 2027

NOTE FOR PAPER SETTERS FOR EXAMINATIONS –

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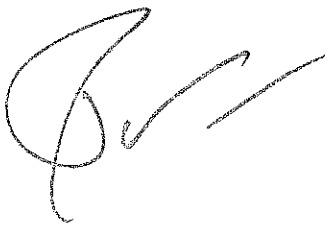
Section A shall consist Four (4) short answer questions having one question from each unit. The students are required to attempt all questions. Each question shall be of 3 Marks.

(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 (Web Technology) – SIXTH SEMESTER

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

Course Title: Free and Open-Source Software
Course Code: UMICST605
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To get familiar with free and open source available softwares.
2. To learn setup open-source account and enhance open-source projects

Unit-I

Introduction to OSS, History, Need of Open Sources, Advantages and disadvantages of OSS,Brief understanding of Software Development Life Cycle, Development, and maintenance of Open-Source Software.

15 Hours

Unit-II

Commercial Software Vs Open-Source Software, Free Software and its features, Freeware Softwares, features of Freeware softwares,Software Licensing - GPL, LGPL and other licenses.

15 Hours

Unit-III

Introduction of Open office, MySql, PHP and GAMBAS, Salient features of OSS like (Open Office, GAMBAS, GIMP, MySQL, PHP and Apache web server), Advantages and disadvantages of Open Office and PHP, Apache Web Server its installation and deploying website

15 Hours

Unit-IV

Applications of Open Source Operating System LINUX: - Introduction, Features of Linux OS, Services of Linux, General Overview, Kernel Mode and User mode – Process and Scheduling, Development with Linux

15 Hours

Practicals Based on:

1. Find out various Open-source software for the concepts studied by you till now.
2. Install the software like Open office, MySQL etc. and perform comparative study of theirsalient features.
3. Use GIMP for Image Editing
4. Use GAMBAS for creating Admission Forms

BCA (Web Technology) – SIXTH SEMESTER

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

Course Title: Free and Open-Source Software
Course Code: UMICST605
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

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.

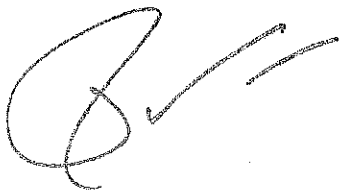
Section A shall consist Four (4) short answer questions (at least one from each unit). The students are required to attempt all questions. Each question shall be of 2½ Marks.

(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 (Web Technology) – SEVENTH SEMESTER

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

Course Title: Research Methodology and Research Ethics
Course Code: UMJCST701
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To introduce the basic concepts of research methodology
2. To understand methods of selecting a research problem and different tools to be employed in a research project.
3. To develop skills in qualitative and quantitative data analysis.

Unit-I

Research process, Problem and Hypothesis: About Research - Introduction, Application of research, Definitions of research, Characteristics/Features of a good research, Types of research, Research Methods and Methodology, Research/Scientific Methods/Discovery, Research approaches, Application of research in management (Research applications in marketing management, Production management, Financial management, Human resource management, Current status of research in India), Limitations of research. Research Process - Defining and Formulating the Research Problem, Extensive Literature Survey

15 Hours

Unit-II

Research Design and Sampling Design: About Research Design - Introduction, Definition, Components of a research designs, Concepts related to research designs, Types of research designs. Sampling Design -Definition of sampling, Features of the sampling technique, Essentials of an ideal sample, Types of sampling, Selecting/Calculating the sample size, Determination of sample size n When estimating the population mean, Some basic technologies of sampling, Common sampling distribution, Sampling theory.

15 Hours

Unit-III

Data Collection, Preparation of Questionnaire and Schedule: About Data Collection - Introduction, Primary data, Secondary data, Collection of primary data, Sources of secondary data. Questionnaire and Schedule Merits, Demerits, Formulation of Questionnaire, Various Method/ Technique for getting the Response, Construction of Questionnaire, Schedule, Types of Schedules, Types of Questions, Case Study Method.

15 Hours

Unit-IV

Analysis of Data, Hypothesis Testing, Role of SPSS and Excel: Analysis of Data -Introduction, Processing of data, Diagrammatic presentation in research. Research Hypothesis - Introduction of Research hypothesis, Steps Involved in Hypothesis Testing, Procedure for Testing Hypothesis, Role of SPSS - Introduction, The Variables view, Statistical Types in SPSS, The SPSS Interface, SPSS output files. Role of MS Excel -Excel and Research, The Excel spreadsheet.

15 Hours

Suggested readings/ references:

1. Mukul Gupta, Deepa Gupta, Research Methodology, PHI.
2. Dr. C. R. Kothari, Research Methodology, New Age International (P Ltd) Publishers.
3. Dr. J. Y. Khan, Research Methodology, A. T. H. Publishing Corporation.
4. Dr. Prasant Sarangi, Research Methodology, Taxmanns.
5. Briony J Oates, Researching Information Systems and Computing, SAGE Publications.

BCA (Web Technology) - SEVENTH SEMESTER

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

Course Title: Research Methodology and Research Ethics
Course Code: UMJCST701
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

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 (Web Technology) – SEVENTH SEMESTER

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

Course Title: Android Programming
Course Code: UMJCST702
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 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Overview of basic constructs of android programming and working.
2. To understand the intricacy of intermediate android development.
3. Have a practical experience of developing an android application.

Unit-I

Overview of Mobile Development, Introduction to Android OS and Architecture, Setting up Android Development Environment (Android Studio), Basic UI Components (Layouts, Views, Widgets), Handling User Input, Introduction to Activities and Intents, Basic Android Project Structure.

15 Hours

Unit-II

Fragments and Fragment Lifecycle, UI Design Best Practices, Recycler View and Adapter Pattern, Data Storage: Shared Preferences, SQLite Database, Networking Basics (HTTP, REST APIs), Asynchronous Programming and Async Task, Debugging and Profiling.

15 Hours

Unit-III

Advanced UI Components (Custom Views, Canvas), Animation and Transitions, Location-based Services (GPS, Maps) Multimedia: Audio and Video Playback, Background Processing and Services, Push Notifications, Material Design Principles

15 Hours

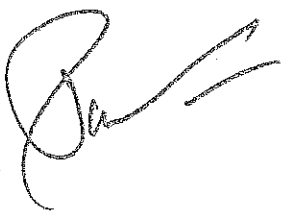
Unit-IV

Building a Complete Android App (Capstone Project), User Authentication and Security, Deployment to Google Play Store, Introduction to Kotlin for Android, Android Jetpack Components, Emerging Trends (AR/VR in Android, Android Things)

15 Hours

Suggested readings/ references:

1. "Android Developer Fundamentals" - Provided by Google as part of Android's official training resources.
2. "Android Programming with Kotlin for Beginners" by John Horton.
3. "Advanced Android in Kotlin".
4. "Android App Development" - Official Android Developer Guide provided by Google.



BCA (Web Technology) - SEVENTH SEMESTER

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

Course Title: Android Programming
Course Code: UMJCST702
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 2025, 2026 and 2027

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 (Web Technology) – SEVENTH SEMESTER

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

Course Title: Theory of Computation.
Course Code: UMJCST703
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To learn about fundamental concepts of finite automata and formal language
2. To enhance student's ability to understand and solve mathematical proofs for computation and algorithm
3. To learn about deterministic and non- deterministic machines.
4. To design grammars and recognizers for different formal languages

Unit-I

Introduction to Finite Automata: The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata. Applications of finite automata, Finite automata with Epsilon transitions.

15 Hours

Unit-II

Finite Automata and Regular Expressions: Applications of Regular Expressions; Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata.

15 Hours

Unit-III

Context–free grammars: Parse trees; Applications; Ambiguity in grammars and Languages. Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG's.

15 Hours

Unit-IV

Deterministic Pushdown Automata and The Turing machine: Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs, The Turing machine.

15 Hours

Suggested readings/ references:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2011.
2. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw Hill, 2007
3. Daniel I.A. Cohen: Introduction to Computer Theory, 2nd Edition, John Wiley & Sons, 2009.
4. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006

BCA (Web Technology)- SEVENTH SEMESTER

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

Course Title: Theory of Computation.
Course Code: UMJCST703
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

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(4 x 12 = 48 marks)

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

10 marks

Final Examination

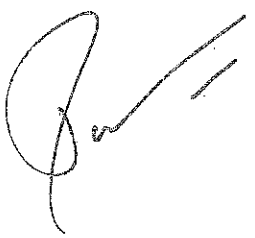
15 Marks

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 (Web Technology) – SEVENTH SEMESTER

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

Course Title: Web Security
Course Code: UMJCST704
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To get familiar with the basics of web security and its need in contemporary technology.
2. Have a multi-dimensional knowledge of web security threats.
3. Understand the basics of advance web security tools.

Unit-I

Introduction to Web Security: Overview of Web Security Concepts, Common Web Vulnerabilities (SQL Injection, Cross-Site Scripting, Cross-Site Request Forgery), Web Security Threat Modeling, Principles of Secure Coding, Authentication and Authorization.

15 Hours

Unit-II

Web Application Security: Input Validation and Output Encoding, Session Management Security, Security Headers and HTTPS, Secure File Uploads and Downloads, Cross-Origin Resource Sharing (CORS), Web Application Firewalls (WAF).

15 Hours

Unit-III

Network Security for Web applications: Fundamentals of Network Security, Transport Layer Security (TLS) and SSL /TLS Best Practices, DNS Security, Secure API Design, Web Security in Cloud Environments, Content Security Policy (CSP).

15 Hours

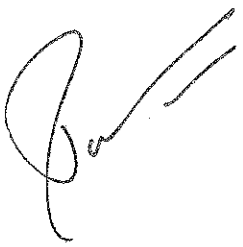
Unit-IV

Advanced Web Security Topics: Web Security Testing and Assessment, Mobile Web Security, Security in Microservices Architecture, Incident Response and Web Security Incident Management, Legal and Ethical Aspects of Web Security, Emerging Trends in Web Security.

15 Hours

Suggested readings/ references:

1. "Web Application Security: A Comprehensive Guide to Secure Web Application Development" by Andrew Hoffman and David Russell.
2. "The Tangled Web: A Guide to Securing Modern Web Applications" by Michal Zalewski.
3. "Network Security Essentials" by William Stallings.
4. "Hacking: The Art of Exploitation" by Jon Erickson.



BCA (Web Technology)- SEVENTH SEMESTER

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

Course Title: Web Security
Course Code: UMJCST704
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

NOTE FOR PAPER SETTERS FOR EXAMINATIONS –

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

10 marks

Final Examination

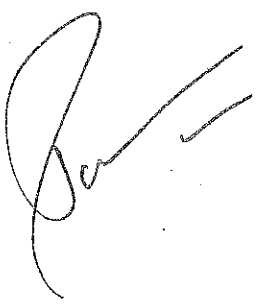
15 Marks

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 (Web Technology)- SEVENTH SEMESTER

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

Course Title: Python Programming
Course Code: UMICST705
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 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To learn programming in core Python.
2. To develop programs in Python using lists, tuples and string
3. To develop the skills to create file and function in Python.
4. To gain knowledge of Object-Oriented implementation in Python.
5. To use and implement database and GUI applications in Python

Unit-I

Python Programming Language: Python Interpreter/Shell, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () function and Is operator, Dynamic and Strongly Typed Language. **Control Flow Statements:** The if Decision Control Flow Statement, The if...else Decision Control Flow Statement, The if...elif...else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break statements.

Unit-II 15 Hours

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Life time of Variables, Default Parameters, Command Line Arguments. **Strings:** Creating and Storing Strings, Basic String operations, Accessing Characters in String by Index Number, String Slicing and Joining, String methods **Lists:** Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement.

Unit-III 15 Hours

Dictionaries: Creating Dictionary, Accessing and modifying key: value pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary methods, The del Statement. **Tuples and Sets:** Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relations between Tuples and Lists, Relations between Tuples and Dictionaries, Tuple Methods, using zip () Function, Sets, Set Methods, Frozen set. **Files:** Types of files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle module, Reading and writing CSV files.

Unit-IV 15 Hours

Object Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data attributes, Encapsulation, Inheritance, The Polymorphism

15 Hours

Suggested readings/ references:

1. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor& Francis, 2018. ISBN-13: 978-0815394372.[Unit I&II- 2,3,4,5,6,7,8,9 Unit III-11,12].
2. Eric Matthes, "Python Crash Course- A Hands-On, Project-Based Introduction to Programming",2nd Edition, No Starch Press, 2019. [Unit III-15, Unit IV-16]
3. Wesley J. Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education, 2016. [Unit IV- 2,5]
4. Kamthane, A. N., & Kamthane, A.A., "Programming and Problem Solving with Python", McGraw Hill Education, 2017.
5. Mark Lutz, "Learning Python", 5th edition, Orelly Publication, 2013, ISBN 978-1449355739.
6. Ljubomir Perkovic, "Introduction to Computing Using Python- An Application Development Focus", Wiley,2012

BCA (Web Technology)- SEVENTH SEMESTER

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

Course Title: Python Programming
Course Code: UMICST705
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 2025, 2026 and 2027

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(4 x 12 = 48 marks)

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Practical/ tutorial Evaluation
Daily evaluation of practical's/tutorials/Viva voce/Records etc. 10 marks

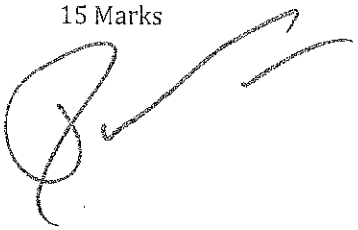
Final Examination 15 Marks

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 (Web Technology)- EIGTH SEMESTER

Course: Major
Course Credits :(L-P-T)
(0-12-0)
Total marks: 300

Course Title: Project Work
Course Code: UMJCSP801
Project Evaluation: 200 Marks
Viva/Presentation: 100 Marks

For examinations to be held in May 2026, 2027 and 2028

To provide the hands on experience in analyzing, designing and implementing various projects, students will be assigned major projects based on the languages they have learned. The project work would be carried out in the department under the guidance of a faculty member. The project work will be assigned to the individual students or group of students in case of bigger project with prior permission of the faculty member of the department. The student is required to submit the certification of successful completion of project from the guide mentioning the total number of hours worked per week and conduct during the project period.

Based on the project work a formal project report should be prepared under the guidance of faculty and submitted to department for evaluation. The Project work shall be evaluated by Board of Examiners nominated by the principal of the college. Examiners will conduct the viva-voce; examine the presentation, project report and demonstration of the project.

Project Work = **12 credits (300 marks)**
Project Evaluation = 08 credits (200 marks)
Viva/ Presentation = 04 credits (100 marks)

Guidelines:

1. The project proposal should be prepared in consultation with the guide. The project proposal should clearly state the project objectives and the environment of the proposed project to be undertaken. As far as possible, the Project should be on a real life problem.
2. The project work should compulsorily include the software development.
3. Synopsis of the project would be submitted to the department depicting the title of the project, DFDs, brief description of project etc.
4. Project proposal to be scrutinized by the Faculty of the Department and the progress of the project work should be continuously monitored by concerned guide.
5. Student is required to work in the Computer Lab. on the project sanctioned.
6. The project report must be submitted in accordance with the prescribed format. Project report would be submitted to the Department before the prescribed date.
7. Students have to make presentations of project work during evaluation. The student shall demonstrate working of the software.

Proforma for the Project Report

1. Title of the Project
2. Objectives
3. System Analysis and Design
4. Input to the Project
5. Output generated
6. Details of Hardware Platform used and Software Tools used
7. Implementation Issues (Clearly defining the area of Application).
8. Miscellaneous
9. Future scope and further enhancement of the Project
10. Bibliography

BCA (Web Technology)- EIGTH SEMESTER

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

Course Title: Cloud Computing
Course Code: UMJCST802
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

Course objectives & learning outcomes:

1. To improve the analytical skills of Cloud Computing.
2. Formal introduction to Cloud Computing.
3. Overall development of Cloud Computing

Unit-I

Introduction to Cloud Computing: Definition, History, Benefits, and Challenges, Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Cloud Deployment Models: Public, Private, Hybrid, Community, Basic Cloud Architecture and Infrastructure, Introduction to Virtualization and Cloud Storage Options

15 Hours

Unit-II

Cloud Technologies and Management: Detailed Overview of IaaS, PaaS, SaaS, and Serverless Computing, Cloud Networking Basics, including CDNs and VPNs, Cloud Security Essentials: Identity and Access Management (IAM), Compliance, and Encryption, Cloud Management and Monitoring Tools, Automation, Orchestration, and Cost Optimization in Cloud Environments.

15 Hours

Unit-III

Advanced Cloud Storage and Database Services, Cloud Security: Advanced Topics and Best Practices, Emerging Trends: Hybrid and Multi-Cloud Strategies, Edge Computing, AI and ML in the Cloud, IoT Integration, Hands-on Labs: Setting up and Managing Cloud Environments, Basic Cloud Application Deployment.

15 Hours

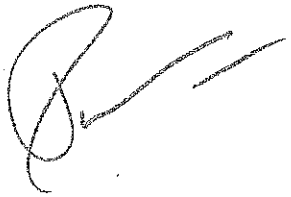
Unit-IV

Cloud Solution Design and Implementation: Planning, Migration, Deployment, and Optimization, Major Cloud Providers: AWS, Azure, Google Cloud – Comparison and Market Analysis, Real-world Case Studies and Applications of Cloud Computing, Future of Cloud Computing and Career Opportunities

15 Hours

Suggested readings/ references:

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood (2013),"Cloud Computing: Concepts, Technology & Architecture" Prentice Hall.
2. Ray J. Rafaels, "Cloud Computing: From Beginning to End", CRC Press,2014.
3. Michael J. Kavis, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", Wiley,2014.
4. Michael Collier and Robin Shahan (2015),"Microsoft Azure Essentials: Fundamentals of Azure", Microsoft Press



BCA (Web Technology)- EIGTH SEMESTER

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

Course Title: Cloud Computing
Course Code: UMJCST802
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

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Practical/ tutorial Evaluation
Daily evaluation of practical's/tutorials/Viva voce/Records etc. 10 marks

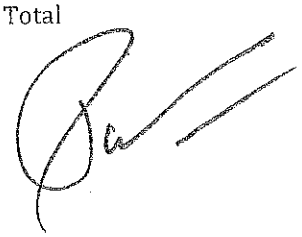
Final Examination 15 Marks

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 (Web Technology)- EIGTH SEMESTER

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

Course Title: Fundamentals of Cloud Computing
Course Code: UMICST803
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

Course objectives & learning outcomes:

1. To improve the analytical skills of Cloud Computing.
2. Formal introduction to Cloud Computing.
3. Overall development of Cloud Computing

Unit-I

Introduction to Cloud Computing: Definition, History, Benefits, and Challenges, Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Cloud Deployment Models: Public, Private, Hybrid, Community, Basic Cloud Architecture and Infrastructure, Introduction to Virtualization and Cloud Storage Options

15 Hours

Unit-II

Cloud Technologies and Management: Detailed Overview of IaaS, PaaS, SaaS, and Serverless Computing, Cloud Networking Basics, including CDNs and VPNs, Cloud Security Essentials: Identity and Access Management (IAM), Compliance, and Encryption, Cloud Management and Monitoring Tools, Automation, Orchestration, and Cost Optimization in Cloud Environments.

15 Hours

Unit-III

Advanced Cloud Storage and Database Services, Cloud Security: Advanced Topics and Best Practices, Emerging Trends: Hybrid and Multi-Cloud Strategies, Edge Computing, AI and ML in the Cloud, IoT Integration, Hands-on Labs: Setting up and Managing Cloud Environments, Basic Cloud Application Deployment.

15 Hours

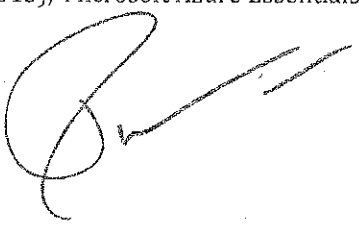
Unit-IV

Cloud Solution Design and Implementation: Planning, Migration, Deployment, and Optimization, Major Cloud Providers: AWS, Azure, Google Cloud – Comparison and Market Analysis, Real-world Case Studies and Applications of Cloud Computing, Future of Cloud Computing and Career Opportunities

15 Hours

Suggested readings/ references:

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood (2013),"Cloud Computing: Concepts, Technology & Architecture" Prentice Hall.
2. Ray J. Rafaels, "Cloud Computing: From Beginning to End", CRC Press,2014.
3. Michael J. Kavis, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", Wiley,2014.
4. Michael Collier and Robin Shahan (2015),"Microsoft Azure Essentials: Fundamentals of Azure", Microsoft Press



BCA (Web Technology)- EIGTH SEMESTER

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

Course Title: Fundamentals of Cloud Computing
Course Code: UMICST803
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

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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 (Web Technology)- EIGTH SEMESTER

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

Course Title: Statistical Concepts
Course Code: UMJCST804
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

Course objectives & learning outcomes:

1. To improve the analytical skills of Statistical Concepts.
2. Formal introduction to Statistical Concepts.
3. Overall development of Statistical Concepts

Unit-I

Overview of Statistics: Definition and Importance of Statistics in Various Fields, Descriptive vs. Inferential Statistics. Types of Data: Qualitative (Categorical) Data and Quantitative (Numerical) Data, Levels of Measurement: Nominal, Ordinal, Interval and Ratio. Data Collection and Sampling Methods: Population vs. Sample, Random Sampling, Stratified Sampling, Cluster Sampling, Introduction to Data Visualization: Basic Graphs and Charts: Histograms, Pie Charts, Bar Graphs, Line Graphs

15 Hours

Unit-II

Measures of Central Tendency: Mean, Median, Mode. Measures of Dispersion: Range, Variance, Standard Deviation. Introduction to Probability: Basic Probability Concepts and Rules, Probability Distributions (with focus on Normal Distribution). Data Visualization in Practice: Box Plots, Scatter Plots, and Understanding Distributions through Graphs.

15 Hours

Unit-III

Sampling Distribution and Central Limit Theorem: Concept of Sampling Distribution, Significance of the Central Limit Theorem in Statistics. Hypothesis Testing: Null and Alternative Hypotheses, Types of Errors: Type I and Type II, p-Values and Significance Levels. Confidence Intervals: Constructing and Interpreting Confidence Intervals, Basic Regression Analysis: Simple Linear Regression: Concept and Interpretation.

15 Hours

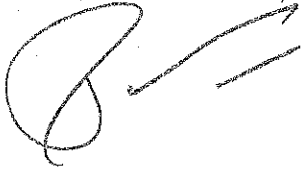
Unit-IV

Correlation Analysis: Pearson and Spearman Correlation Coefficients, ANOVA (Analysis of Variance), Understanding One-Way ANOVA. Non-Parametric Tests: Chi-Square Test, Kruskal-Wallis Test. Statistical Software Overview: Introduction to Software like R, Python, SPSS, or SAS.

15 Hours

Suggested readings/ references:

1. Robert S. Witte and John S. Witte (2017), "Statistics", Wiley.
2. Peter Bruce and Andrew Bruce (2017), "Practical Statistics for Data Scientists: 50 Essential Concepts", O'Reilly Media.
3. Mario F. Triola (2017), "Elementary Statistics", Pearson.
4. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani,"An Introduction to Statistical Learning: with Applications in R",Springer.



BCA (Web Technology)- EIGTH SEMESTER

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

Course Title: Statistical Concepts
Course Code: UMJCST804
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

NOTE FOR PAPER SETTERS FOR EXAMINATIONS –

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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

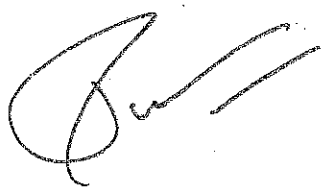
Final Examination 15 Marks

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 (Web Technology)- EIGTH SEMESTER

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

Course Title: E-Commerce
Course Code: UMICST805
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

Course objectives & learning outcomes:

1. Have a basic familiarity of e- commerce and understand the technologies associated with it.
2. To understand the relationship between the customer and e-commerce.
3. To have knowledge about the working model of e-commerce.

Unit-I

Introduction to E-Commerce: Definition and Scope of E-commerce, Historical Evolution of E-commerce, Types of Ecommerce (B2B, B2C, C2C, etc.), E-commerce Business Models, Technologies, and Infrastructure for E-commerce, Regulatory and Legal Framework for E-commerce

15 Hours

Unit-II

E-Commerce Platform and Technologies: Overview of E-commerce Platforms (Magento, WooCommerce, Shopify, etc.), Payment Gateways and Online Transactions, Security in E-commerce Transactions, Mobile Commerce (M-commerce), Emerging Technologies in E-commerce (Blockchain, AI, IoT).

15 Hours

Unit-III

Digital Marketing Strategies for E-commerce, Social Media Marketing in E-commerce, Search Engine Optimization (SEO) for E-Commerce, Customer Realtonship Management (CRM) in E-commerce, Analytics and Performance Management.

15 Hours

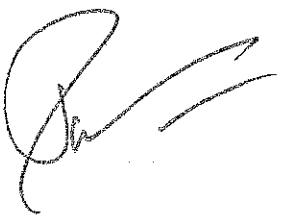
Unit-IV

E-Commerce logistics and Supply Chain Management: Order Fulfilment and Logistics in E-Commerce, Inventory management and Warehousing, Last-Mile Delivery and Fulfillment Centers, Reverse Logistics and Returns Management, Sustainability and Green Logistics in E-commerce

15 Hours

Suggested readings/ references:

1. "E-commerce 2019: Business, Technology, Society" by Kenneth C. Laudon and Carol Guercio Traver.
2. "Mastering Magento 2 - Second Edition" by Bret Williams (for Magento)
3. "Learning WooCommerce: Build a successful online store with WordPress and WooCommerce" by Cody Landefeld and Patrick Rauland (for WooCommerce)
4. "E-commerce Marketing: Strategy, Implementation and Practice" by Dave Chaffey and Richard Mayer.
5. "Supply Chain Management: Strategy, Planning, and Operation" by Sunil Chopra and Peter Meindl.



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(3-0-1)
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Course Title: E-Commerce
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Practical/ tutorial Evaluation 10 marks
Daily evaluation of practical's/tutorials/Viva voce/Records etc. 15 Marks

Final Examination

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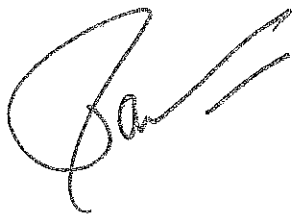


BCA (Web Technology) - EIGHTH SEMESTER

Course: Skill Enhancement Course
Course Credits :(L-P-T)
(0-12-0)
Total marks: 300

Course Title: Research Project/ Dissertation
Course Code: USECSP806
Dissertation: 200 Marks
Viva/Presentation: 100 Marks

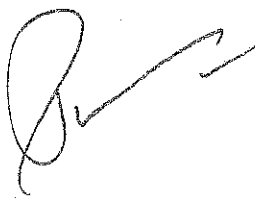
For examinations to be held in May 2026, 2027 and 2028

Research Project/Dissertation is a unique course involving application of knowledge in solving/analyzing/ exploring a real-life situation/complex problem/data analysis. It is intended to provide research competencies at the undergraduate level. It enables the acquisition of special/advanced knowledge through support study/a project work. The following mechanism shall be adopted for completion of the dissertation:

1. Admission to Honours with Research Programme (4th year, 7th Semester) shall be on the basis of the cumulative score (75% marks and above in the first five semesters) and subject to availability of permanent faculty with doctoral degree and infrastructure and number of seats in the College.
2. Research Project work (12 credits) shall be started at the beginning of 7th Semester.
3. There shall be a Project Synopsis in the programme based on the major area/subject. The permanent faculty with Ph.D. and research experience (as per UGC guidelines) shall be the research project supervisor after being recognized by the Departmental Research Committee (DRC) of the Nodal Department. The progress of the dissertation work should continuously be monitored by concerned Supervisor and the research outcomes may be published in Reputed/Refereed/Peer reviewed/indexed Journals.
4. The college offering FYUGP with Research should have its own College Research Committee (CRC) for each discipline with at least one member from any University of the region.
5. The project report/ dissertation shall be evaluated by the external expert from other University/ Colleges to be nominated by the Principal out of the panel supplied by the CRC.
6. Project proposal to be scrutinized by the College Research Committee for the concerned subject.
7. In the 8th Semester, Evaluation of Dissertation shall be offline and Viva-Voce shall be either offline or online as per the convenience of the examiner. The Dissertation evaluation shall be carried out by an external expert.

Research Project = **12 credits (300 marks)**
Dissertation = 08 credits (200 marks)
Viva/ Presentation = 04 credits (100 marks)

Note: A separate guideline shall be issued with regard to the payment of remuneration to the external expert for evaluation of the Research project.



BCA (Soft. Dev.)

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 2023-24, 2024-25

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)

SOFTWARE DEVELOPMENT

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	UMJCST161	Programming Paradigms & C Language	4(3L+1P)	15	60	10	15	100
2	Minor	UMICST162	Computer Fundamentals and PC Software	4(3L+1P)	15	60	10	15	100
3	MD	UMDCST163	Computer Fundamentals	3	15	60	NA	NA	75
4	SEC	USECST104	PC Software: Installation and Troubleshootin g	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	UMJCST261	Data and File Structures using C Language	4(3L+1P)	15	60	10	15	100
2	Minor	UMICST262	Python Programming	4(3L+1P)	15	60	10	15	100
3	MD	UMDCST263	C Programming	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	UMJCST361	Object Oriented programming using C++	4(3L+1P)	15	60	10	15	100
2	Major	UMJCST362	Database Management System & SQL	4(3L+1P)	15	60	10	15	100
3	Minor	UMICST363	Open-Source Software	4(3L+1T)	15	60	10	15	100
4	MD	UMDCST364	Computer Fundamentals	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	UMJCST461	Operating System	4(3L+1P)	15	60	10	15	100
2	Major	UMJCST462	Mathematics for Computer Science	4(3L+1T)	15	60	10	15	100
3	Major	UMJCST463	PHP Language	4(3L+1T)	15	60	10	15	100
4	Major	UMJCST464	Computer Networks and Internet	4(3L+1T)	15	60	10	15	100
5	Minor	UMICST465	Numerical Methods	4(3L+1T)	15	60	10	15	100

Semester-V

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST561	Software Engineering Practices	4(3L+1T)	15	60	10	15	100
2	Major	UMJCST562	Programming in Java	4(3L+1P)	15	60	10	15	100
3	Major	UMJCST563	Visual programming in VB.NET	4(3L+1P)	15	60	10	15	100
4	Major	UMJCST564	Data Mining	2	10	40	NA	NA	50
5	Minor	UMICST565	Software Engineering Practices	4(3L+1T)	15	60	10	15	100
6	SEC	USECSI566	Summer Internship	2	NA	NA	NA	NA	50

Semester-VI

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST661	Introduction to Android Programming	4(3L+1P)	15	60	10	15	100
2	Major	UMJCST662	Artificial Intelligence	4(3L+1T)	15	60	10	15	100
3	Major	UMJCST663	Programming in Python	4(3L+1P)	15	60	10	15	100
4	Major	UMJCST664	Neural Networks	4(3L+1T)	15	60	10	15	100
5	Minor	UMICST665	Basic Concepts of AI	4(3L+1T)	15	60	10	15	100

Semester–VII

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST761	Research Methodology and Research Ethics	4(3L+1T)	15	60	10	15	100
2	Major	UMJCST762	Shell Programming	4(3L+1P)	15	60	10	15	100
3	Major	UMJCST763	Introduction to R software	4(3L+1P)	15	60	10	15	100
4	Major	UMJCST764	Analysis and Design of algorithms	4(3L+1T)	15	60	10	15	100
5	Minor	UMICST765	Shell Programming	4(3L+1P)	15	60	10	15	100

Semester–VIII (UG Honours)

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCSP861	Project Work	12	NA	NA	NA	NA	300
2	Major	UMJCST862	IoT and its Application	4(3L+1T)	15	60	10	15	100
3	Minor	UMICST863	Cryptography and Network Security	4(3L+1T)	15	60	10	15	100

Semester–VIII (UG Honours with Research)

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST864	Introduction to Cloud Computing	4(3L+1T)	15	60	10	15	100
2	Minor	UMICST865	Introduction to Cloud Computing	4(3L+1T)	15	60	10	15	100
3	SEC	USECSP866	Research Project / Dissertation	12	NA	NA	NA	NA	300

BCA (Software Development) - FIFTH SEMESTER

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

Course Title: Software Engineering Practices
Course Code: UMJCST561
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

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

Course objectives & learning outcomes:

1. Describe the essential characteristics, and identify. using examples. the connections between the characteristics of a good software system
2. Describe the elements of a basic software development process and illustrate the variety of different life cycles
3. Understand the motivation for, and best practices of, an agile approach to software development
4. Identify the different kinds of model used in the development of software and describe the relationship between models, viewpoints and software development

Unit-1

Introduction: The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).

Requirement analysis: Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modeling Techniques, Flow Oriented Modeling, Need for SRS, Characteristics and Components of SRS.

15 Hrs

Unit-2

Software project management: Estimation in Project Planning Process, Project Scheduling.

Risk management: Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan.

15 Hrs

Unit-3

Quality management: Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.

Design engineering: Design Concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modeling Component Level Design.

15 Hrs

Unit-4

Testing strategies & tactics: Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.

15 Hrs

Suggested readings/ references:

1. R.S. Pressman, Software Engineering: A Practitioner's Approach (7th Edition), McGraw- Hill.
2. P. Jalote, An Integrated Approach to Software Engineering (2nd Edition), Narosa Publishing House.
3. K.K. Aggarwal and Y. Singh, Software Engineering (2nd Edition), New Age International Publishers.
4. D. Bell, Software Engineering for Students (4th Edition), Addison-Wesley.
5. R. Mall, Fundamentals of Software Engineering (2nd Edition), Prentice-Hall of India.

BCA (Software Development) - FIFTH SEMESTER

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

Course Title: Software Engineering Practices
Course Code: UMJCST561
Mid Semester assessment: 15 Marks of 1.5 hours duration
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Tutorial: 25 Marks

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Viva-Voce	5 Marks
Total	15 Marks

BCA (Software Development) - FIFTH SEMESTER

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

Course Title: Programming in Java
Course Code: UMJCST562
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 2024, 2025 and 2026

Course objectives & learning outcomes:

1. Use the syntax and semantics of java programming language and basic concepts of OOP.
2. Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
3. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.

Unit-1

Java Architecture and Features, Understanding the semantic and syntax, differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods). Arrays and Strings: Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To& From Methods, String Buffer Classes

15 Hrs

Unit-2

Object-Oriented Programming: Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.
I/O: Simple I/O using System. Out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

15 Hrs

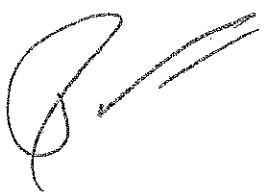
Unit-3

Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata: Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, extending interfaces and packages; Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata

15 Hrs

Unit-4

Exception Handling, Threading, Networking and Database Connectivity: Exception types, uncaught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.



15 Hrs

Suggested readings/ references:

1. The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH.
2. Bruce Eckel, "Thinking in Java", 3rd Edition, PHI, 2002.
3. E. Balaguruswamy, "Programming with Java", 4th Edition, McGraw Hill.2009.
4. Paul Deitel, Harvey Deitel, "Java: How to Program", 10th Edition, Prentice Hall, 2011.

BCA (Software Development) - FIFTH SEMESTER

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

Course Title: Programming in Java
Course Code: UMJCST562
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

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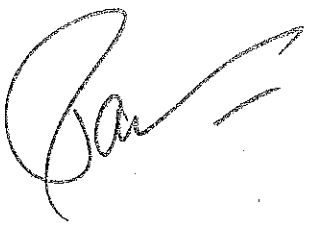


BCA (Software Development) - FIFTH SEMESTER

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

Course Title: Visual Programming in VB.NET
Course Code: UMJCST563
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25

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

Course objectives & learning outcomes:

1. Learn .NET Framework and describe some of the major enhancements to the new version of Visual Basic.
2. Understand basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE)
3. Create applications using Microsoft Windows Forms and create applications using ADO. NET

Unit-1

Introduction to .NET Framework & VB.NET: .NET Architecture, .NET Languages, Microsoft Intermediate Language (MSIL), The Just-In-Time (JIT) compiler, The .NET framework class library.

VB.NET: Introduction to Visual Studio IDE, Variables, Scope & Lifetime of a Variable, Data Types, Constants, Operators & Expressions, Type casting, Boxing and Unboxing.

15 Hrs

Unit-2

Conditional Statements: Use of conditional statement, multibranaching statement (select) and With...End With statement. Looping Statement: DO, FOR, FOR EACH, NEXT and WHILE, Working with EXIT, CONTINUE and WITH statements. Arrays and its types; structure, collection and its type. Working with Procedures: Introduction, types, use of parameters, parameter passing, calling procedures. OOP concepts: Encapsulation, Inheritance, Interfaces and Polymorphism Working with modules, classes (partial) and namespaces.

15 Hrs

Unit-3

Developing Windows Forms: Working with basic controls – Button, CheckBox, CheckedListBox, ComboBox, DateTimePicker, GroupBox, HScrollBar, RadioButton, VscrollBar, Label, ListBox, PictureBox, TextBox and Time controls. Working with advanced controls – LinkLabel, RichTextBox, ColorDiolog, FontDialog. Error handling In Windows Forms: Types of Validations, Types of Errors, Exceptions, Classified Runtime based Exceptions. SDI and MDI Applications: SDI and MDI interfaces, Characteristics of MDI components, Creating MDI Forms.

15 Hrs

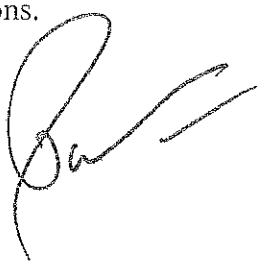
Unit-4

ADO.NET: ADO.NET Data Namespaces, SqlConnection, SqlCommand, SqlDataAdapter, DataSet Class, Data View. ASP.NET: Introduction to ASP.NET Web Forms, Implementation of ASP.NET controls: Dropdown List, Textbox, Button, Checkbox, Radio Button.

15 Hrs

Suggested references:

1. Steven Holzner; VB.NET Black Book by Dreamtech publication
2. Francesco Balena: Programming Microsoft Visual Basic.NET, Microsoft Press
3. Evangelos Petroutsos, "Mastering Visual Basic .NET", BPB Publications.



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

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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 (Software Development) - FIFTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: Data Mining
Course Code: UMJCST564
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 2024, 2025 and 2026

Course objectives & learning outcomes:

1. Pre-process the data for subsequent data mining tasks
2. Apply a suitable classification algorithm to train the classifier and evaluate its performance.
3. Apply appropriate clustering algorithm to cluster the data and evaluate clustering quality
4. Use association rule mining algorithms and generate frequent item-sets and association rule.

Unit-1

Introduction to Data Mining: Motivation and challenges for data mining, Types of data mining tasks, Applications of data mining, Data measurements, Data quality, Supervised vs. unsupervised techniques Data Pre-processing: Data aggregation, sampling, dimensionality reduction, feature subset selection.

15 Hrs

Unit-2

Cluster Analysis: Basic concepts of clustering, measure of similarity, types of clusters and clustering methods, K-means algorithm, measures for cluster validation, determine optimal number of clusters

15 Hrs

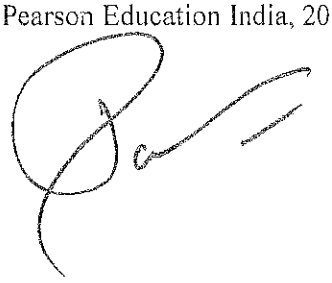
Unit-3

Association Rule mining: Transaction data-set, frequent item set, support measure, rule generation, confidence of association rule.

15 Hrs

Suggested references:

1. Tan P.N., Steinbach M, Karpatne A. and Kumar V. Introduction to Data Mining,2nd edition, Pearson, 2021.
2. Han J., Kamber M. and Pei J. Data Mining: Concepts and Techniques, 3rd edition, 2011, Morgan Kaufmann Publishers.
3. Zaki M. J.and Meira J. Jr. Data Mining and Machine Learning: Fundamental Concepts and Algorithms, 2nd edition, Cambridge University Press, 2020.
4. Aggarwal C. C. Data Mining: The Textbook, Springer, 2015.
5. Dunham M. Data Mining: Introductory and Advanced Topics, 1st edition, Pearson Education India, 2006.



BCA (Software Development) - FIFTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: Data Mining
Course Code: UMJCST564
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 2024, 2025 and 2026

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.

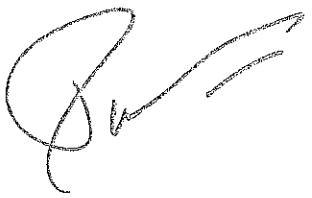
Section A shall consist Four (4) short answer questions (at least one from each unit). The students are required to attempt all questions. Each question shall be of 2½ Marks.

(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 (Software Development) - FIFTH SEMESTER

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

Course Title: Software Engineering Practices
Course Code: UMICST565
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

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

Course objectives & learning outcomes:

1. Describe the essential characteristics, and identify, using examples, the connections between the characteristics of a good software system
2. Describe the elements of a basic software development process and illustrate the variety of different life cycles
3. Understand the motivation for, and best practices of, an agile approach to software development
4. Identify the different kinds of model used in the development of software and describe the relationship between models, viewpoints and software development

Unit-1

Introduction: The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).

Requirement analysis: Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modeling Techniques, Flow Oriented Modeling, Need for SRS, Characteristics and Components of SRS.

15 Hrs

Unit-2

Software project management: Estimation in Project Planning Process, Project Scheduling.

Risk management: Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan.

15 Hrs

Unit-3

Quality management: Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.

Design engineering: Design Concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modeling Component Level Design.

15 Hrs

Unit-4

Testing strategies & tactics: Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.

15 Hrs

Suggested readings/ references:

1. R.S. Pressman, Software Engineering: A Practitioner's Approach (7th Edition), McGraw- Hill.
2. P. Jalote, An Integrated Approach to Software Engineering (2nd Edition), Narosa Publishing House.
3. K.K. Aggarwal and Y. Singh, Software Engineering (2nd Edition), New Age International Publishers.
4. D. Bell, Software Engineering for Students (4th Edition), Addison-Wesley.
5. R. Mall, Fundamentals of Software Engineering (2nd Edition), Prentice-Hall of India.

BCA (Software Development) - FIFTH SEMESTER

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

Course Title: Software Engineering Practices
Course Code: UMICST565
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 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

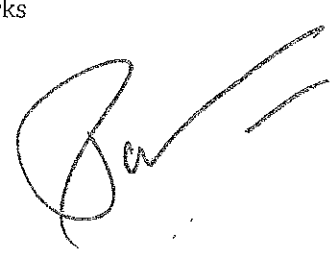
15 Marks

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 (Software Development) - FIFTH SEMESTER

Course: Skill Enhancement Course
Course Credits: (0-2-0)
Total marks: 50

Course Title: Summer Internship
Course Code: USECSI566
End Semester assessment: 50 Marks

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

It shall be a short-term internship of 15 days duration for a job/professional training in a suitable organization or hands on training or activity-based course at college level in order to gain work experience.

All students will undergo internships/ Apprenticeships in a firm, industry, or organization or Training in labs with faculty and researchers in their own or other HEIs/research institutions during the summer term. Students will be provided with opportunities for internships with local industry, business organizations, health and allied areas, local governments (such as panchayats, municipalities). Parliament or elected representatives, media organizations, artists, crafts persons, and a wide variety of organizations so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability.

Community engagement and service: The curricular component of 'community engagement and service' seeks to expose students to the socio-economic issues in society so that the theoretical learning can be supplemented by actual life experiences to generate solutions to real-life problems. This can be part of summer term activity.

Field-based learning/minor project: The field-based learning/minor project will attempt to provide opportunities for students to understand the different socio-economic contexts. It will aim at giving students exposure to development-related issues in rural and urban settings. It will provide opportunities for students to observe situations in rural and urban contexts, and to observe and study actual field situations regarding issues related to socioeconomic development. Students will be given opportunities to gain a first-hand understanding of the policies, regulations, organizational structures, processes, and programmes that guide the development process. They would have the opportunity to gain an understanding of the complex socio-economic problems in the community., and innovation practices required to generate solutions to the identified problems. This may be a summer term project.

SCHEME OF EXAMINATIONS –

The internship shall be under a college teacher who will be designated as Internship Supervisor. After completion of summer internship, students will have to produce a report related to the work carried out along with a course completion certificate from the concerned organization/industry/ institute. The internship shall be evaluated internally based on presentation and viva-voce by Board of Examiners nominated by the principal of the college.

BCA (Software Development) - SIXTH SEMESTER

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

Course Title: Introduction to Android Programming
Course Code: UMJCST661
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 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Android Application Development course is designed to speed up with writing apps for Android devices.
2. Learn the basics of Android platform and get to understand the application lifecycle
3. Learn to write simple GUI applications, use built-in widgets and components, work with the database to store data locally, and much more.

Unit-1

Android Overview, Android Versions, Environmental Setup, JDK, SDK, Architecture, Features, Libraries, Emulator, Creating First Android Application.

15 Hrs

Unit-2

Introduction to Activities, Activity Lifecycle, Introduction to Intents, Linking Activities using Intents, Calling inbuilt Applications Using Intents, Introduction to Fragments, Adding fragments dynamically, Lifecycle of Fragments, Interaction between fragments.

15 Hrs

Unit-3

UI Controls, Views and Viewgroups, Textview, Edittext, Autocomplete Textview, Buttons, Image Button, Toggle Button, Radio Button and Radio group, Check Box, Action Bar, Progress Bar, Time Picker, Data Picker, List, UI Layout (Absolute Layout, Table Layout, Frame Layout, Scroll Layout, Relative Layout), Notifications.

15 Hrs

Unit-4

Basic Graphics, Input Handling, Image View, Image Switcher, Playing Audio, Playing Video, Introduction to SQLite, SQLite Openhelper, SQLite Database, Creating, Opening and Closing Database, Working with Cursors, Insert, Delete, Update, Building and execute Queries.

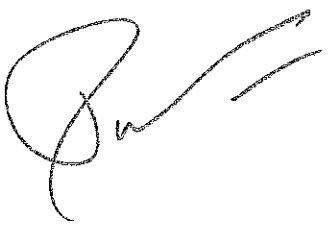
15 Hrs

Suggested readings/ references:

1. Greg Nudeiman "Android Design Patterns: Interaction Design Solution for Developers", Wiley.
2. Android application development for java programmers. By James C. Sheusi. Publisher: Cengage Learning.
3. Dave Smith and Jeff Friesen, "Android Recipes: A Problem Solution Approach", A Press.
4. Bill Philips and Brain Hardy "Android Programming: Big Nerd Ranch Guide "2nd Edition.
5. Erik Hellman "Android Programming Pushing the Limits", Wiley.

Online reading / supporting material:

1. http://www.developer.android.com
2. http://docs.oracle.com/javase/tutorial/index.htm (Available in the form of free downloadable ebooks also).



BCA (Software Development) - SIXTH SEMESTER

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

Course Title: Introduction to Android Programming
Course Code: UMJCST661
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 2025, 2026 and 2027

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

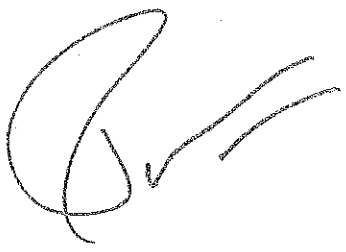
15 Marks

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 (Software Development) - SIXTH SEMESTER

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

Course Title: Artificial Intelligence
Course Code: UMJCST662
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To introduce basic concepts and techniques of Artificial Intelligence (AI).
2. To apply informed search techniques for different applications.
3. To learn various knowledge representation techniques and writing Prolog programs.
4. To learn about the latest techniques for developing AI systems

Unit-1

Introduction to Artificial Intelligence, Background and Applications, Turing Test and Rational Agent approaches to AI, Introduction to Intelligent Agents, their structure, behavior and environment.

15 Hrs

Unit-2

Problem Solving and Searching Techniques: Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristics Search Techniques: Best First Search, A* algorithm, Constraint Satisfaction Problem, Means-End Analysis, Introduction to Game Playing, Min-Max and Alpha-Beta pruning algorithms.

15 Hrs

Unit-3

Knowledge Representation: Introduction to First Order Predicate Logic, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, Frames, and Scripts, Production Rules, Conceptual Graphs. Programming in Logic (PROLOG)

15 Hrs

Unit-4

Dealing with Uncertainty and Inconsistencies: Truth Maintenance System, Default Reasoning, Probabilistic Reasoning, Bayesian Probabilistic Inference, Possible World Representations.

Understanding Natural Languages: Parsing Techniques, Context-Free and Transformational Grammars, Recursive and Augmented Transition Nets.

15 Hrs

Suggested readings/ references:

1. Russell, Stuart, J. and Norvig, Peter, *Artificial Intelligence - A Modern Approach*,Pearson, 4th edition, 2020.
2. Patterson, DAN, W, *Introduction to A.I. and Expert Systems* – PHI.
3. Clocksin, W., F. and Mellish, *Programming in PROLOG*, 5th edition, Springer.
4. Bratko, Ivan, *Prolog Programming for Artificial Intelligence*, Addison-Wesley,Pearson Education, 4th edition.

BCA (Software Development) - SIXTH SEMESTER

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

Course Title: Artificial Intelligence
Course Code: UMJCST662
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

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.

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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

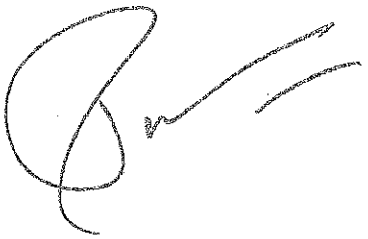
15 Marks

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 (Software Development) - SIXTH SEMESTER

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

Course Title: Programming in Python
Course Code: UMJCST663
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25

For examinations to be held in May 2025, 2026 and 2027

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-1

Introduction: Basic concepts: Functional Programming OOP'S 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 Hrs

Unit-2

Conditional statements and Loops: Modulus 0perator, 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 Hrs

Unit-3

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 Hrs

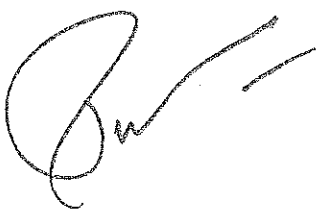
Unit-4

Lists, Dictionaries and Tuples: Lists- List as a sequence, traversing a list, List operations, List slices, List 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, list and Tuples, Dictionaries and Tuples.

15 Hrs

Suggested references:

1. T. Budd, Exploring Python, TMH, 1 st Edition.
2. Python Tutorial/Documentation www.python.
3. Allen Downey, Jeffrey Elkner, Chris Meyers, how to think like a computer scientist: learning with Python, freely available online.
4. http://docs.python.Org/3/tutorial/index.html
5. http://interactivepython.org/courselib/static/pythonds
6. http://www.ibiblio.org/g2swap/byteofpython/read/



BCA (Software Development) - SIXTH SEMESTER

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

Course Title: Programming in Python
Course Code: UMJCST663
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25

For examinations to be held in May 2025, 2026 and 2027

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

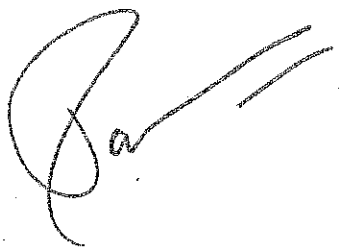
15 Marks

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 (Software Development) - SIXTH SEMESTER

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

Course Title: Neural Networks
Course Code: UMJCST664
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25

For examinations to be held in May 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Understand the difference between biological neuron and artificial neuron
2. Understand building blocks of Neural Networks.
3. Understand the Application areas of Neural Networks
4. Develop Neural Network Models

Unit-1

Introduction to Neural Networks: Basics of neural networks and human brain, Models of a neuron, Biological Neuron- Artificial Neural Model-Types of activation functions, Characteristics of Artificial Neural Networks, Neural Network viewed as Directed Graphs, Network Architectures.
techniques

Unit-2

15 Hrs

Learning Process 1: Error correction learning, Memory based Learning, Hebbian Learning. Learning Process 2: Competitive, Boltzmann Learning, Credit Assignment problem, Memory, Adaption, Statistical nature of learning process. Single Layer Perceptron: Perception, The Perceptron Convergence Theorem, Relation between the Perceptron and Bayes Classifier for a Gaussian Environment, The Batch Perceptron Algorithm.

Unit-3

15 Hrs

Multilayer Perceptron: Introduction, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR problem, Heuristics for Making the back-propagation Algorithm Perform Better, Multilayer Feed Forward Networks, Generalization, Cross Validation, Recognition tasks performed by feed forward nets: Pattern Classification, Pattern Recognition, Pattern Association, Pattern Mapping.

Unit-4

15 Hrs

Feedback Neural Networks: Competitive Learning Neural Networks, Stochastic Networks, Simulated Annealing, Hopfield Network, Boltzmann Machine, Associative Memory Task performed by Competitive Nets: Pattern Clustering, Pattern Storage.

15 Hrs

Suggested references:

1. Neural Networks a comprehensive foundation, Simon Hhaykin, Pearson Education 2nd Edition.
2. Haykins, "Neural Networks" ,1e, 2003, Pearson Education Asia.
3. Mohamad H. Hassoun, "Fundamental of Artificial Neural Network", 2e, PHI.

BCA (Software Development) - SIXTH SEMESTER

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

Course Title: Neural Networks
Course Code: UMJCST664
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25

For examinations to be held in May 2025, 2026 and 2027

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

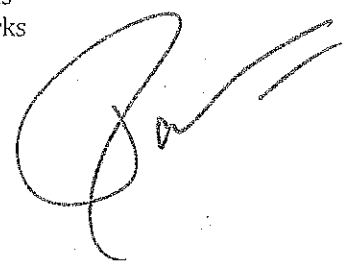
15 Marks

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 (Software Development) - SIXTH SEMESTER

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

Course Title: Artificial Intelligence
Course Code: UMICST665
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To introduce basic concepts and techniques of Artificial Intelligence (AI).
2. To apply informed search techniques for different applications.
3. To learn various knowledge representation techniques and writing Prolog programs.
4. To learn about the latest techniques for developing AI systems.

Unit-1

Introduction to Artificial Intelligence, Background and Applications, Turing Test and Rational Agent approaches to AI, Introduction to Intelligent Agents, their structure, behavior and environment.

Unit-2 15 Hrs

Problem Solving and Searching Techniques: Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristics Search Techniques: Best First Search, A* algorithm, Constraint Satisfaction Problem, Means-End Analysis, Introduction to Game Playing, Min-Max and Alpha-Beta pruning algorithms.

Unit-3 15 Hrs

Knowledge Representation: Introduction to First Order Predicate Logic, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, Frames, and Scripts, Production Rules, Conceptual Graphs. Programming in Logic (PROLOG)

Unit-4 15 Hrs

Dealing with Uncertainty and Inconsistencies: Truth Maintenance System, Default Reasoning, Probabilistic Reasoning, Bayesian Probabilistic Inference, Possible World Representations. Understanding Natural Languages: Parsing Techniques, Context-Free and Transformational Grammars, Recursive and Augmented Transition Nets.

Suggested readings/ references: 15 Hrs

1. Russell, Stuart, J. and Norvig, Peter, *Artificial Intelligence - A Modern Approach*,Pearson, 4th edition, 2020.
2. Patterson, DAN, W, *Introduction to A.I. and Expert Systems* – PHI, 2007.
3. Clocksin, W., F. and Mellish, *Programming in PROLOG*, 5th edition, Springer, 2003
4. Bratko, Ivan, *Prolog Programming for Artificial Intelligence*, Addison-Wesley,Pearson Education, 4th edition, 2012.

BCA (Software Development) - SIXTH SEMESTER

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

Course Title: Artificial Intelligence
Course Code: UMICST665
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

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

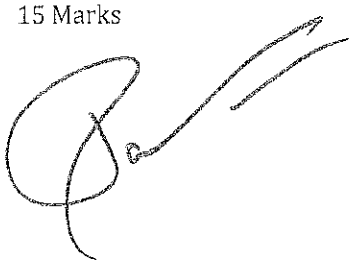
15 Marks

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 (Software Development) - SEVENTH SEMESTER

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

Course Title: Research Methodology and Research Ethics
Course Code: UMJCST761
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To acquaint and enhance the knowledge of research methodology and ethics.
2. To provide insights as to how research is conducted.
3. Develop the ability to design robust research studies, including selecting appropriate methodologies, sampling techniques, and data collection methods.

Unit-1

Introduction to Research: The concept of research, characteristics of good research, Application of Research, Meaning and sources of Research problem, characteristics of good Research problem, Research process, outcomes, Meaning and types of Research hypothesis, Importance of Review of Literature, Organizing the Review of Literature. Types of Research: Types of research, pure (basic, fundamental) and applied research, qualitative and quantitative.

Unit-2 15 Hrs

Research Design: Meaning, need, types of research design – Exploratory, Descriptive, Casual research Design, Components of research design, and Features of good Research design. Experiments, surveys and case study Research design. Qualitative and Quantitative Research. Sampling, Data Collection and analysis: Types and sources of data – Primary and secondary, Methods of collecting data, Concept of sampling and sampling methods – sampling frame, sample, characteristics of good sample, simple random sampling, purposive sampling, convenience sampling, snowball sampling

Unit-3 15 Hrs

Classification and tabulation of data, graphical representation of data, graphs and charts – Histograms, frequency polygon and frequency curves, bell shaped curve and its properties. Statistical Methods for Data Analysis: Applications of Statistics in Research, measures of central tendency and dispersion. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages).

Unit-4 15 Hrs

Overview of Research Ethics, Definition and importance of research ethics. Ethical Principles in Research, Principles like beneficence, justice, and respect for persons. Ethics in Data Collection and Analysis Informed consent, confidentiality, and privacy. Ethical Publication and Communication Issues of plagiarism, data fabrication, and falsification. Qualities of good researcher.

15 Hrs

Suggested readings/ references:

1. Donald Cooper and PS Schindler (2009) Business Research Methods, 9th edition, Tata McGraw Hill.
2. Kothari C. R Research Methodology
3. Uma Sekaran (2010) Research Methods for Business, 4th edition, Wiley.
4. Ranjit Kumar (2009) Research Methodology, 2nd edition, Pearson Education

BCA (Software Development) - SEVENTH SEMESTER

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

Course Title: Research Methodology and Research Ethics
Course Code: UMJCST761
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

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

10 marks

Final Examination

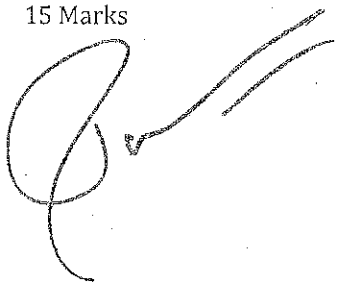
15 Marks

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 (Software Development) - SEVENTH SEMESTER

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

Course Title: Shell Programming
Course Code: UMJCST762
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 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Understand the basic concepts of UNIX Architecture and basic Commands.
2. Understand different types of Files, File system and basic file system commands.
3. Understand the commands related to Shell basics, vi editor and regular expression commands.
4. Understand the concepts of advance file concepts, commands related to Shell script and filter commands.

Unit-1

Introduction to Shell Programming, Overview of shells and their importance, Various Types of Shell, Basic commands: ls, cd, pwd, cp, mv, rm, Understanding the file system, Basic file permissions and ownership, Introduction to shell scripts, Writing and executing simple scripts, Variables and data types, System variables, Ordinary and environment variables, positional parameters, passing command line arguments. Shell Keywords, The. profile, read and read-only commands. The tput command, Command line arguments. exit and exit status of a command.

Unit-2 15 Hrs

Control structures: if-then-fi, if-then-else-fi, elif, nested if-elses, case control structure, Looping constructs: for, while, until loop, nesting of loops, break and continue statements, Scope of variables, Logical operators for conditional execution. The set and shift commands and handling positional parameters. The test command and its shortcut. Operators and types of operators.

Unit-3 15 Hrs

Functions and modular programming, Command-line arguments and options ($1, $2, etc), Using getopts for parsing options, Advanced variable usage, Arrays and associative arrays, Error handling and exit codes, grep: Searching patterns in text, awk and sed: Text processing tools.

Unit-4 15 Hrs

Creating Shell Programs for Automate System Tasks find: Searching for files, archiving and compression: tar, gzip, zip, User and group management, Process management (ps, kill), System monitoring (top, htop), Automating tasks at scheduled intervals, Basic networking commands (ping, traceroute, ifconfig), SSH for remote access, File transfer: scp, rsync.

15 Hrs

Suggested readings/ references:

1. "UNIX Concepts and Applications" – Sumitabha Das, Tata McGraw-Hill Education.
2. "UNIX Shell Programming" – Yashwant Kanetkar, BPB Publications.
3. "The Linux Command Line" -William E. Shotts
4. "Learning the bash Shell"-Cameron Newham and Bill Rosenblatt
5. "Classic Shell Scripting"-Arnold Robbins and Nelson H.F. Beebe
6. "Unix Shell Programming"-Stephen G. Kochan and Patrick Wood
7. "Mastering Unix Shell Scripting"-Randal K. Michael

BCA (Software Development) - SEVENTH SEMESTER

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

Course Title: Shell Programming
Course Code: UMJCST762
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 2025, 2026 and 2027

NOTE FOR PAPER SETTERS FOR EXAMINATIONS –

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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 (Software Development) - SEVENTH SEMESTER

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

Course Title: Introduction to R software
Course Code: UMJCST763
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25

For examinations to be held in Dec 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Import/export small data sets in and out of R environment.
2. Draw different types of plots to aid analysis of datasets.
3. Identify a suitable technique for analysis data for the given objective.
4. Interpret and use the results of analysis.

Unit-1

Introduction to R: Installation of R, features of R, applications of R programming, data types in R, scripting in R, data editing, use of R as a calculator, control structures in R.

15 Hrs

Unit-2

Data Handling in R: Importing data in R (loading Tables and CSV files), Reading and writing files in R

15 Hrs

Unit-3

Basic data structures in R: Vectors, matrices, array, lists, data frames.

15 Hrs

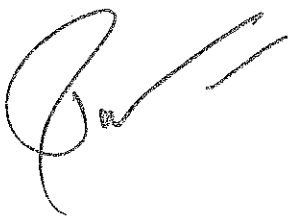
Unit-4

Visualization Tools: Introduction to simple graphics and plots, bar charts, histograms, pie charts, scatter plots (plotting multiple variables), line plots and regression, word clouds, radar charts, waffle charts, box plots, exporting plots as images.

15 Hrs

Suggested references:

1. Thomas Rahlf, Data Visualization with R: 100 Examples, Springer, 2017.
2. Joseph Adler, R in a Nutshell: A Desktop Quick Reference, 2nd edition, O'Reilly Media, 2012.
3. Robert Kabacoff, R in Action: Data Analysis and Graphics with R, Manning Publications, 2011.
4. Tilman M. Davies, The book of R, 1st Edition, No Starch Press, 2016.



BCA (Software Development) - SEVENTH SEMESTER

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

Course Title: Introduction to R software
Course Code: UMJCST763
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25

For examinations to be held in Dec 2025, 2026 and 2027

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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

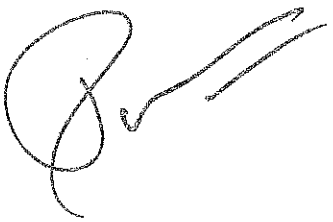
15 Marks

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 (Software Development) - SEVENTH SEMESTER

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

Course Title: Analysis and Design of Algorithms
Course Code: UMJCST764
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25

For examinations to be held in Dec 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Analyse the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.

Unit-1

Introduction: Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm.
Algorithm Design Techniques: Iterative techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms.

15 Hrs

Unit-2

Sorting and Searching Techniques
Advanced Sorting techniques - Heap Sort, Quick Sort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Searching Techniques, Medians & Order Statistics, Complexity Analysis.

15 Hrs

Unit-3

Lower Bounding Technique: Decision Trees, Balanced Trees, Red-Black Trees

15 Hrs

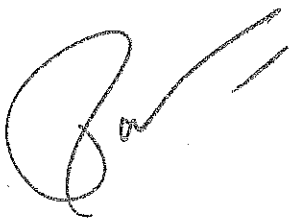
Unit-4

Advanced Analysis Technique: Amortized analysis. Graphs: Graph Algorithms-Breadth First Search, Depth First Search and its Applications, Minimum Spanning Trees.

15 Hrs

Suggested references:

1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction to Algorithms, PHI, 3rd Edition.
2. S. Dasgupta, C. Papadimitriou, and U. Vazirani. Algorithms. McGraw-Hill Higher Education.
3. J. Kleinberg and E. Tardos. Algorithm design. Addison-Wesley. First edition 2005, 2nd edition February 2022.
4. S.Skiena, The Algorithm Design Manual, 2nd edition, Springer.



BCA (Software Development) - SEVENTH SEMESTER

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

Course Title: Analysis and Design of Algorithms
Course Code: UMJCST764
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25

For examinations to be held in Dec 2025, 2026 and 2027

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

10 marks

Final Examination

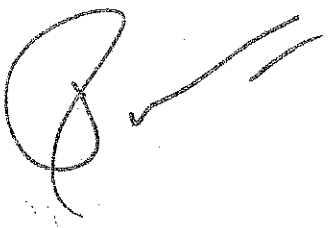
15 Marks

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 (Software Development) - SEVENTH SEMESTER

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

Course Title: Shell Programming
Course Code: UMICST765
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 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Understand the basic concepts of UNIX Architecture and basic Commands.
2. Understand different types of Files, File system and basic file system commands.
3. Understand the commands related to Shell basics, vi editor and regular expression commands.
4. Understand the concepts of advance file concepts, commands related to Shell script and filter commands.

Unit-1

Introduction to Shell Programming, Overview of shells and their importance, Various Types of Shell, Basic commands: ls, cd, pwd, cp, mv, rm, Understanding the file system, Basic file permissions and ownership, Introduction to shell scripts, Writing and executing simple scripts, Variables and data types, System variables, Ordinary and environment variables, positional parameters, passing command line arguments. Shell Keywords, The. profile, read and read-only commands. The tput command, Command line arguments. exit and exit status of a command.

15 Hrs

Unit-2

Control structures: if-then-fi, if-then-else-fi, elif, nested if-elses, case control structure, Looping constructs: for, while, until loop, nesting of loops, break and continue statements, Scope of variables, Logical operators for conditional execution. The set and shift commands and handling positional parameters. The test command and its shortcut. Operators and types of operators.

15 Hrs

Unit-3

Functions and modular programming, Command-line arguments and options ($1, $2, etc), Using getopts for parsing options, Advanced variable usage, Arrays and associative arrays, Error handling and exit codes, grep: Searching patterns in text, awk and sed: Text processing tools.

15 Hrs

Unit-4

Creating Shell Programs for Automate System Tasks find: Searching for files, archiving and compression: tar, gzip, zip, User and group management, Process management (ps, kill), System monitoring (top, htop), Automating tasks at scheduled intervals, Basic networking commands (ping, traceroute, ifconfig), SSH for remote access, File transfer: scp, rsync.

15 Hrs

Suggested readings/ references:

1. "UNIX Concepts and Applications" – Sumitabha Das, Tata McGraw-Hill Education.
2. "UNIX Shell Programming" – Yashwant Kanetkar, BPB Publications.
3. "The Linux Command Line" -William E. Shotts
4. "Learning the bash Shell"-Cameron Newham and Bill Rosenblatt
5. "Classic Shell Scripting"-Arnold Robbins and Nelson H.F. Beebe
6. "Unix Shell Programming"-Stephen G. Kochan and Patrick Wood
7. "Mastering Unix Shell Scripting"-Randal K. Michael

BCA (Software Development) - SEVENTH SEMESTER

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

Course Title: Shell Programming
Course Code: UMICST765
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 2025, 2026 and 2027

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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

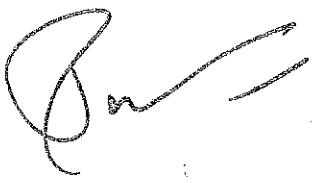
Final Examination 15 Marks

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 (Software Development) - EIGHTH SEMESTER

Course: Major
Course Credits :(L-P-T)
(0-12-0)
Total marks: 300

Course Title: Project Work
Course Code: UMJCSP861
Project Evaluation: 200 Marks
Viva/Presentation: 100 Marks

For examinations to be held in May 2026, 2027 and 2028

To provide the hands on experience in analyzing, designing and implementing various projects, students will be assigned major projects based on the languages they have learned. The project work would be carried out in the department under the guidance of a faculty member. The project work will be assigned to the individual students or group of students in case of bigger project with prior permission of the faculty member of the department. The student is required to submit the certification of successful completion of project from the guide mentioning the total number of hours worked per week and conduct during the project period.

Based on the project work a formal project report should be prepared under the guidance of faculty and submitted to department for evaluation. The Project work shall be evaluated by Board of Examiners nominated by the principal of the college. Examiners will conduct the viva-voce; examine the presentation, project report and demonstration of the project.

Project Work = **12 credits (300 marks)**
Project Evaluation = 08 credits (200 marks)
Viva/ Presentation = 04 credits (100 marks)

Guidelines:

1. The project proposal should be prepared in consultation with the guide. The project proposal should clearly state the project objectives and the environment of the proposed project to be undertaken. As far as possible, the Project should be on a real life problem.
2. The project work should compulsorily include the software development.
3. Synopsis of the project would be submitted to the department depicting the title of the project, DFDs, brief description of project etc.
4. Project proposal to be scrutinized by the Faculty of the Department and the progress of the project work should be continuously monitored by concerned guide.
5. Student is required to work in the Computer Lab. on the project sanctioned.
6. The project report must be submitted in accordance with the prescribed format. Project report would be submitted to the Department before the prescribed date.
7. Students have to make presentations of project work during evaluation. The student shall demonstrate working of the software.

Proforma for the Project Report

1. Title of the Project
2. Objectives
3. System Analysis and Design
4. Input to the Project
5. Output generated
6. Details of Hardware Platform used and Software Tools used
7. Implementation Issues (Clearly defining the area of Application).
8. Miscellaneous
9. Future scope and further enhancement of the Project
10. Bibliography

BCA (Software Development) - EIGHTH SEMESTER

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

Course Title: IoT and its Applications
Course Code: UMJCST862
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

Course objectives & learning outcomes:

1. Describe what IoT is and how it works today and recognise the factors that contributed to the emergence of IoT
2. Design and program IoT devices and use real IoT protocols for communication
3. Define the infrastructure for supporting IoT deployments

Unit-1

Fundamentals of IoT: Introduction, History of IoT, Definitions, Scope, Characteristics, Applications of IoT, Various technologies (Hardware & Software) making up IoT ecosystem, IoT levels, IoT Architectures, Physical & Logical Design of IoT, Edge Computing and Cloud Computing, IoT Standards, Functional blocks of IoT and Communication Models, Difference between IoT and M2M.

15 Hrs

Unit-2

Sensors Networks: Definition, Types of Sensors, Types of Actuators, Examples and Working, Microcontrollers and microprocessors, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks- Introduction, Challenges and Constraints & Applications. Security in WSN: Challenges of Security in Wireless Sensor Networks, Wireless Technologies for IoT: IEEE 802.15.4, ZigBee, HART, IP Based Protocols for IoT IPv6, REST, Communication protocols (MQTT, CoAP, HTTP).

15 Hrs

Unit-3

Introduction to IoT programming languages: Embedded systems programming, IoT operating systems (FreeRTOS, mbed OS), Building IoT applications: Introduction to Arduino IDE – writing code in sketch, compiling-debugging, uploading the file to Arduino board. Embedded 'C' Language basics - Variables and Identifiers, Built-in Data Types, Arithmetic operators and Expressions, Constants and Literals, assignment. Conditional Statements and Loops - Decision making using Relational Operators, Logical Connectives - conditions, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement. Arrays – Declaring and manipulating single dimension arrays Functions - Standard Library of C functions in Arduino IDE, Prototype of a function: Formal parameter list, Return Type, Function call.

15 Hrs

Unit-4

Data collection, storage, and retrieval: Database systems for IoT, Big Data and analytics in IoT, IoT Edge computing and fog computing. Security and Future of IoT ecosystem need of security in IoT, security protocols (DTLS, TLS), Attack, Defense, and Network Robustness of Internet of Things, Privacy Preservation Data Dissemination, Authentication in IoT. Future IoT eco system - Examples for new trends - AI, ML penetration to IoT.

15 Hrs

Suggested readings/ references:

1. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN: 978-1- 84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
3. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
4. David Hanes and Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things"
5. Charles Crowell, "IoT - Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT"

BCA (Software Development) - EIGHTH SEMESTER

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

Course Title: IoT and its Applications
Course Code: UMJCST862
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

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

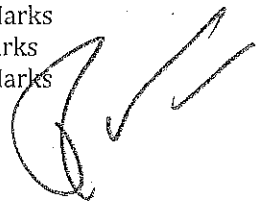
15 Marks

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 (Software Development) - EIGHTH SEMESTER

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

Course Title: Cryptography and Network Security
Course Code: UMICST863
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

Course objectives & learning outcomes:

1. Understand basics of Cryptography and Network Security.
2. To be able to secure a message over insecure channel by various means.
3. Learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. Understand various protocols for network security to protect against the threats in the networks.

Unit-1

Introduction to Cryptography and Block Ciphers: Introduction to security attacks - services and mechanism - introduction to cryptography Conventional Encryption: Conventional encryption model - classical encryption techniques substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and block ciphers - Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion and diffusion - Data Encryption Standard(DES) - strength of DES - differential and linear crypt analysis of DES - block cipher modes of operations - triple DES – AES.

15 Hrs

Unit-2

Public key cryptography and Authentication requirements: Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS.

15 Hrs

Unit-3

Integrity checks and Authentication algorithms: MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME.

15 Hrs

Unit-4

Security and Key Management: IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. Web and System Security Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.

15 Hrs

Suggested readings/ references:

1. Atul Kahate," Cryptography and Network Security ", McGraw Hill Education.
2. William Stallings, "Cryptography and Network security Principles and Practices", Pearson/PHI.
3. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", Pearson.
4. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
5. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.
6. WenboMao," Modern Cryptography: Theory and Practice," Prentice Hall
7. William Stallings," Network Security Essentials: Applications and Standards", Prentice Hall
8. Douglas R. Stinson, CRC press."Cryptography: Theory and Practice "

BCA (Software Development) - EIGHTH SEMESTER

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

Course Title: Cryptography and Network Security
Course Code: UMICST863
Mid Semester assessment: 15 Marks of 1.5 hours duration
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For examinations to be held in May 2026, 2027 and 2028

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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 (Software Development) - EIGHTH SEMESTER

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

Course Title: Introduction to Cloud Computing
Course Code: UMJCST864
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25

For examinations to be held in May 2026, 2027 and 2028

Course objectives & learning outcomes:

1. Knowledge of the fundamental concepts and principles of cloud computing, including virtualization, scalability, reliability, and security.
2. Ability to design, develop, and deploy cloud-based applications using popular cloud platforms and services.
3. Ability to evaluate and select cloud-based solutions based on their technical, economic, and business requirements.
4. Understanding of the broader societal and environmental impacts of cloud-based services and applications.

Unit-1

Overview of Computing Paradigm: Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing. Utility Computing, Cloud Computing. Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Benefits and limitations of Cloud Computing.

15 Hrs

Unit-2

Cloud Computing Architecture: Comparison with traditional computing architecture (client/server), Services provided at various levels, Service Models- Infrastructure as a Service (IaaS), Platform as a Service (PaaS). Software as a Service (SaaS), How Cloud Computing Works, Deployment Models- Public cloud, Private cloud. Hybrid cloud, Community cloud, Case study of NIST architecture.

15 Hrs

Unit-3

Case Studies: Case study of Service model using Google App Engine, Microsoft Azure, Amaz EC2, Eucalyptus. Service Management in Cloud Computing, Service Level Agreements (SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud,Economics of scaling.

15 Hrs

Unit-4

Cloud Security: Infrastructure Security- Network level security, Host level security, Application-level security, Data security and Storage- Data privacy and security Issues, Jurisdictional issues raised by Data location, Authentication in cloud computing.

15 Hrs

Suggested readings/ references:

1. Cloud Computing Bible, Barrie Sosinskj , Wiley-India.
2. Cloud Computing. Principles and Paradigm's, Editors: Raj Kumar Buyya, James Broberg, Andrzej M. Goscinski, Wile.
3. Cloud Computing. Principles, Systems and Applications, Editors. Nikos Antonopoulos, Lee Gillam, Springer.
4. Cloud Security. A Comprehensive Guide to Secure Cloud Computing, Ronald L.Krutz, Russell Dean Vines, Wiley-India.
5. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications, Adobe Reader ebooks available from eBooks.com.

BCA (Software Development) - EIGHTH SEMESTER

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

Course Title: Introduction to Cloud Computing
Course Code: UMJCST864
Mid Semester assessment: 15 Marks of 1.5 hours duration
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Tutorial: 25

For examinations to be held in May 2026, 2027 and 2028

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10 marks

Final Examination

15 Marks

Pattern for external practical examination

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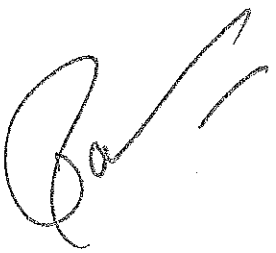
Viva-Voce	5 Marks
Total	15 Marks

Pattern for external tutorial examination

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



BCA (Software Development) - EIGHTH SEMESTER

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

Course Title: Introduction to Cloud Computing
Course Code: UMICST865
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

Course objectives & learning outcomes:

1. Knowledge of the fundamental concepts and principles of cloud computing, including virtualization, scalability, reliability, and security.
2. Ability to design, develop, and deploy cloud-based applications using popular cloud platforms and services.
3. Ability to evaluate and select cloud-based solutions based on their technical, economic, and business requirements.
4. Understanding of the broader societal and environmental impacts of cloud-based services and applications.

Unit-1

Overview of Computing Paradigm: Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing. Utility Computing, Cloud Computing. Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Benefits and limitations of Cloud Computing.

15 Hrs

Unit-2

Cloud Computing Architecture: Comparison with traditional computing architecture (client/server), Services provided at various levels, Service Models- Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), How Cloud Computing Works, Deployment Models- Public cloud, Private cloud. Hybrid cloud, Community cloud, Case study of NIST architecture.

15 Hrs

Unit-3

Case Studies: Case study of Service model using Google App Engine, Microsoft Azure, Amaz EC2, Eucalyptus. Service Management in Cloud Computing, Service Level Agreements (SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud,Economics of scaling.

15 Hrs

Unit-4

Cloud Security: Infrastructure Security- Network level security, Host level security, Application-level security, Data security and Storage- Data privacy and security Issues, Jurisdictional issues raised by Data location, Authentication in cloud computing.

15 Hrs

Suggested readings/ references:

1. Cloud Computing Bible, Barrie Sosinskj , Wiley-India.
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4. Cloud Security. A Comprehensive Guide to Secure Cloud Computing, Ronald L.Krutz, Russell Dean Vines, Wiley-India.
5. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications, Adobe Reader ebooks available from eBooks.com.

BCA (Software Development) - EIGHTH SEMESTER

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

Course Title: Introduction to Cloud Computing
Course Code: UMICST865
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
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Daily evaluation of practical's/tutorials/Viva voce/Records etc.

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Final Examination

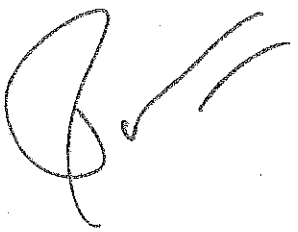
15 Marks

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 (Software Development) - EIGHTH SEMESTER

Course: Skill Enhancement Course
Course Credits :(L-P-T)
(0-12-0)
Total marks: 300

Course Title: Research Project/ Dissertation
Course Code: USECSP866
Dissertation: 200 Marks
Viva/Presentation: 100 Marks

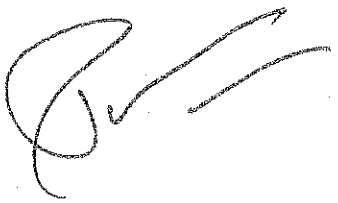
For examinations to be held in May 2026, 2027 and 2028

Research Project/Dissertation is a unique course involving application of knowledge in solving/analyzing/ exploring a real-life situation/complex problem/data analysis. It is intended to provide research competencies at the undergraduate level. It enables the acquisition of special/advanced knowledge through support study/a project work. The following mechanism shall be adopted for completion of the dissertation:

1. Admission to Honours with Research Programme (4th year, 7th Semester) shall be on the basis of the cumulative score (75% marks and above in the first five semesters) and subject to availability of permanent faculty with doctoral degree and infrastructure and number of seats in the College.
2. Research Project work (12 credits) shall be started at the beginning of 7th Semester.
3. There shall be a Project Synopsis in the programme based on the major area/subject. The permanent faculty with Ph.D. and research experience (as per UGC guidelines) shall be the research project supervisor after being recognized by the Departmental Research Committee (DRC) of the Nodal Department. The progress of the dissertation work should continuously be monitored by concerned Supervisor and the research outcomes may be published in Reputed/Refereed/Peer reviewed/indexed Journals.
4. The college offering FYUGP with Research should have its own College Research Committee (CRC) for each discipline with at least one member from any University of the region.
5. The project report/ dissertation shall be evaluated by the external expert from other University/ Colleges to be nominated by the Principal out of the panel supplied by the CRC.
6. Project proposal to be scrutinized by the College Research Committee for the concerned subject.
7. In the 8th Semester, Evaluation of Dissertation shall be offline and Viva-Voce shall be either offline or online as per the convenience of the examiner. The Dissertation evaluation shall be carried out by an external expert.

Research Project = **12 credits (300 marks)**
Dissertation = 08 credits (200 marks)
Viva/ Presentation = 04 credits (100 marks)

Note: A separate guideline shall be issued with regard to the payment of remuneration to the external expert for evaluation of the Research project.



BCA (Data Sc.)

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

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

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

Semester-V

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST531	Analysis and Design of Algorithms	4(3L+1P)	15	60	10	15	100
2	Major	UMJCST532	Computer Networks	4(3L+1T)	15	60	10	15	100
3	Major	UMJCST533	Data warehousing and Data Mining	4(3L+1T)	15	60	10	15	100
4	Major	UMJCST534	Business Intelligence and Analytics	2	10	40	NA	NA	50
5	Minor	UMICST535	Data warehousing and Data Mining	4(3L+1T)	15	60	10	15	100
6	SEC	USECSI536	Summer Internship	2	NA	NA	NA	NA	50

Semester-VI

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST631	Computer Architecture	4(3L+1T)	15	60	10	15	100
2	Major	UMJCST632	Big Data through Hadoop	4(3L+1P)	15	60	10	15	100
3	Major	UMJCST633	Artificial Intelligence	4(3L+1T)	15	60	10	15	100
4	Major	UMJCST634	IoT Concepts and Applications	4(3L+1T)	15	60	10	15	100
5	Minor	UMICST635	Multimedia Computing	4(3L+1T)	15	60	10	15	100

Semester–VII

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST731	Image Processing	4(3L+1T)	15	60	10	15	100
2	Major	UMJCST732	R programming for Data Science	4(3L+1P)	15	60	10	15	100
3	Major	UMJCST733	Research Methodology and Research Ethics	4(3L+1T)	15	60	10	15	100
4	Major	UMJCST734	Data handling and Visualization	4(3L+1T)	15	60	10	15	100
5	Minor	UMICST735	Social Network Analytics	4(3L+1T)	15	60	10	15	100

Semester–VIII (UG Honours)

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCSP831	Project Work	12	NA	NA	NA	NA	300
2	Major	UMJCST832	Machine Learning	4(3L+1P)	15	60	10	15	100
3	Minor	UMICST833	Machine Learning	4(3L+1P)	15	60	10	15	100

Semester–VIII (UG Honours with Research)

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
					Mid Semester	End Exam	Assessment	Exam	
1	Major	UMJCST834	Statistical Concepts	4(3L+1T)	15	60	10	15	100
2	Minor	UMICST833	Machine Learning	4(3L+1T)	15	60	10	15	100
3	SEC	USECSP835	Research Project / Dissertation	12	NA	NA	NA	NA	300

BCA (Data Science) - FIFTH SEMESTER

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

Course Title: Analysis and Design of Algorithms
Course Code: UMJCST531
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 2024, 2025 and 2026

Course objectives & learning outcomes:

1. Develop a strong foundation in algorithm design techniques
2. Understand the principles of algorithm analysis and efficiency.

Unit-1

Basics of Algorithms, Definition and characteristics of algorithms, Importance and applications of algorithmic problem-solving, Algorithm Analysis, Time and space complexity, Asymptotic notation (Big O, Omega, Theta), Worst-case, average-case, and best-case analysis.

15 Hrs

Unit-2

Sorting: Sorting Algorithms, Bubble sort, insertion sort, selection sort, Merge sort, quicksort, radix sort, Comparison of sorting algorithms, Searching Algorithms, Linear search, Binary search, Hashing and hash functions

15 Hrs

Unit-3

Advanced Search Structures: Binary search trees, Balanced search trees, AVL, Red-Black trees, B-trees, Basic Graph Algorithms, Breadth-first search, Depth-first search, Shortest path algorithms: Dijkstra, Bellman-Ford. Minimum Spanning Trees, Kruskal's algorithm, Prim's algorithm, Applications in network design.

15 Hrs

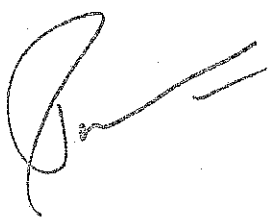
Unit-4

Algorithm Design Strategies, Divide and conquer, Greedy algorithms, Dynamic programming, Backtracking. Dynamic Programming, Principles and applications, Examples: Longest Common Subsequence, Matrix Chain Multiplication, NP-Completeness, Introduction to computational complexity, P vs. NP problem and NP-complete problems.

15 Hrs

Suggested readings/ references:

1. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C., Introduction to Algorithms. MIT Press.
2. Kleinberg, J., & Tardos, É., Algorithm Design. Addison-Wesley.
3. Dasgupta, S., Papadimitriou, C. H., & Vazirani, U. V., Algorithms. McGraw-Hill.



BCA (Data Science) - FIFTH SEMESTER

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

Course Title: Analysis and Design of Algorithms
Course Code: UMJCST531
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Practical: 25 Marks

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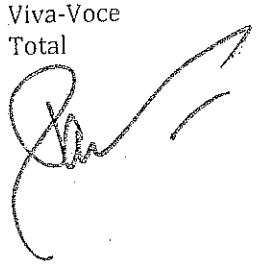


BCA (Data Science) - FIFTH SEMESTER

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

Course Title: Computer Networks
Course Code: UMJCST532
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

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

Course objectives & learning outcomes:

1. To study the basic taxonomy and terminology of the computer networking model and architecture.
2. To study the fundamentals of data communication and protocols.
3. To study network design and performance issues.
4. To explore the basic knowledge of cryptography and network security.

Unit-1

Introduction to Computer Networking, Data Communication, Networks – Distributed Processing, Network Architecture, Applications; Protocols and Standards, Standard Organization, Line Configuration – Point to Point, Multi Point; Topology – Mesh, Star, Tree, Bus, Ring, Hybrid; Transmission mode, Categories of Network – LAN, MAN, WAN, Inter Networks.

15 Hrs

Unit-2

The OSI Reference Model, The TCP/IP Protocol Suite, Comparison between OSI and TCP/IP Reference model, Analog and Digital signals, digital data transmission – parallel transmission, serial transmission, Data Transmission Media: Guided Media and Satellites, Switching: Circuit switching, Message switching and Packet switching.

15 Hrs

Unit-3

Functions of the layers- Physical layer, Data Link layer, Network layer, Transport layer, session layer, Presentation layer, Application layer, Error Detection and Correction, Token Bus, Token Ring and Virtual LAN, Protocols: IP, HTTP, TCP. FTP, ARP

IPv4 Address: Address Space, Classful addressng, Classless addressing, Subnetting and Network Address Translation (NAT), IPv6, UDP, TCP, Routing Algorithms: Distance Vector Routing, Link State Routing.

15 Hrs

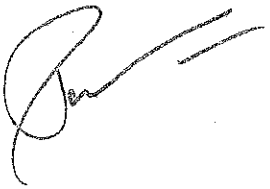
Unit-4

Introduction of Network Security and its importance, Principles of cryptography: Symmetric Key and Public Key, Public Key Algorithm — RSA, Communication Security: IPSec, VPN, Firewalls, Wireless Security, Security Services, Digital Signatures.

15 Hrs

Suggested readings/ references:

1. Behrouz A. Forouzan, "Data Communications and Networking", 4e, 2004, Tata McGraw Hills.
2. Computer Networking – Andres & Tanenbaum"
3. William Stallings. "Data and Computer Communication", 7e, 2016, Pearson Education Asia.
4. Prakash C. Gupta, "Data Communications and Computer Networks", PHI
5. Michael A. Miller, "Data and Network Communications", 2e, Delmar Thomson Learning.



BCA (Data Science) - FIFTH SEMESTER

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

Course Title: Computer Networks
Course Code: UMJCST532
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 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) - FIFTH SEMESTER

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

Course Title: Data Warehousing and Data Mining
Course Code: UMJCST533
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

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

Course objectives & learning outcomes:

1. To improve the analytical skills of Data Warehousing and Mining.
2. Formal introduction to Data Warehousing and Data Mining.
3. Overall development of Data Mining and Warehouse

Unit-1

Introduction to Data Warehousing and Data Mining, Overview of Data Mining and Data Warehousing Concepts, Importance of Data in decision making, Introduction to data preprocessing and cleaning, Basics of data warehouse architecture and design.

15 Hrs

Unit-2

Introduction of Data exploration and Preprocessing, Exploratory Data Analysis (EDA) techniques, Data cleaning, transformation and normalization, Handling missing data and outliers, Feature engineering for effective data mining.

15 Hrs

Unit-3

Data mining techniques, Classification and Regression (decision trees, naïve bayes, regression analysis and evaluation metrics for classification models), Clustering and Association rules (K-Means clustering, hierarchical clustering, association rule mining, evaluation metrics for clustering models).

15 Hrs

Unit-4

Advanced Data mining techniques, Ensemble learning (Bagging and Boosting), Neural Network for data mining, Deep learning in data mining, design and implementation of Data Warehouses, Data integration and ETL (Extract, Transform, Load) processes.

15 Hrs

Suggested readings/ references:

1. Han, J., Kamber, M., & Pei, J. (2011). "Data Mining: Concepts and Techniques." Morgan Kaufmann.
2. Kimball, R., & Ross, M. (2013). "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling." Wiley.
3. Witten, I. H., Frank, E., Hall, M. A., & Pal, C. J. (2016). "Data Mining: Practical Machine Learning Tools and Techniques." Morgan Kaufmann.
4. Inmon, W. H., & Hackathorn, R. D. (2008). "Using the Data Warehouse." Wiley.
5. Tan, P.-N., Steinbach, M., & Kumar, V. (2006). "Introduction to Data Mining." Pearson.
6. Kimball, R., Reeves, L., Ross, M., & Thornthwaite, W. (2011). "The Data Warehouse Lifecycle Toolkit." Wiley.

BCA (Data Science) - FIFTH SEMESTER

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

Course Title: Data Warehousing and Data Mining
Course Code: UMJCST533
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 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

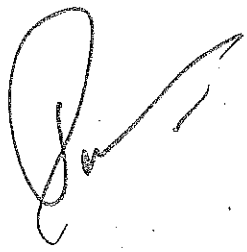
15 Marks

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) - FIFTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: Business Intelligence and Analytics
Course Code: UMJCST534
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 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.

Unit-1

Business Intelligence-Introduction, Definition, History of BI and Evolution, Business Intelligence Segments, Difference between Information and Intelligence, Defining Business Intelligence Value Chain, Factors of Business Intelligence System, Business Intelligence Applications.

15 Hrs

Unit-2

Decision making - Introduction and Definition, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.

15 Hrs

Unit-3

Foundation of Data Analytics- Introduction, Evolution, Concept and Scopes, Big Data, Metrics and Data classification, Data Reliability & Validity, Problem Solving with Analytics, Different phases of Analytics in the business, Descriptive Analytics, Predictive Analytics and Prescriptive Analytics, Different Applications of Analytics in Business, Text Analytics and Web Analytics, Concepts of Data Science.

15 Hrs

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) - FIFTH SEMESTER

Course: Major
Course Credits: (L-P-T)
(2-0-0)
Total marks: 50

Course Title: Business Intelligence and Analytics
Course Code: UMJCST534
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 2024, 2025 and 2026

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.

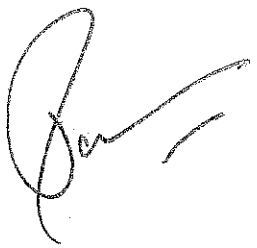
Section A shall consist Four (4) short answer questions (at least one from each unit). The students are required to attempt all questions. Each question shall be of 2½ Marks.

(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) - FIFTH SEMESTER

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

Course Title: Data Warehousing and Data Mining
Course Code: UMICST535
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

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

Course objectives & learning outcomes:

1. To improve the analytical skills of Data Warehousing and Mining.
2. Formal introduction to Data Warehousing and Data Mining.
3. Overall development of Data Mining and Warehouse

Unit-1

Introduction to Data Warehousing and Data Mining, Overview of Data Mining and Data Warehousing Concepts, Importance of Data in decision making, Introduction to data preprocessing and cleaning, Basics of data warehouse architecture and design.

15 Hrs

Unit-2

Introduction of Data exploration and Preprocessing, Exploratory Data Analysis (EDA) techniques, Data cleaning, transformation and normalization, Handling missing data and outliers, Feature engineering for effective data mining.

15 Hrs

Unit-3

Data mining techniques, Classification and Regression (decision trees, naïve bayes, regression analysis and evaluation metrics for classification models), Clustering and Association rules (K-Means clustering, hierarchical clustering, association rule mining, evaluation metrics for clustering models).

15 Hrs

Unit-4

Advanced Data mining techniques, Ensemble learning (Bagging and Boosting), Neural Network for data mining, Deep learning in data mining, design and implementation of Data Warehouses, Data integration and ETL (Extract, Transform, Load) processes.

15 Hrs

Suggested readings/ references:

1. Han, J., Kamber, M., & Pei, J. (2011). "Data Mining: Concepts and Techniques." Morgan Kaufmann.
2. Kimball, R., & Ross, M. (2013). "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling." Wiley.
3. Witten, I. H., Frank, E., Hall, M. A., & Pal, C. J. (2016). "Data Mining: Practical Machine Learning Tools and Techniques." Morgan Kaufmann.
4. Inmon, W. H., & Hackathorn, R. D. (2008). "Using the Data Warehouse." Wiley.
5. Tan, P.-N., Steinbach, M., & Kumar, V. (2006). "Introduction to Data Mining." Pearson.
6. Kimball, R., Reeves, L., Ross, M., & Thornthwaite, W. (2011). "The Data Warehouse Lifecycle Toolkit." Wiley.

BCA (Data Science) - FIFTH SEMESTER

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

Course Title: Data Warehousing and Data Mining
Course Code: UMICST535
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 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) - FIFTH SEMESTER

Course: Skill Enhancement Course
Course Credits: (0-2-0)
Total marks: 50

Course Title: Summer Internship
Course Code: USECSI536
End Semester assessment: 50 Marks

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

It shall be a short-term internship of 15 days' duration for a job/professional training in a suitable organization or hands on training or activity-based course at college level in order to gain work experience.

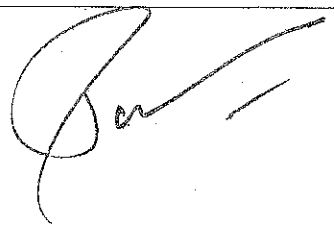
All students will undergo internships/ Apprenticeships in a firm, industry, or organization or Training in labs with faculty and researchers in their own or other HEIs/research institutions during the summer term. Students will be provided with opportunities for internships with local industry, business organizations, health and allied areas, local governments (such as panchayats, municipalities). Parliament or elected representatives, media organizations, artists, crafts persons, and a wide variety of organizations so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability.

Community engagement and service: The curricular component of 'community engagement and service' seeks to expose students to the socio-economic issues in society so that the theoretical learning can be supplemented by actual life experiences to generate solutions to real-life problems. This can be part of summer term activity.

Field-based learning/minor project: The field-based learning/minor project will attempt to provide opportunities for students to understand the different socio-economic contexts. It will aim at giving students exposure to development-related issues in rural and urban settings. It will provide opportunities for students to observe situations in rural and urban contexts, and to observe and study actual field situations regarding issues related to socioeconomic development. Students will be given opportunities to gain a first-hand understanding of the policies, regulations, organizational structures, processes, and programmes that guide the development process. They would have the opportunity to gain an understanding of the complex socio-economic problems in the community., and innovation practices required to generate solutions to the identified problems. This may be a summer term project.

SCHEME OF EXAMINATIONS –

The internship shall be under a college teacher who will be designated as Internship Supervisor. After completion of summer internship, students will have to produce a report related to the work carried out along with a course completion certificate from the concerned organization/industry/ institute. The internship shall be evaluated internally based on presentation and viva-voce by Board of Examiners nominated by the principal of the college.



BCA (Data Science) - SIXTH SEMESTER

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

Course Title: Computer Architecture
Course Code: UMJCST631
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To explain the assembly language programming,
2. To explain the overview of computer organization.
3. To explain the principle of CPU system.

Unit-1

Basic computer organization and design Operational concepts, Instruction codes, Computer Registers, Computer Instructions, Memory locations and addresses, Instruction cycle, Timing and control, Bus structures.

15 Hrs

Unit-2

Assembly Language Programming: Introduction to assembly language, Assembly language programming for a specific architecture. Central Processing Unit: General Register Organization, Stack Organization, Addressing modes, Instruction Classification, Program control.

15 Hrs

Unit-3

Memory Organization Memory Hierarchy, Main Memory, Organization of RAM, SRAM, DRAM, Read Only Memory ROM-PROM, EROM, EEPROM, Auxiliary memory, Cache memory, Virtual Memory, Memory mapping Techniques.

15 Hrs

Unit-4

Parallel Computer Structures: Introduction to parallel processing, Pipeline computers, Multi processing systems, Architectural classification scheme-SISD, SIMD, MISD, MIMD.
Pipelining and Vector processing: Introduction to pipelining, Instruction and Arithmetic pipelines (design) Vector processing, Array Processors.

15 Hrs

Suggested readings/ references:

1. M.Morris Mano-Computer Systems Architecture, Third Edition, Pearson Education.
2. Kai Hwang and F A Briggs-Computer Architecture and parallel processing, McGraw Hills,1990.
3. Carl Hamacher -Computer Organization, Fifth Edition, Tata McGraw Hill.
4. John P Hayes -Computer Architecture & Organization–Mc Graw Hill.
5. William Stallings-Computer Organization and Architecture, Seventh Edition, Pearson Education.

BCA (Data Science) - SIXTH SEMESTER

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

Course Title: Computer Architecture
Course Code: UMJCST631
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

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

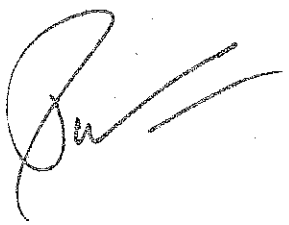
15 Marks

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) - SIXTH SEMESTER

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

Course Title: Big Data through Hadoop
Course Code: UMJCST632
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 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To improve the analytical skills of Big Data.
2. Formal introduction to Hadoop.
3. Overall development of Big Data Hadoop.

Unit-1

Introduction to Big Data, Overview of Big Data, Characteristics and Challenges, Importance of Big Data in Various Industries, Introduction to Hadoop, Evolution of Hadoop, Hadoop Architecture, Hadoop Distributed File System (HDFS), Hadoop Ecosystem Overview, MapReduce Programming Model, Hadoop Ecosystem Components: YARN, HBase, Hive, Pig, etc., Use Cases of Hadoop in Real-world Scenarios.

15 Hrs

Unit-2

Hadoop Distributed File System (HDFS), HDFS Architecture and Components, Data Replication and Fault Tolerance, HDFS Commands and Operations, Map Reduce Programming, Map Reduce Concepts and Workflow, Writing and Running Map Reduce Programs, MapReduce Optimization Techniques, Introduction to HBase, HBase Data Model and Architecture, CRUD Operations in HBase.

15 Hrs

Unit-3

Data Processing and Advanced Concepts, Spark Basics, Introduction to Apache Spark, Spark Architecture and Components, Writing Spark Applications in Scala/Python, Spark Advanced Concepts, Spark RDDs and DataFrames, Spark Streaming, Machine Learning with Spark MLlib.

15 Hrs

Unit-4

Real-world Applications and Case Studies, Big Data Security, Security Challenges in Big Data, Authentication and Authorization in Hadoop, Real-world Applications and Case Studies, Industry-specific Applications (e.g., finance, healthcare, e-commerce), Case Studies of Successful Hadoop Implementations, Emerging Trends in Big Data and Hadoop.

15 Hrs

Suggested readings/ references:

1. White, T. (2015). Hadoop: The Definitive Guide. O'Reilly Media.
2. Mayer-Schönberger, V., & Cukier, K. (2013). Big Data: A Revolution That Will Transform How We Live, Work, and Think. Houghton Mifflin Harcourt.
3. Hurwitz, J. S., Nugent, A., Halper, F., & Kaufman, M. (2013). Big Data For Dummies. Wiley.
4. Koitzsch, K. (2014). Pro Hadoop Data Analytics: Designing and Building Big Data Systems using the Hadoop Ecosystem. Apress.
5. Chambers, B., & Zaharia, M. (2018). Spark: The Definitive Guide. O'Reilly Media.

BCA (Data Science) - SIXTH SEMESTER

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

Course Title: Big Data through Hadoop
Course Code: UMJCST632
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 2025, 2026 and 2027

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

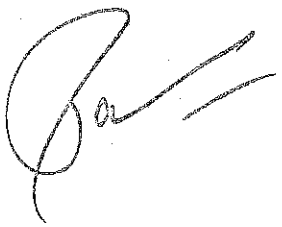
15 Marks

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) - SIXTH SEMESTER

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

Course Title: Artificial Intelligence
Course Code: UMJCST633
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To provide a formal Introduction to Artificial Intelligence.
2. To improve the analytical skills of Artificial Intelligence

Unit-1

Definition, History and Evolution of Artificial intelligence, Overview of artificial intelligence characteristics and challenges, Applications of Artificial Intelligence, Introduction to machine learning, Supervised, unsupervised and reinforcement learning, Artificial Intelligence and Machine learning use cases in real world scenario.

15 Hrs

Unit-2

Regression and classification, Simple and multiple linear regression, model evaluation and interpretation, classification algorithms: SVM, decision trees and Random forest, Clustering algorithms: K-means clustering, Dimensionality reduction.

15 Hrs

Unit-3

Neural Networks and deep learning, convolutional neural networks, Data pre-processing, recurrent neural networks, Introduction to natural language processing, word embedding and text preprocessing, Introduction to genetic algorithm.

15 Hrs

Unit-4

Computer Vision and Image Processing, Reinforcement Learning and Robotics, AI in Healthcare, Finance, and E-commerce, Ethics and Responsible AI, Emerging Trends in AI and Machine Learning, applying machine learning and deep learning to a dataset or problem.

15 Hrs

Suggested readings/ references:

1. Russell, S., & Norvig, P. (2010). Artificial Intelligence: A Modern Approach. Pearson.
2. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
3. Jurafsky, D., & Martin, J. H. (2020). Speech and Language Processing. Pearson.
4. Bishop, C. M. (2006). Pattern Recognition and Machine Learning. Springer.
5. Silver, D., et al. (2018). A General Reinforcement Learning Algorithm that Masters Chess, Shogi, and Go through Self-Play. Science.

BCA (Data Science) - SIXTH SEMESTER

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

Course Title: Artificial Intelligence
Course Code: UMJCST633
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

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) - SIXTH SEMESTER

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

Course Title: : IoT Concepts and Applications
Course Code: UMJCST634
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To explore the fundamental concepts, technologies, and applications of the Internet of Things (IoT).
2. To integrate hardware and software components of IoT to create intelligent, connected systems.
3. To engage students in practical hands-on projects to apply their knowledge and develop IoT solutions.

Unit-1

Definition, evolution, and key components of IoT, Overview of IoT architecture and communication protocols Introduction to IoT platforms and ecosystems. Understanding common sensors and actuators, their functionalities and their integration into networks. Exploring Role of cloud computing in IoT and the significance of edge computing.

15 Hrs

Unit-2

Communication protocols used in IoT, such as MQTT, CoAP, and HTTP. Selecting appropriate protocols for different scenarios. Data exchange formats: JSON, XML. Explore wireless technologies like Wi-Fi, Bluetooth, LoRa and Zigbee in the context of IoT. Authentication and authorization mechanisms, understanding the privacy concerns, security and ethical considerations and challenges in IoT communication.

15 Hrs

Unit-3

Hardware Platforms: Overview of popular IoT hardware platforms i.e., Raspberry Pi and Arduino. Setting up and configuring IoT devices. Interfacing sensors and actuators with IoT devices. Software Platforms: Exploring IoT development platforms i.e., AWS IoT, Azure IoT, ThingSpeak, etc. Building and deploying IoT applications, integration with cloud services.

15 Hrs

Unit-4

Edge Computing: Understanding edge computing and its significance in IoT, edge devices and edge analytics, designing IoT solutions with edge computing capabilities. IoT Analytics: Understanding fundamentals of data analytics for IoT, including data collection, storage, and analysis. Explore tools and techniques for analyzing and visualizing IoT data. Develop skills in interpreting insights derived from IoT data analytics. Big Data concepts in IoT. Applications of IoT: Healthcare and wearables, Smart cities and Infrastructure, Industrial IoT, etc.

15 Hrs

Suggested readings/ references:

1. "IoT Fundamentals, Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes and Gonzalo Salgueiro (Publisher: Pearson India)
2. "Mastering Internet of Things: Unlocking the Power of Connected Devices" by Tim Pulver (Publisher: O'Reilly Media)
3. "Internet of Things Programming Projects: Build modern IoT solutions with the Raspberry Pi 3 and Python" by Colin Dow (Publisher: Pack Publishing)
4. "Designing Connected Products: UX for the Consumer Internet of Things" by Claire Rowland, Elizabeth Goodman, Martin Charlier, and Ann Light (Publisher: O'Reilly Media)
5. "IoT Solutions in Microsoft's Azure IoT Suite: Data Acquisition and Analysis in the Real World" by Scott Klein and Matthew Wenz. (Publisher: Apress)
6. "Internet of Things (IoT): Technologies, Applications, Challenges, and Solutions" by B. K. Tripathy and J. Anuradha (Publisher: CRC Press)
7. "Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security" by Perry Lea (Publisher: Pack Publishing)
8. "The Internet of Medical Things (IoMT): Healthcare Transformation (Advances in Learning Analytics for Intelligent Cloud-IoT Systems)" by R. J. Hemalatha, D. Akila, D. Balaganesh, and Anand Paul (Publisher:Wiley-Scrivener).

BCA (Data Science) - SIXTH SEMESTER

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

Course Title: : IoT Concepts and Applications
Course Code: UMJCST634
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

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

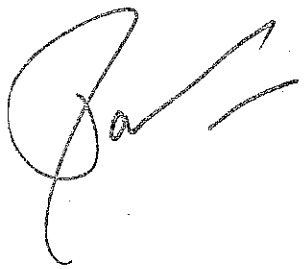
Final Examination 15 Marks

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) - SIXTH SEMESTER

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

Course Title: Multimedia Computing
Course Code: UMICST635
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To grasp fundamental concepts and structures of multimedia systems.
2. To explore sound system principles and speech-related aspects in multimedia.
3. To understand digital image representation, formats, synthesis, and transformation.
4. To gain insights into video signal representation, computer-based animation, and transmission methods in multimedia.

Unit-1

Introduction to Multimedia; Global Structure of Multimedia; Multimedia Application; Multimedia System and Properties; Characteristics of a Multimedia System; Challenges for Multimedia System; Components of a Multimedia System.

15 Hrs

Unit-2

Concept of Sound System; Music and Speech; Speech Generation; Speech Analysis; Speech Transmission.

15 Hrs

Unit-3

Digital Image Representation; Image and graphics Format; Image Synthesis, analysis and Transformation.

15 Hrs

Unit-4

Video Signal Representation; Computer Video Format; Computer- Based animation; Animation Language; Methods of Controlling Animation; Display of Animation; Transmission of Animation.

15 Hrs

Suggested readings/ references:

1. Multimedia Communications, Applications, Networks, Protocols and Standards, Fred Halsall, Pearson Education Asia.
2. Multimedia Systems, John F. Koegel Buford, Pearson Education Asia.

BCA (Data Science) - SIXTH SEMESTER

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

Course Title: Multimedia Computing
Course Code: UMICST635
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2025, 2026 and 2027

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(4 x 12 = 48 marks)

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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) - SEVENTH SEMESTER

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

Course Title: Image Processing
Course Code: UMJCST731
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To develop a foundational understanding of image representation, pixel relationships, and the components of Digital Image Processing systems.
2. To apply image transforms, including Fourier Transform, and enhance images using both frequency and spatial domain techniques.
3. To gain practical skills in image restoration, noise modelling, and grasp the essentials of image compression standards.
4. To learn segmentation techniques, edge detection, and feature extraction, applying these skills to real-world scenarios in fields such as medical imaging and remote sensing

Unit-1

Basics of Image representation and relationship between pixels- Elements of a Digital Image Processing (DIP) system- Simple image formation model and visual perception- Sampling and Quantization- Color fundamentals, models, and File Formats.

15 Hrs

Unit-2

Image Transforms: Fourier Transform, Discrete Fourier Transform- Frequency domain image enhancement: low-pass filtering, high-pass filtering- Spatial domain image enhancement: point processing, contrast stretching, thresholding- Histogram processing: equalization, modification- Spatial filtering techniques: averaging, smoothing, sharpening, median filtering.

15 Hrs

Unit-3

Image Restoration concepts- Noise modelling and Blur removal- Image compression: Need, redundancy, and compression standards (JPEG & MPEG)- Elements of information theory- Error-free and Lossy compression techniques.

15 Hrs

Unit-4

Image Segmentation techniques: Thresholding, Region-based segmentation- Edge, lines, and curve detection, edge operators- Image Features and Extraction- Texture analysis- Case Studies in Image Security, Steganography, and Digital watermarking- Visual effects, Case studies in Medical Imaging and remote sensing.

15 Hrs

Suggested readings/ references:

1. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, Pearson Education.
2. Digital Image Processing: An Algorithmic Approach with MATLAB, Uvais Qidwai, Akshay Kulkarni, CRC Press.
3. Principles of Digital Image Processing: Core Algorithms by Wilhelm Burger and Mark J. Burge.
4. Feature Extraction and Image Processing for Computer Vision by Mark S. Nixon and Alberto S. Aguado.

BCA (Data Science) - SEVENTH SEMESTER

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

Course Title: Image Processing
Course Code: UMJCST731
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

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(4 x 12 = 48 marks)

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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) - SEVENTH SEMESTER

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

Course Title: R Programming for Data Science
Course Code: UMJCST732
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 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To Introduce students about the fundamental concepts of data science.
2. To develop students' programming skills in languages commonly used in data science, such as Python or R, and introduce relevant libraries and frameworks.
3. To aware students how to acquire, clean, and pre-process data from various sources to prepare it for analysis.
4. To provide an overview of machine learning concepts and algorithms, including supervised and unsupervised learning techniques.
5. To train students how to evaluate machine learning models and select the best model for a given problem.

Unit-1

Data Scientist's Tool Box: Turning data into actionable knowledge, introduction to the tools that will be used in building data analysis software: version control, markdown, git, GitHub, R, and RStudio.

15 Hrs

Unit-2

R Programming Basics: Overview of R, R data types and objects, reading and writing data, Control structures, functions, scoping rules, dates and times, Loop functions, debugging tools, Simulation, code profiling,

15 Hrs

Unit-3

Getting and Cleaning Data: Obtaining data from the web, from APIs, from databases and from colleagues in various formats. basics of data cleaning and making data —tidyl.

15 Hrs

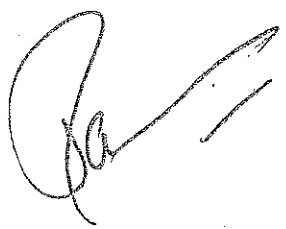
Unit-4

Exploratory Data Analysis: Essential exploratory techniques for summarizing data, applied before formal modeling commences, eliminating or sharpening potential hypotheses about the world that can be addressed by the data, common multivariate statistical techniques used.

15 Hrs

Suggested readings/ references:

1. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontiline" by Schroff/O'Reilly, 2013.
2. Foster Provost, Tom Fawcett, "Data Science for Business" What You Need to Know About Data Mining and Data-Analytic Thinking" by O'Reilly, 2013.
3. John W. Foreman, "Data Smart: Using data Science to Transform Information into Insight" by John Wiley & Sons, 2013.
4. Ian Ayres, "Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart" Ist Edition by Bantam, 2007.
5. Eric Seigel, "Predictive Analytics: The Power to Predict who Will Click, Buy, Lie, or Die", 1st Edition, by Wiley, 2013.
6. Matthew A. Russel, "Mining the Social Web: Data mining Facebook, Twitter, LinkedIn, Goole+, GitHub, and More", Second Edition, by O'Reilly Media, 2013.



BCA (Data Science) - SEVENTH SEMESTER

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

Course Title: R Programming for Data Science
Course Code: UMJCST732
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 2025, 2026 and 2027

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(4 x 12 = 48 marks)

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

10 marks

Final Examination

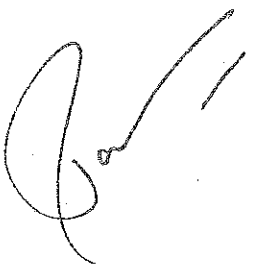
15 Marks

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) - SEVENTH SEMESTER

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

Course Title: Research Methodology and Research Ethics
Course Code: UMJCST733
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To acquaint and enhance the knowledge of research methodology and ethics.
2. To provide insights as to how research is conducted.
3. Develop the ability to design robust research studies, including selecting appropriate methodologies, sampling techniques, and data collection methods.

Unit-1

Introduction to Research: The concept of research, characteristics of good research, Application of Research, Meaning and sources of Research problem, characteristics of good Research problem, Research process, outcomes, Meaning and types of Research hypothesis, Importance of Review of Literature, Organizing the Review of Literature. Types of Research: Types of research, pure (basic, fundamental) and applied research, qualitative and quantitative.

15 Hrs

Unit-2

Research Design: Meaning, need, types of research design – Exploratory, Descriptive, Casual research Design, Components of research design, and Features of good Research design. Experiments, surveys and case study Research design. Qualitative and Quantitative Research. Sampling, Data Collection and analysis: Types and sources of data – Primary and secondary, Methods of collecting data, Concept of sampling and sampling methods – sampling frame, sample, characteristics of good sample, simple random sampling, purposive sampling, convenience sampling, snowball sampling.

15 Hrs

Unit-3

Classification and tabulation of data, graphical representation of data, graphs and charts – Histograms, frequency polygon and frequency curves, bell shaped curve and its properties. Statistical Methods for Data Analysis: Applications of Statistics in Research, measures of central tendency and dispersion. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages).

15 Hrs

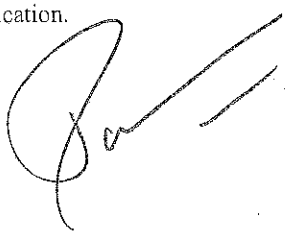
Unit-4

Overview of Research Ethics, Definition and importance of research ethics. Ethical Principles in Research, Principles like beneficence, justice, and respect for persons. Ethics in Data Collection and Analysis Informed consent, confidentiality, and privacy. Ethical Publication and Communication Issues of plagiarism, data fabrication, and falsification. Qualities of good researcher.

15 Hrs

Suggested readings/ references:

1. Donald Cooper and PS Schindler (2009) Business Research Methods, 9th edition, Tata McGraw Hill.
2. Kothari C. R Research Methodology
3. Uma Sekaran (2010) Research Methods for Business, 4th edition, Wiley.
4. Ranjit Kumar (2009) Research Methodology, 2nd edition, Pearson Education.



BCA (Data Science) - SEVENTH SEMESTER

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

Course Title: Research Methodology and Research Ethics
Course Code: UMJCST733
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

NOTE FOR PAPER SETTERS FOR EXAMINATIONS -

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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) - SEVENTH SEMESTER

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

Course Title: Data handling and Visualization
Course Code: UMJCST734
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

Course objectives & learning outcomes:

1. Data Analysis and Visualization intends to extend student's knowledge and practice in data analysis and visualization, software, and applications. It provides the board overview of techniques of the visualization process, detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques.
2. Explain the concept of visualization in the processing and analysis of data.
3. Develop visualization methods and visualization systems using software applications.
4. Perform creative work in the field of visualization.

Unit-1

Introduction to visualization- Introduction of visual perception, Visual representation of data, Data Abstraction, Visual Encodings, Use of Color, Perceptual Issues, Information overloads. Creating visual representations-Visualization reference model, Visual mapping, Visual analytics, Design of Visualization applications.

15 Hrs

Unit-2

Non spatial data visualization- Visualization of one, two and multi-dimensional data, Tabular data, quantitative values (scatter plot), Separate, Order, and Align (Bar, staked Bar, dots and line charts), Tree data, Displaying Hierarchical Structures, graph data, rules for graph drawing and labeling, text and document data, levels of text representation, visualizations of a single text document, word cloud, flow data.
Time series data, characteristics of time data, visualization time series data, mapping of time.

15 Hrs

Unit-3

Spatial Data Visualization- Scalar fields, Isocontours (Topographic Terrain Maps), scalar volumes, Direct Volume Rendering (Multidimensional Transfer Functions) , Maps(dot, pixel), vector fields.Defining Marks and Channels.

15 Hrs

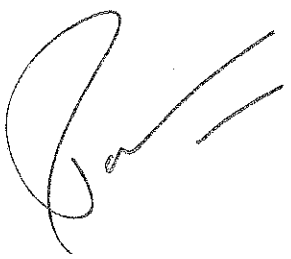
Unit-4

Software tools and data for visualization: The iris data set, The Detroit Data Set, The Breakfast Cereal Data Set, The Dow Jones Industrial Average Data set (time series), MS Spreadsheet, Python, Matlab, Java, Tableau.

15 Hrs

Suggested readings/ references:

1. Fry, Visualizing Data. O'Reilly Media, 2008, ISBN 0596514557
2. Ware, Information Visualization: Perception for Design, 3rd ed. Morgan Kaufmann, 2012
3. Telea, Data Visualization: Principles and Practice. A. K. Peters, Ltd, 2007, ISBN 1568813066.



BCA (Data Science) - SEVENTH SEMESTER

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

Course Title: Data handling and Visualization
Course Code: UMJCST734
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

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

10 marks

Final Examination

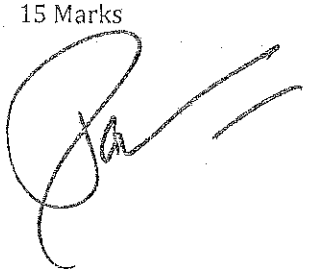
15 Marks

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) - SEVENTH SEMESTER

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

Course Title: Social Network Analytics
Course Code: UMICST735
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

Course objectives & learning outcomes:

1. To provide students with a foundational understanding of social networks, their structure, and the principles of social network analysis.
2. To familiarize students with methods of collecting and preprocessing social network data for analysis.
3. To introduce students to advanced social network analysis techniques and their applications.
4. To explore real-world applications of social network analytics across various domains.

Unit-1

Definition and characteristics of social networks, historical evolution and significance. Graph Theory: Basics, nodes, edges, and graphs. Types of graphs: directed, undirected, weighted. Social network representation: Node and edge attributes, adjacency matrices and adjacency lists. Metrics in social network analysis: Degree centrality, closeness centrality, betweenness centrality, clustering coefficient and network density, some famous social networking sites.

15 Hrs

Unit-2

Data Collection Techniques: Web scraping and APIs, surveys and interviews for network data. Data Cleaning and Preprocessing: handling missing data, removing duplicates and outliers. Data Visualization for social networks: Graph visualization tools, visualization of dynamic networks. Ethical considerations in social network data: Privacy issues, informed consent and data anonymization.

15 Hrs

Unit-3

Community Detection: Modularity-based methods, Girvan-Newman algorithm. Centrality measures in dynamic networks: Temporal centrality metrics, involving networks and temporal analysis. Influence and information diffusion: Identifying influential nodes, modeling information diffusion in networks. Link prediction: common link prediction algorithms, applications in recommendation systems.

15 Hrs

Unit-4

Social network analytics in business: Customer relationship analysis, social media marketing strategies. Healthcare applications: Disease spread modeling, patient interaction networks. Security applications: Identifying suspicious activities, cybersecurity and network forensics. Case studies and project work: Analysis of a real-world social network dataset, project presentations and discussions.

15 Hrs

Suggested readings/ references:

1. "Social Network Analysis: Methods and Applications" by Stanley Wasserman and Katherine Faust (Publisher: Cambridge University Press)
2. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World" by David Easley and Jon Kleinberg (Publisher: IEEE)
3. "Analyzing Social Networks" by Stephen P. Borgatti, Martin G. Everett, and Jeffrey C. Johnson (Publisher: SAGE Publications)
4. "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More" by Matthew A. Russell (Publisher: O'Reilly Media)
5. "Social Network Data Analytics" by Charu C. Aggarwal (Publisher: Springer Nature).
6. 6. "Social Network Analysis for Startups: Finding connections on the social web" by Maksim Tsvetovat and Alexander Kouznetsov (Publisher: O'Reilly Media)
7. 7. "Introduction to Graph Theory" by Douglas B. West (Publisher: Pearson)
8. "Graph Theory and Its Applications" by Jonathan L. Gross, Jay Yellen (Publisher: Chapman and Hall/CRC).

BCA (Data Science) - SEVENTH SEMESTER

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

Course Title: Social Network Analytics
Course Code: UMICST735
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in Dec 2025, 2026 and 2027

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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) - EIGHTH SEMESTER

Course: Major
Course Credits :(L-P-T)
(0-12-0)
Total marks: 300

Course Title: Project Work
Course Code: UMJCSP831
Project Evaluation: 200 Marks
Viva/Presentation: 100 Marks

For examinations to be held in May 2026, 2027 and 2028

To provide the hands on experience in analyzing, designing and implementing various projects, students will be assigned major projects based on the languages they have learned. The project work would be carried out in the department under the guidance of a faculty member. The project work will be assigned to the individual students or group of students in case of bigger project with prior permission of the faculty member of the department. The student is required to submit the certification of successful completion of project from the guide mentioning the total number of hours worked per week and conduct during the project period.

Based on the project work a formal project report should be prepared under the guidance of faculty and submitted to department for evaluation. The Project work shall be evaluated by Board of Examiners nominated by the principal of the college. Examiners will conduct the viva-voce; examine the presentation, project report and demonstration of the project.

Project Work = **12 credits (300 marks)**
Project Evaluation = 08 credits (200 marks)
Viva/ Presentation = 04 credits (100 marks)

Guidelines:

1. The project proposal should be prepared in consultation with the guide. The project proposal should clearly state the project objectives and the environment of the proposed project to be undertaken. As far as possible, the Project should be on a real life problem.
2. The project work should compulsorily include the software development.
3. Synopsis of the project would be submitted to the department depicting the title of the project, DFDs, brief description of project etc.
4. Project proposal to be scrutinized by the Faculty of the Department and the progress of the project work should be continuously monitored by concerned guide.
5. Student is required to work in the Computer Lab. on the project sanctioned.
6. The project report must be submitted in accordance with the prescribed format. Project report would be submitted to the Department before the prescribed date.
7. Students have to make presentations of project work during evaluation. The student shall demonstrate working of the software.

Proforma for the Project Report

1. Title of the Project
2. Objectives
3. System Analysis and Design
4. Input to the Project
5. Output generated
6. Details of Hardware Platform used and Software Tools used
7. Implementation Issues (Clearly defining the area of Application).
8. Miscellaneous
9. Future scope and further enhancement of the Project
10. Bibliography

BCA (Data Science) - EIGHTH SEMESTER

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

Course Title: Machine Learning
Course Code: UMJCST832
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 2026, 2027 and 2028

Course objectives & learning outcomes:

1. To provide students with a foundational understanding of machine learning concepts, types, and applications.
2. To introduce students to various supervised, unsupervised learning techniques and their applications.
3. To provide an overview of neural networks, deep learning architecture and an introduction to reinforcement learning along with their areas of applications.

Unit-1

Introduction: definition and scope of machine learning. Data: labelled and unlabeled data. Machine learning types: supervised, unsupervised, reinforcement learning. Machine learning pipeline: data collection and preprocessing, feature selection/ feature engineering, model training and evaluation. Training issues: underfitting, overfitting, bias-variance tradeoff. Evaluation metrics: confusion matrix, accuracy, precision, recall, specificity, f1-score, ROC and AUC. Applications of machine learning.

15 Hrs

Unit-2

Understanding supervised learning, types of supervised machine learning: regression and classification. Regression analysis: Linear regression, implementation and applications. Classification techniques: Logistic Regression, K-NN, Decision Trees and SVM. Ensemble learning: bagging and boosting, Random Forest, Gradient boosting. Applications of supervised machine learning and issues.

15 Hrs

Unit-3

Unsupervised learning, unlabeled data, need for unsupervised machine learning. Dimensionality reduction: PCA and its working, clustering and its types: K-Means, Hierarchical Clustering, DBSCAN. Association mining: basics of association mining, apriori algorithm, examples. Application areas of Unsupervised learning.

15 Hrs

Unit-4

Perceptron model and its working, activation functions. Types of neural networks: Multilayer Perceptron, feed forward, back-propagation, etc. Deep learning basics, common deep learning architectures: CNN, LSTM, RNN, etc. Deep learning frameworks: tensorflow, pytorch, etc. Basics of Reinforcement: Agent, environment, reward hypothesis and Q-learning. Applications areas and issues.

15 Hrs

Suggested readings/ references:

1. "Introduction to Machine Learning with Python" by Andreas C. Müller and Sarah Guido (Publisher: O'Reilly).
2. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy (Publisher: MIT Press).
3. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron (Publisher: Shroff/O'Reilly).
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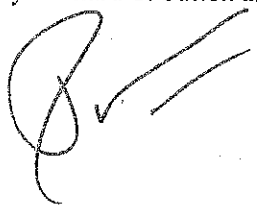
9. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto (Publisher: MIT Press).



BCA (Data Science) - EIGHTH SEMESTER

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

Course Title: Machine Learning
Course Code: UMJCST832
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 2026, 2027 and 2028

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) - EIGHTH SEMESTER

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

Course Title: Machine Learning
Course Code: UMICST833
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 2026, 2027 and 2028

Course objectives & learning outcomes:

1. To provide students with a foundational understanding of machine learning concepts, types, and applications.
2. To introduce students to various supervised, unsupervised learning techniques and their applications.
3. To provide an overview of neural networks, deep learning architecture and an introduction to reinforcement learning along with their areas of applications.

Unit-1

Introduction: definition and scope of machine learning. Data: labelled and unlabeled data. Machine learning types: supervised, unsupervised, reinforcement learning. Machine learning pipeline: data collection and preprocessing, feature selection/ feature engineering, model training and evaluation. Training issues: underfitting, overfitting, bias-variance tradeoff. Evaluation metrics: confusion matrix, accuracy, precision, recall, specificity, f1-score, ROC and AUC. Applications of machine learning.

15 Hrs

Unit-2

Understanding supervised learning, types of supervised machine learning: regression and classification. Regression analysis: Linear regression, implementation and applications. Classification techniques: Logistic Regression, K-NN, Decision Trees and SVM. Ensemble learning: bagging and boosting, Random Forest, Gradient boosting. Applications of supervised machine learning and issues.

15 Hrs

Unit-3

Unsupervised learning, unlabeled data, need for unsupervised machine learning. Dimensionality reduction: PCA and its working, clustering and its types: K-Means, Hierarchical Clustering, DBSCAN. Association mining: basics of association mining, apriori algorithm, examples. Application areas of Unsupervised learning.

15 Hrs

Unit-4

Perceptron model and its working, activation functions. Types of neural networks: Multilayer Perceptron, feed forward, back-propagation, etc. Deep learning basics, common deep learning architectures: CNN, LSTM, RNN, etc. Deep learning frameworks: tensorflow, pytorch, etc. Basics of Reinforcement: Agent, environment, reward hypothesis and Q-learning. Applications areas and issues.

15 Hrs

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BCA (Data Science) - EIGHTH SEMESTER

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

Course Title: Machine Learning
Course Code: UMICST833
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 2026, 2027 and 2028

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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

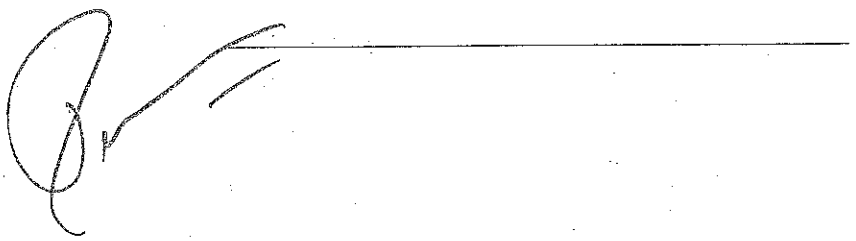
15 Marks

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) - EIGHTH SEMESTER

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

Course Title: Statistical Concepts
Course Code: UMJCST834
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

Course objectives & learning outcomes:

1. To have foundational concepts of statistics
2. Analyzing data with various statistical tools
3. Various applications of statistics in business economics and social sciences.

Unit-1

Definition and Scope of Statistics, Importance of Statistics in various fields, Descriptive vs. Inferential Statistics, Statistical Thinking and Problem Solving, Historical Development of Statistics.

15 Hrs

Unit-2

Measures of Central Tendency: Mean, Median, Mode, Measures of Dispersion: Range, Variance, Standard Deviation, Frequency Distributions and Histograms, Graphical Presentation of Data, Data Cleaning and Outlier Detection.

15 Hrs

Unit-3

Basic Probability Concepts, Discrete Probability Distributions (Binomial, Poisson), Continuous Probability Distributions (Normal, Exponential), Joint and Marginal Probability, Conditional Probability.

15 Hrs

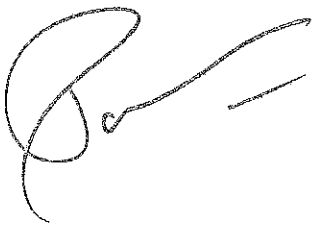
Unit-4

Point and Interval Estimation, Hypothesis Testing, Regression Analysis and Correlation, Analysis of Variance (ANOVA), Applications in Business, Economics, and Social Sciences.

15 Hrs

Suggested readings/ references:

1. "Introduction to the Practice of Statistics" by David S. Moore, George P. McCabe, and Bruce A. Craig
2. "Statistics for Business and Economics" by Paul Newbold, William L. Carlson, and Betty Thorne
3. "Statistics: The Art and Science of Learning from Data" by Alan Agresti and Christine A. Franklin
4. "Statistics: Concepts and Controversies" by David S. Moore, William I. Notz, and Michael A. Fligner
5. "Probability and Statistics for Engineers and Scientists" by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, and Keying Ye
6. "An Introduction to Probability and Statistics" by Vijay K. Rohatgi and A. K. Md. Ehsanes Saleh
7. "Statistical Methods" by S.P. Gupta
8. "Fundamentals of Applied Statistics" by S.C. Gupta and V.K. Kapoor.



BCA (Data Science) - EIGHTH SEMESTER

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

Course Title: Statistical Concepts
Course Code: UMJCST834
Mid Semester assessment: 15 Marks of 1.5 hours duration
End Semester assessment: 60 Marks of 3.0 hours duration
Tutorial: 25 Marks

For examinations to be held in May 2026, 2027 and 2028

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Practical/ tutorial Evaluation
Daily evaluation of practical's/tutorials/Viva voce/Records etc. 10 marks

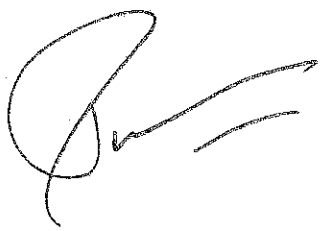
Final Examination 15 Marks

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) - EIGHTH SEMESTER

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

Course Title: Machine Learning
Course Code: UMICST833
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 2026, 2027 and 2028

Course objectives & learning outcomes:

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15 Hrs

Unit-2

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15 Hrs

Unit-3

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15 Hrs

Unit-4

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15 Hrs

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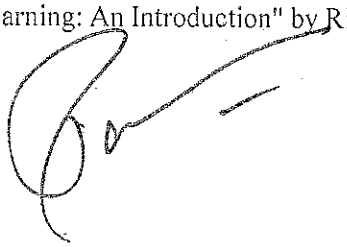

BCA (Data Science) - EIGHTH SEMESTER

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

Course Title: Machine Learning
Course Code: UMICST833
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 2026, 2027 and 2028

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

10 marks

Final Examination

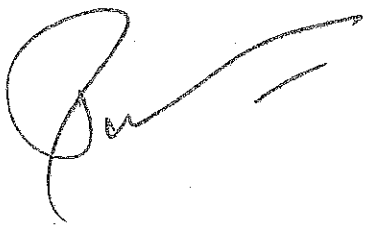
15 Marks

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) - EIGHTH SEMESTER

Course: Skill Enhancement Course
Course Credits :(L-P-T)
(0-12-0)
Total marks: 300

Course Title: Research Project/ Dissertation
Course Code: USECSP835
Dissertation: 200 Marks
Viva/Presentation: 100 Marks

For examinations to be held in May 2026, 2027 and 2028

Research Project/Dissertation is a unique course involving application of knowledge in solving/analyzing/ exploring a real-life situation/complex problem/data analysis. It is intended to provide research competencies at the undergraduate level. It enables the acquisition of special/advanced knowledge through support study/a project work. The following mechanism shall be adopted for completion of the dissertation:

1. Admission to Honours with Research Programme (4th year, 7th Semester) shall be on the basis of the cumulative score (75% marks and above in the first five semesters) and subject to availability of permanent faculty with doctoral degree and infrastructure and number of seats in the College.
2. Research Project work (12 credits) shall be started at the beginning of 7th Semester.
3. There shall be a Project Synopsis in the programme based on the major area/subject. The permanent faculty with Ph.D. and research experience (as per UGC guidelines) shall be the research project supervisor after being recognized by the Departmental Research Committee (DRC) of the Nodal Department. The progress of the dissertation work should continuously be monitored by concerned Supervisor and the research outcomes may be published in Reputed/Refereed/Peer reviewed/indexed Journals.
4. The college offering FYUGP with Research should have its own College Research Committee (CRC) for each discipline with at least one member from any University of the region.
5. The project report/ dissertation shall be evaluated by the external expert from other University/ Colleges to be nominated by the Principal out of the panel supplied by the CRC.
6. Project proposal to be scrutinized by the College Research Committee for the concerned subject.
7. In the 8th Semester, Evaluation of Dissertation shall be offline and Viva-Voca shall be either offline or online as per the convenience of the examiner. The Dissertation evaluation shall be carried out by an external expert.

Research Project = **12 credits (300 marks)**
Dissertation = 08 credits (200 marks)
Viva/ Presentation = 04 credits (100 marks)

Note: A separate guideline shall be issued with regard to the payment of remuneration to the external expert for evaluation of the Research project.