UNIVERSITY OF JAMMU

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

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION
(26/May/Adp./08)

In supersession to this office Notification No. F.Acd./II/26/605-629 dated 22.04.2026, 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 following:

a) The existing syllabi and Courses of Studies of **B.Tech (Information Technology & Mathematical Innovations) Four Year Innovative Undergraduate Programme (Design Your Degree)** of Semester-V **as notified vide no. F.Acd./II/25/12019-035 dated 04.11.2025 is** applicable for the academic session 2025-2026 **only.**

b) Adoption of the revised syllabi and courses of study of **B.Tech (Information Technology & Mathematical Innovations) Four Year Innovative Under graduate Programme (Design Your Degree)** of Semester V **(as given in the annexure)** for the examinations to be held in the years as per details given below:-

Subject	Semester	For the examinations to be held in the year
B.Tech. (Information Technology & Mathematical Innovations)		
	Semester- V	December 2026, 2027 and 2028
	Semester-VI	May 2026, 2027 and 2028

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

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/26/1156-72
Dated: 07/5/2026
Copy for information and necessary action to:-

1. Director/Convener, Board of Studies in Design Your Degree
2. All members of the Board of Studies.
3. C.A. to the Controller of Examinations
4. Director, Computer Centre, University of Jammu
5. Joint Registrar/Deputy Registrar/Asst. Registrar (Conf. /Exams. UG)

7/5/26.
Joint Registrar (Academic)

7/5/26
07/5/2

B. Tech (Information Technology & Mathematical Innovations)

Semester-V (Revised)

For the session 2026,2027,2028

S. No.	Course No.	Course Title	Credits	Internal Evaluation	External Evaluation	Hours/Week			Total Marks
						L	P/EL	T	
1	UMJDTT-511	Understanding Computer System Architecture & Circuits	4	40	60	3	1	0	100
2	UMJDTT-512	The Logic Behind Machines: Theory of Computation	4	40	60	3	1	0	100
3	UMJDTT-513	Information exchange in computing devices: Data Communication & Computer Networks	4	40	60	3	1	0	100
4	UMJDTT-514	Instructing computing devices: Operating System	4	40	60	3	1	0	100
5	UMJDTT-515	Building Blocks of Discrete Structures and Computing	4	40	60	3	1	0	100
6	UMJDTT-516**	Internship	4	40	60	0	4	0	100
7	UMJDTP-517**	Project 1	6	100	50	0	6	0	150
8	UMJDTP-518**	Project 2	6	100	50	0	6	0	150

***L-Lecture, *T- Tutorial, *P/EL- Practical / Experiential Learning**

**** Guidelines attached**

B. Tech (Information Technology & Mathematical Innovations)

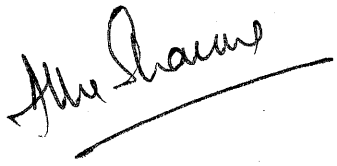
Semester-VI (Revised)

For the session 2026,2027,2028

S. No.	Course No.	Course Title	Credits	Internal Evaluation	External Evaluation	Hours/Week			Total Marks
						L	P/EL	T	
1	UMJDTT-611	Linear Logic: The Art of Optimization	4	40	60	3	1	0	100
2	UMJDTT-612	Exploring Database Management Systems	4	40	60	3	1	0	100
3	UMJDTT-613	Architecting the Web: Modern Web Application Engineering	4	40	60	3	1	0	100
4	UMJDTT-614	Computer Graphics and Visualization using Java	4	40	60	3	1	0	100
5	UMJDTT-615	Data Structure Design using Object Oriented Programming (C/C++)	4	40	60	3	1	0	100
6	UMJDTP-616**	Project 1	6	100	50	0	6	0	150
7	UMJDTP-617**	Project 2	6	100	50	0	6	0	150

***L- Lecture, *T- Tutorial, *P/EL- Practical / Experiential Learning**

**** Guidelines attached**



B. Tech (Information Technology & Mathematical Innovations)

Semester-VII (Revised)

For the session 2026,2027,2028

S. No.	Course No.	Course Title	Credits	Internal Evaluation	External Evaluation	Hours/Week			Total Marks
						L	P/EL	T	
1	UMJDTT-711	Computer and Brain: Knowledge Discovery and Artificial Intelligence with Python / MATLAB	4	40	60	3	1	0	100
2	UMJDTT-712***	Quantum Technologies	4	40	60	3	1	0	100
	UMJDTT-713***	AI Driven Digital Forensics and Cyber threat Intelligence							
	UMJDTT-714***	3D Printing & Design							
	UMJDTT-715***	Crypto Currency & Block Chain Technologies							
	UMJDTT-716***	e-yantra							
3	UMJDTT-717	Robotics Process Automation & Drones	4	40	60	3	1	0	100
4	UMJDTT-718	AI in Neuro & Cognitive Computing	4	40	60	3	1	0	100
5	UMJDTT-719	Numerical methods: from approximation to perfection	4	40	60	3	1	0	100
6	UMJDTP-720 **	Project 1	6	100	50	0	6	0	150
7	UMJDTP-721 **	Project 2	6	100	50	0	6	0	150

***L- Lecture, *T- Tutorial, *P/EL- Practical / Experiential Learning**
**** Guidelines attached**
***** Elective Course**

B. Tech (Information Technology & Mathematical Innovations)

Semester-VIII (Revised)

For the session 2026,2027,2028

S. No.	Course No.	Course Title	Credits	Internal Evaluation	External Evaluation	Hours/Week			Total Marks
						L	P/EL	T	
1	UMJDTT-811	Advance, Generative AI & Agents	4	40	60	3	1	0	100
2	UMJDTT-812	The Science of Chance	4	40	60	3	1	0	100
3	UMJDTT-813	Computer Vision	4	40	60	3	1	0	100
4	UMJDTT-814	IoT Sensor Networks & Data Analytics	4	40	60	3	1	0	100
5	UMJDTT-815	AI-Driven Cyber Forensics and Intelligence Engineering	4	40	60	3	1	0	100
6	UMJDTP-816**	Project 1	6	100	50	0	6	0	150
7	UMJDTP-817**	Project 2	6	100	50	0	6	0	150

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** Guidelines attached

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Semester V
(For the session 2026, 2027, 2028)

Course Code: UMJDTT-511

Credits: 04
Contact Hours: 60

Course Title: Understanding Computer System Architecture & Circuits
Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

COURSE DESCRIPTION:
This course provides a comprehensive understanding of computer architecture and organization, bridging theoretical foundations with practical applications. Students will explore the evolution of computer systems, digital circuit design, microprocessor programming, memory hierarchies, and advanced processor features. Through simulations, assembly programming, and hands-on projects, learners will gain the ability to analyze system performance, design hardware-software solutions, and apply modern architectural concepts such as parallelism, cache optimization, and system interfacing to real-world computing problems.

LEARNING OUTCOMES:
By the end of this course, students will be able to:
1. Understand and explain the principles, components, and performance metrics of computer architecture, including CPU, memory, I/O systems, and instruction set design.
2. Design and analyze digital circuits, microprocessor-based systems, and memory hierarchies using simulation tools and assembly programming.
3. Evaluate and apply advanced processor features such as cache mapping, branch prediction, parallel architectures, and system interfacing techniques.
4. Integrate theoretical concepts with practical applications through hands-on projects and simulations to solve real-world computing problems.

MODULE I: Computer Architecture Fundamentals
History and evolution of computer systems. Overview of architectures: Von Neumann vs. Harvard. Basic components: CPU, memory, I/O systems, system buses. Instruction Set Architecture (ISA): RISC vs. CISC, instruction types, addressing modes. Performance metrics: MIPS, CPI, FLOPS, Amdahl's Law.
Hands-On Activities:
1. Identify and compare architectures of different real-world processors.
2. Measure CPU performance metrics using benchmarking tools.

MODULE II: Digital Logic and Circuit Design
Boolean algebra and logic gates. Combinational circuits: adders, subtractors, multiplexers, encoders, decoders. Sequential circuits: flip-flops, registers, counters. Logic families: TTL, CMOS characteristics, power dissipation. Design and simulation of arithmetic and control circuits.
Hands-On Activities:
1. Simulate combinational and sequential circuits using software like Logisim or Multisim.
2. Design and test arithmetic units (e.g., 4-bit adder, ALU).

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Course Title: Understanding Computer System Architecture & Circuits
Maximum Marks : 100
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External Evaluation : 60

MODULE III: Microprocessor Architecture and Programming (8085)
Internal architecture and pin configuration. Address, data, and control buses. Instruction set of 8085. Basics of Assembly language programming. Stack, subroutines, and interrupts.

Hands-On Activities:
1. Write and execute basic assembly programs for 8085 using an emulator.
2. Interface simple input/output devices with the 8085 in a simulation environment.

MODULE IV: Memory Systems and CPU Organization
Types of memory: RAM, ROM, EPROM, EEPROM. Memory hierarchy: Registers, cache, main memory, secondary storage. Cache memory: Mapping techniques (direct, associative, set-associative), coherence protocols (MESI). Memory technologies: SRAM, DRAM, ROM. Memory optimization: Prefetching, write-through vs. write-back policies. Concept of virtual memory. CPU organization: Single-cycle and multi-cycle data path, control unit design (hardwired vs. microprogrammed).

Hands-On Activities:
1. Simulate cache mapping and replacement policies.
2. Analyze performance impact of memory hierarchy using tools like GEM5 or SimpleScalar.

MODULE V: Advanced Architectures and System Interfacing
Instruction-level parallelism: Superscalar processors, out-of-order execution. Branch prediction: Static and dynamic techniques, branch target buffers. SIMD and MIMD architectures: Introduction and applications. System interfacing: Memory-mapped vs. isolated I/O, DMA, interrupts (PIC, APIC). Modern interfaces: PCIe, USB, SATA, I^2C, SPI. Parallel architectures: Multi-core, SMP, NUMA, many-core systems. Interconnection networks: Bus, crossbar, Network-on-Chip (NoC).

Hands-On Activities:
1. Analyze multi-core performance using parallel processing benchmarks.
2. Simulate I/O interfacing scenarios.

MINOR PROJECTS DURING THE SEMESTER:
1. Design a Cache Simulator to evaluate hit/miss rates under various mapping and replacement policies.
2. 8085 Microprocessor-Based Traffic Light Controller simulation.
3. Benchmarking and Analyzing Multi-Core CPU Performance using parallel algorithms.
4. Simulation of a Virtual Memory Paging System with different replacement policies.

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Credits: 04
Contact Hours: 60

Course Title: Understanding Computer System Architecture & Circuits
Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

PEDAGOGY:
Mentor should introduce each topic through practical, real-world scenarios such as processor performance in gaming, IoT device interfacing, or multi-core server optimization. Students should approach problems using a "How Computers Really Work" methodology, enabling them to derive hardware and software solutions naturally through experimentation rather than rote memorization.

GUIDELINES FOR ASSESSMENT AND EVALUATION FOR SEMESTERS V - VIII OF FYUGP (DYD)

1. Assessment and Evaluation Model

Features of this Model of Assessment and Evaluation are:

- Domain knowledge: Tested through class tests and end-sem examination.
- Creativity: Assignments, seminars, open-ended examination questions.
- Hands-on experience: Practical tasks and project work to build real-world problem-solving skills.

Following scheme of assessment and evaluation shall be followed for the last two years of FYUGP (DYD):

1.1 Continuous Internal Assessment (CIA) - 40 Marks

This ensures sustained engagement and assessment beyond the final exam. CIA shall have the following components:

- Class Tests and Quizzes (10 Marks): This shall focus on concepts clarity, analytical ability comprising 2 or 3 short written or online tests.
- Assignments and Creative Tasks (10 Marks): This shall be focused on Problem-solving or reflective assignments and Open-ended questions to assess creativity.
- Practical and Hands-on Activities (15 Marks): This shall have the activities like Lab work, field tasks, coding assignments, design exercises, case study etc.
- Seminar and Presentation (5 Marks): This shall have individual or group presentation to be evaluated for communication, originality, creativity, and depth.

1.2 End-Semester Examination - 60 Marks

This is designed to test comprehensive domain knowledge and applications. The question paper shall have three sections:

- Section A - 20 Marks: Short answer questions to test fundamentals and breadth of domain knowledge.
- Section B - 20 Marks: Problem-solving and applications of the domain knowledge. The problems need to be conceptual numerical and case-based related to real world applications.
- Section C - 20 Marks: This is to be devoted to essay/analytical questions (choice-based) and have to be Open-ended, requiring synthesis, critical thinking, and creativity.

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Semester V
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Course Code: UMJDTT-511

Course Title: Understanding Computer System Architecture & Circuits

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

RECOMMENDED TEXTBOOKS

Primary Textbooks:

1. M. Morris Mano and Charles R. Kime, Logic and Computer Design Fundamentals, Pearson.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design, Morgan Kaufmann.
3. Supplementary Textbooks:
4. Ramesh S. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, Prentice Hall.
5. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson.
6. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.

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Semester V
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Course Code: UMJDTT-512

Course Title: The Logic Behind Machines: Theory of Computation

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

COURSE DESCRIPTION:

This course introduces the theoretical foundations of computation, focusing on formal languages, automata theory, and the principles underlying compiler design. Students will study regular expressions, finite automata, context-free grammars, pushdown automata, and Turing machines, along with the concepts of decidability and unsolvable problems. Emphasis is placed on connecting mathematical models of computation to real-world applications through simulations, hands-on activities, and mini-projects, enabling learners to model, design, and analyze computational systems effectively.

LEARNING OUTCOMES:

1. To apply mathematical foundations, algorithmic principles and computer science theory to the modeling and design of computational systems.
2. To demonstrate knowledge of basic mathematical models of computation and describe how they relate to formal languages.
3. To understand the limitations of computers and know about unsolvable problems.
4. To understand different phases, intermediate representations, algorithms and principles of working of a compiler

MODULE I: REGULAR EXPRESSIONS AND LANGUAGES:

Sets, relations, functions; strings, alphabets, and languages, Regular expressions and their algebra, Regular grammar and languages, Closure properties, Finite automata (FA), Mealy and Moore machines, Applications of regular expressions

Hands-On Activities:

1. Simulate and test regular expressions for pattern matching
2. Convert regular expressions to equivalent finite automata

MODULE II: FINITE AUTOMATA

Non-Deterministic and Deterministic Finite Automata, Equivalence of Regular Expression and Finite automata, Equivalence of ε-NFA and NFA, Equivalence of NFA and DFA, Pumping Lemma for Regular Languages, Applications of finite automata.

Hands-On Activities:

1. Design DFAs for language recognition
2. Validate input strings against NFAs and DFAs using simulation tools

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Course Title: The Logic Behind Machines: Theory of Computation

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

MODULE III: CONTEXT FREE GRAMMAR

Grammar and its classification, Production rules and derivation, Context free Languages, Closure properties for context free languages, Pushdown Automata, Backus-Naur Form, Chomsky Normal Form, Griebach Normal Form, Pumping Lemma for Context free languages, Applications of Context Free Grammar.

Hands-On Activities:

1. Convert CFGs to CNF and GNF
2. Design PDAs for balanced parentheses and palindromes

MODULE IV: TURING MACHINES

Description, Transition diagram, Roles of Turing machine, Church-Turing Thesis, Modular Construction of complex Turing machines, Extensions of Turing machines, Non-Deterministic Turing Machines. Universal Turing Machine, Turing acceptable and Turing decidable languages.

Hands-On Activities:

1. Design a TM for binary addition or palindrome checking
2. Explore simulations of Universal Turing Machines

MODULE V: FUNCTION THEORY

Recursive Function Theory and Unsolvable Problems Partial, total and constant functions, Primitive recursive functions; Unbounded minimalization and μ-recursion; Decidable and Undecidable Problems, The Halting Problem, Reduction to Another Undecidable Problem, Undecidability of Post Correspondence Problem.

Hands-On Activities:

1. Analyze problems for decidability
2. Discuss proof sketches for undecidability using reduction techniques

MINOR PROJECTS DURING THE SEMESTER:

1. Design a lexical analyzer using regular expressions and finite automata
2. Construct a PDA for parsing a simple expression grammar
3. Analyze the halting problem for different machine models

PEDAGOGY:

Mentor must introduce each topic by connecting it to real-life computing scenarios such as language design, compilers, and problem-solving in computer science. Concepts like automata, grammars, and Turing machines should be taught through visual tools, simulators, and relatable analogies to enable intuitive understanding. Students should be encouraged to discover patterns, construct machines, and explore computational boundaries using the "How to Solve it" approach. Abstract theoretical ideas must unfold organically through engaging examples rather than as rigid formal definitions.

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Course Title: The Logic Behind Machines: Theory of Computation

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

Guidelines for Assessment and Evaluation for Semesters V - VIII of FYUGP (DYD)

1. Assessment and Evaluation Model

Features of this Model of Assessment and Evaluation are:

- Domain knowledge: Tested through class tests and end-sem examination.
- Creativity: Assignments, seminars, open-ended examination questions.
- Hands-on experience: Practical tasks and project work to build real-world problem-solving skills.

Following scheme of assessment and evaluation shall be followed for the last two years of FYUGP (DYD):

1.1 Continuous Internal Assessment (CIA) - 40 Marks

This ensures sustained engagement and assessment beyond the final exam. CIA shall have the following components:

- Class Tests and Quizzes (10 Marks): This shall focus on concepts clarity, analytical ability comprising 2 or 3 short written or online tests.
- Assignments and Creative Tasks (10 Marks): This shall be focussed on Problem-solving or reflective assignments and Open-ended questions to assess creativity.
- Practical and Hands-on Activities (15 Marks): This shall have the activities like Lab work, field tasks, coding assignments, design exercises, case study etc.
- Seminar and Presentation (5 Marks): This shall have individual or group presentation to be evaluated for communication, originality, creativity, and depth.

1.2 End-Semester Examination - 60 Marks

This is designed to test comprehensive domain knowledge and applications. The question paper shall have three sections:

- Section A - 20 Marks: Short answer questions to test fundamentals and breadth of domain knowledge.
- Section B - 20 Marks: Problem-solving and applications of the domain knowledge. The problems need to be conceptual numerical and case-based related to real world applications.
- Section C - 20 Marks: This is to be devoted to essay/analytical questions (choice-based) and have to be Open-ended, requiring synthesis, critical thinking, and creativity.

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Semester V
(For the session 2026, 2027, 2028)

Course Code: UMJDTT-512

Course Title: The Logic Behind Machines: Theory of Computation

Credits: 04

Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

RECOMMENDED TEXTBOOKS:

1. H. R. Lewis and C. H. Papadimitriou - Elements of the Theory of Computation, Prentice Hall of India.
2. J. E. Hopcroft, R. Motwani and J. D Ullman - Introduction to Automata Theory, Languages and Computation, Pearson Education Asia.
3. Michael Sipser, Introduction to the Theory of Computation, Second Edition, Thomson, 2006.
4. Jeffrey Shallit, A Second Course in Formal Languages and Automata Theory, Cambridge University Press, 2008.
5. K. L. P. Mishra and N. Chandrasekaran - "Theory of Computations (Automata, languages and Computation)", Prentice Hall.
6. Rogers H., Theory of Recursive Functions and effective computing, Mcgraw-Hill
7. J.C.Martin–Introduction to Languages and Theory of Computation, Tata Mcgraw Hill.

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Semester V
(For the session 2026, 2027, 2028)

Course Code: UMJDTT-513

Course Title: Information exchange in computing devices: Data Communication & Computer Networks

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

COURSE DESCRIPTION:

This course provides a comprehensive introduction to computer networks, covering data communication principles, networking models, protocols, and system architectures. Students will explore physical and data link layer technologies, routing algorithms, Internet protocols, and transport layer services, along with applications such as DNS, HTTP, and secure communication. Emphasis is placed on practical skills through simulations, socket programming, and security implementations, enabling learners to design, analyze, and secure modern computer networks.

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.

MODULE I: FUNDAMENTALS OF COMMUNICATION

Fundamentals of Communication, Modulation, Data Encoding, OSI reference model, TCP/IP model, network standardization, Inter-networking. Physical layer, Switching Technique, Transmission media, Co-axial, Twisted Pair and Fiber Optic Cables, Transmission Impairments, Electromagnetic Spectrum, Radio waves, Microwaves, Satellites, Wireless Mobile Telecommunications Technology.

Hands-On Activities:

1. Use spectrum analyzers to explore signal frequencies
2. Set up basic wired and wireless transmission models

MODULE II: DATA TRANSMISSION AND MEDIA ACCESS METHODS

Data Link layer, Design issues, Frame, Error detection and correction, Flow Control, Elementary Data link protocols, Character-oriented and Bit-oriented Protocols, Sliding
window protocols. Channel allocation methods, TDM, FDM, ALOHA, Carrier sense Multiple access protocols, Collision free protocols, IEEE standard 802 for LANS, Ethernet, Token Bus, Token ring.

Hands-On Activities:

1. Simulate sliding window and stop-and-wait protocols
2. Implement CSMA/CD and compare with ALOHA in NS2/NS3

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MODULE III: NETWORK ESTABLISHMENT CONCEPTS

Network Layer, Store and Forward Packet Switching, Connectionless and Connection-oriented services, Virtual Circuit, Routing Algorithms, Shortest path, Flooding, Link State, Distant vector, Hierarchical, Broadcast and Multicast Routing. OSPF, BGP, Congestion, Congestion control algorithms.

Hands-On Activities:

1. Visualize routing algorithms using simulation tools
2. Analyze congestion using network traffic simulators

MODULE IV: INTERNET PROTOCOLS

TCP/TP Protocol, IP Addresses, Classes of IP Addresses, Subnets, IPv6, Network layer in the Internet, Internet Control Protocols, ARP, RARP, BOOTP, DHCP, Transport Layer, Protocol Stack, TCP and UDP, Transport Services Primitives, Sockets, Socket Programming concept.

Hands-On Activities:

1. Develop basic TCP and UDP socket programs in Python
2. Configure IP addressing and subnetting on local networks

MODULE V: NETWORK APPLICATION AND NETWORK SECURITY

Application layer, Name service (DNS), Domain Hierarchy, Name servers, Name resolutions, Traditional applications, Telnet, FTP, SMTP, MIME, World wide web-HTTP, HTTP Methods. Cryptographic Algorithms, DES, AES, RSA, Key exchange methods, Authentication Protocol, Digital Signatures.

Hands-On Activities:

1. Simulate secure message exchange using RSA
2. Set up DNS and FTP servers in a virtual lab environment

MINOR PROJECTS DURING THE SEMESTER:

1. Design a secure file transfer protocol using TCP and encryption
2. Analyze routing efficiency in dynamic topologies
3. Implement DNS resolver with local caching

PEDAGOGY:

Mentor must introduce each topic by relating it to everyday technologies like email, web browsing, mobile communication, and IoT devices to foster intuitive understanding. Networking concepts such as protocols, transmission methods, and addressing should emerge naturally through real-life problem scenarios like online video streaming or secure file transfer. Emphasis should be laid on simulation-based learning and hands-on lab experiments using packet tracers, socket programming, or protocol analyzers. Students should be guided to build mental models of layered architectures and data flows by following a "How to Solve it" approach, empowering them to design, troubleshoot, and optimize networks.

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Course Title: Information exchange in computing devices: Data Communication & Computer Networks

Credits: 04
Contact Hours: 60

Maximum Marks : 100
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Guidelines for Assessment and Evaluation for Semesters V - VIII of FYUGP (DYD)

1 Assessment and Evaluation Model

Features of this Model of Assessment and Evaluation are:

- Domain knowledge: Tested through class tests and end-sem examination.
- Creativity: Assignments, seminars, open-ended examination questions.
- Hands-on experience: Practical tasks and project work to build real-world problem-solving skills.

Following scheme of assessment and evaluation shall be followed for the last two years of FYUGP (DYD):

1.1 Continuous Internal Assessment (CIA) - 40 Marks

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- Assignments and Creative Tasks (10 Marks): This shall be focused on Problem-solving or reflective assignments and Open-ended questions to assess creativity.
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1.2 End-Semester Examination - 60 Marks

This is designed to test comprehensive domain knowledge and applications. The question paper shall have three sections:

- Section A - 20 Marks: Short answer questions to test fundamentals and breadth of domain knowledge.
- Section B - 20 Marks: Problem-solving and applications of the domain knowledge. The problems need to be conceptual numerical and case-based related to real world applications.
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Course Code: UMJDTT-513

Course Title: Information exchange in computing devices: Data Communication & Computer Networks

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

RECOMMENDED TEXTBOOKS:

1. Andrew S. Tanenbaum, "*Computer Networks*", 5 e, 2013, Pearson Education Asia.
2. Behrouz A. Forouzan, "*Data Communications and Networking*", 4e, 2004, Tata McGraw Hills.
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.
6. James F. Kurose and Keith W. Ross, "*Computer Networking*", 3e, Pearson Education.
7. William A. Shay, "*Understanding Data Communications and Networks*", 2e, Thomson Asia Pvt. Ltd.

UNIVERSITY OF JAMMU
Four Year Innovative Undergraduate Program
(Design Your Degree)
B. Tech (Information Technology & Mathematical Innovations) (Revised)
Semester V
(For the session 2026, 2027, 2028)

Course Code: UMJDTT-514

Course Title: Instructing computing devices: Operating System

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

COURSE DESCRIPTION:

This course introduces the principles and mechanisms of modern operating systems, focusing on process management, memory management, file systems, and I/O handling. Students will learn key concepts such as scheduling, synchronization, deadlocks, virtual memory, and system calls, while also gaining practical exposure to Unix/Linux environments and shell programming. Through simulations, coding exercises, and hands-on projects, learners will develop the ability to analyze and implement core OS functionalities and understand their role in real-world computing systems.

LEARNING OUTCOMES:

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and their communication.
3. To learn the mechanisms involved in memory management in OS.
4. To brief the students about basic concepts of Unix& Linux and programs using shell programming.

MODULE I: INTRODUCTION TO OPERATING SYSTEMS

Evolution of operating systems, Operating systems concepts, Types of operating systems, Different views of the operating system, Operating system services, System calls, Types of system calls. Operating system Structure, Layered Approach, Microkernels, Virtual machines.

Hands-On Activities:

1. Use system calls like fork, exec, wait in a Linux environment
2. Identify OS structures in various Linux distributions

MODULE II: PROCESS MANAGEMENT

Process concept, Operation on processes, Inter-process communication, Mutual exclusion, Introduction to Process scheduling, Scheduling algorithms, Process Synchronization, Inter process Synchronization, Critical section problem, Semaphores, Monitors, Message passing.

Deadlocks, System Model, Deadlock characterization, Deadlock prevention, Deadlock avoidance.

Hands-On Activities:

1. Simulate process scheduling algorithms
2. Implement producer-consumer problem using semaphores in C/Linux

MODULE III: MEMORY MANAGEMENT

Memory management, Swapping, Contiguous memory allocation, Relocation & protection, Memory management, Paging, Segmentation, Intel Pentium Segmentation, Intel Pentium Paging, Virtual memory, Demand paging, Performance of demand paging, Page replacement algorithms: FIFO, Optimal, LRU, Counting based page replacement.

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Credits: 04

Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

Hands-On Activities:

1. Analyze page faults using simulation tools
2. Write code to simulate LRU and FIFO algorithms

MODULE IV: FILE & I/O MANAGEMENT

File & I/O Management Files system structure, File system implementation, Directory Implementation. Allocation Methods, contiguous allocation, linked allocation, Indexed allocation Disk organization, Disk space management, Disk scheduling, Disk Management, RAID Structure.

Hands-On Activities:

1. Simulate file allocation techniques
2. Analyze disk scheduling with real input-output logs.

MODULE V: INTRODUCTION TO LINUX/UNIX

Directory tree, file types, file permissions, Common UNIX commands: ls, cat, mv, cp, grep, chmod, etc., Shell programming basics: Variables, control structures, loops, Filters and text-processing tools, Introduction to VI editor

Hands-On Activities:

1. Write shell scripts for batch file operations and log processing
2. Explore directory and permission structures in Linux

MINOR PROJECTS DURING THE SEMESTER:

1. Simulate a simple shell with process and file management commands
2. Design and analyze scheduling algorithms using real or synthetic data
3. Develop a memory management visualizer for paging and segmentation

PEDAGOGY

Mentor must introduce operating system concepts through relatable, real-world computing experiences such as multitasking on smartphones, file management, and memory usage in common applications. Abstract concepts like process scheduling, memory management, and system calls should be demonstrated using simulations and practical examples within Linux/UNIX environments. Students should be encouraged to experiment through shell scripting, process tracing, and memory allocation exercises. Teaching should follow the "How to Solve it" approach, enabling learners to internalize the design and functioning of an OS by building intuition and problem-solving skills, rather than memorizing definitions and mechanisms.

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Credits: 04
Contact Hours: 60

Course Title: Instructing computing devices: Operating System
Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

Guidelines for Assessment and Evaluation for Semesters V - VIII of FYUGP (DYD)

1 Assessment and Evaluation Model

Features of this Model of Assessment and Evaluation are:

- Domain knowledge: Tested through class tests and end-semester examination.
- Creativity: Assignments, seminars, open-ended examination questions.
- Hands-on experience: Practical tasks and project work to build real-world problem-solving skills.

Following scheme of assessment and evaluation shall be followed for the last two years of FYUGP (DYD):

1.1 Continuous Internal Assessment (CIA) - 40 Marks

This ensures sustained engagement and assessment beyond the final exam. CIA shall have the following components:

- Class Tests and Quizzes (10 Marks): This shall focus on concepts clarity, analytical ability comprising 2 or 3 short written or online tests.
- Assignments and Creative Tasks (10 Marks): This shall be focused on Problem-solving or reflective assignments and Open-ended questions to assess creativity.
- Practical and Hands-on Activities (15 Marks): This shall have the activities like Lab work, field tasks, coding assignments, design exercises, case study etc.
- Seminar and Presentation (5 Marks): This shall have individual or group presentation to be evaluated for communication, originality, creativity, and depth.

1.2 End-Semester Examination - 60 Marks

This is designed to test comprehensive domain knowledge and applications. The question paper shall have three sections:

- Section A - 20 Marks: Short answer questions to test fundamentals and breadth of domain knowledge.
- Section B - 20 Marks: Problem-solving and applications of the domain knowledge. The problems need to be conceptual numerical and case-based related to real world applications.
- Section C - 20 Marks: This is to be devoted to essay/analytical questions (choice-based) and must be Open-ended, requiring synthesis, critical thinking, and creativity.

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Course Code: UMJDTT-514

Credits: 04
Contact Hours: 60

Course Title: Instructing computing devices: Operating System
Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

RECOMMENDED TEXTBOOKS:

1. Silberschart, Galvin, Gagne, "Operating System Concepts", 9th Edition, WSE Wiley, 2016.
2. Andrew. S. Tanenbaum, "Modern operating systems", 4th Edition, Pearson Prentice Hall, 2018
3. Milan Milenkovic, "Operating system-concepts and design", 2nd Edition, McGraw Hill International Edition, 2005
4. A. S. Godbole, "Operating systems", 3rd Edition, Tata McGraw hill, 2017.
5. Deitel H. M., "Operating System", 3rd Edition, Pearson Publications, 2012.
6. Madnick& Donovan, "Operating Systems", Tata McGraw Hill, 2003.
7. Sumitabha Das, "UNIX Concepts and Application", 4th Edition, Tata McGraw Hill, 2017.
8. Richard L. Petersen, "The Complete Reference Linux", 6th Edition, Tata McGraw Hill, 2010

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Semester V
(For the session 2026, 2027, 2028)

Course Code: UMJDTT-515

Course Title: Building Blocks of Discrete Structures and Computing

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

COURSE DESCRIPTION:

This course introduces the foundations of algebraic structures and graph theory with applications in computing and communication. Students will explore groups, subgroups, and their role in cryptography, while learning to model and analyze systems using graphs. Key topics include shortest paths, graph coloring, isomorphism, trees, spanning trees, and Huffman coding. Through problem-solving, simulations, and hands-on activities, learners will develop the ability to apply mathematical principles to encryption, scheduling, network design, and data compression in real-world scenarios.

LEARNING OUTCOMES:

1. Identify and verify the properties of groups and subgroups, and apply them to cryptographic principles.
2. Represent real-world systems as graphs, analyze connectivity and related properties, and test for isomorphism.
3. Apply algorithms such as Dijkstra's for shortest paths and use graph coloring techniques for scheduling and resource allocation.
4. Understand tree properties and traversal methods, and apply Huffman coding for efficient data compression.
5. Implement Prim's and Kruskal's algorithms to find minimum spanning trees for cost-effective network design

MODULE I: INTRODUCTION TO ALGEBRAIC STRUCTURES & GROUPS

- Building Blocks of Operations: Discover how sets and binary operations form the backbone of mathematical structures used in computing.
- Group Power: Step into the world of groups—sets where closure, associativity, identity, and inverses rule the game.
- Abelian Harmony: Experience the simplicity of commutative groups and their role in symmetric systems.
- Cyclic Spins: See how cyclic groups revolve around a single generator, powering encryption and coding.
- Permutation Playgrounds: Explore permutation groups and their magic in rearranging data without losing structure.
- Subgroup Secrets: Identify subgroups and understand how smaller structures inherit group power.
- From Math to Machines: Apply group theory to cryptography, error detection, network security, and pattern recognition.

Hands-On Activities:

1. Operation Lab: Code addition modulo n and string concatenation; verify closure, associativity, identity, and inverse properties.

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Maximum Marks : 100
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2. Group Detective: Given a set and operation table, check if it forms a group; identify which property fails if it doesn't.
3. Cyclic Explorer: Generate all elements of a cyclic group from one generator and visualize the cycle.
4. Permutation Playground: List all permutations of a set and verify group properties under composition.
5. Crypto Mini-Challenge: Implement a simple RSA-like encryption using modular arithmetic and cyclic group concepts.

MODULE II: THE ART OF GRAPHS—CONNECTIONS UNVEILED

- Webs and Maps: Explore what graphs are and how we represent them (adjacency, incidence).
- Walking the Bridges: Discover Euler's Relation and tackle Eulerian paths.
- Spot the Twins: Learn how to recognize when two graphs are truly the same (isomorphism).
- Testing Strength: Identify points of fragility—connectivity, cut vertices, and bridges.
- Strategic Watching: Get the basics of covering sets.
- Epic Journeys: Seek out Euler and Hamilton paths and circuits.

Hands-On Activities:

1. Map a real network (classroom, bus routes) as a graph.
2. Solve your own "Bridge of Königsberg" puzzle.
3. Detect isomorphism between pairs of graphs.
4. Remove nodes/edges to test network resilience.
5. Find Euler/Hamilton paths in sample graphs.

MODULE III: MEMORY MANAGEMENT

- Shortest Routes: Master Dijkstra's algorithm to find the quickest path through a network.
- The Salesman's Quest: Dive into the Travelling Salesman Problem, exploring challenges in finding optimal tours.
- Scheduling Success: Translate jobs and tasks into graphs to solve scheduling challenges efficiently.
- Matchmaking and Independence: Understand graph matching and independent sets to pair up elements or find conflict-free groups.
- Color Your World: Apply graph coloring strategies to solve real-world problems like resource allocation and scheduling.
- Planar Insights: Uncover the beauty of planar graphs and grasp Euler's formula's elegant balance.
- Hidden Obstacles: Explore Kuratowski's theorem to recognize graphs that can't be drawn on a plane without crossings.

Hands-On Activities:

1. Implement Dijkstra's algorithm on sample maps to find shortest paths.
2. Experiment with small Travelling Salesman instances to understand complexity.

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Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
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3. Create task graphs and develop job schedules respecting dependencies.
4. Solve simple matching problems and identify independent sets in graphs.
5. Apply graph coloring to timetable or resource allocation scenarios.
6. Visualize planar graphs and verify Euler's formula.
7. Detect non-planar graphs using Kuratowski's criteria.

MODULE IV: FILE & I/O MANAGEMENT

- Roots and Branches: Understand what trees are—their definitions and key properties shaping hierarchical structures.
- Walking the Tree: Explore tree traversal methods—preorder, inorder, and postorder—and see how they reveal different views of data.
- Secret Codes: Dive into prefix codes and Huffman coding, learning how trees help compress data efficiently and uniquely.
- Bridging Networks: Learn what spanning trees are and why they form the backbone of connecting all nodes without cycles.
- Building Minimal Links: Master Prim's and Kruskal's algorithms to craft minimum spanning trees, finding the least-cost way to connect everything.

Hands-On Activities:

1. Perform preorder, inorder, and postorder traversals on sample trees.
2. Build a Huffman tree from character frequencies and encode/decode messages.
3. Identify spanning trees in sample graphs.
4. Implement Prim's and Kruskal's algorithms to find minimum spanning trees on weighted graphs.

PEDAGOGY

Each topic in this course begins with relatable real-life scenarios or practical problems, providing students with an intuitive grasp of core concepts. Emphasizing a "learning by doing" philosophy, students actively build their mathematical understanding through hands-on activities, interactive coding simulations, and collaborative classroom problem-solving. This approach ensures theory is naturally connected to application, fostering deeper insight and confidence in the subject.

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Course Title: Building Blocks of Discrete Structures and Computing

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

Guidelines for Assessment and Evaluation for Semesters V - VIII of FYUGP (DYD)

1 Assessment and Evaluation Model

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Course Code: UMJDTT-515

Course Title: Building Blocks of Discrete Structures and Computing

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

RECOMMENDED TEXTBOOKS:

1. Gallian, J. A., Contemporary Abstract Algebra (10th ed.), Cengage Learning, 2018.
2. Rosen, Kenneth H., Discrete Mathematics and Its Applications, 8th ed., McGraw-Hill Education, New York, NY, 2019.
3. Epp, S. S., Discrete Mathematics with Applications (5th ed.), Cengage Learning, 2019.
4. Liu, C. L., & Mohapatra, D. P., Elements of Discrete Mathematics: A Computer-Oriented Approach (3rd ed.), Tata McGraw Hill, 2008.
5. West, Douglas B. Introduction to Graph Theory, 2nd ed., Prentice Hall, Upper Saddle River, NJ, 2000.

i. Software and Tools:
   a. Python (networkx, matplotlib, itertools)
   b. Gephi or Graphviz (for visualization)
   c. Spreadsheet tools like Excel for combinatorics
   d. C++ or Java for algorithm implementation

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Course Code: UMJDTI-516
Credits: 04

Course Title: Internship
Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

Internship Guidelines:
To foster analytical thinking, problem-solving ability, and application of mathematical and computational techniques in real-world scenarios, students enrolled in the B.Tech (Information Technology & Mathematical Innovation) program are required to undertake an internship during Semester V as per the following guidelines:

1. Nature of Internship
- Students shall undertake an industry-oriented internship in areas such as Information Technology, Computational Intelligence, Data Analytics, Artificial Intelligence, or related domains.
- The internship may be carried out in recognized organizations, research institutions, startups, or government/private sector establishments.

2. Duration
- The internship shall be of minimum 2 months (8 weeks) duration.
- It shall be completed within the stipulated period as prescribed by the department.

3. Internship Report
- At the end of Semester V, students are required to submit a detailed internship report.
- The report must be duly certified by the internship guide/mentor and should include the work carried out, methodology adopted, and outcomes achieved.

4. Evaluation
- The internship shall be evaluated at the end of the semester through report assessment and viva voce.
- The evaluation will be conducted jointly, carrying a total of 100 marks, distributed as follows:
  - Internal Evaluation: 40 Marks
  - External Evaluation: 60 Marks

5. Mandatory Requirement
- Successful completion of the internship and submission of the report is mandatory for progression and award of the degree.
- Non-compliance may lead to withholding of results or requirement to repeat the internship.

6. Required Documents
Students shall submit:
- Internship Completion Certificate
- Certified Internship Report
- Any additional feedback/document, if applicable

Note:
The internship is expected to reflect the integration of AI technologies, mathematical innovation and computational methods in addressing real-world problems.

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Course Code: UMJDTP-517
Credits: 06

Course Title	: Project 1
Maximum Marks	: 150
Internal Evaluation	: 100
External Evaluation	: 50

Guidelines for Interdisciplinary Major Projects:
To promote transdisciplinarity, experiential learning, skill development and local to global relevance the essence of the DYD program the BOS of SIIEDC resolves to have at least two semester long major projects carrying 150 marks each in semesters V to VIII.

1. Objectives

i. Integrate theoretical knowledge across disciplines.
ii. Encourage research-oriented and inquiry-driven learning.
iii. Develop analytical, digital, and communication competencies.
iv. local, regional, or global developmental challenges.
v. Enhance employability and innovation skills.

2. Nature and Scope of Projects

Projects may include interdisciplinary academic research, mathematical or computational modelling. design thinking and technological solutions, community engagement initiatives, policy analysis of educational innovation and entrepreneurship or sustainability-focused projects. Each project must clearly demonstrate integration of at least two courses of the current semester. Transdisciplinary project in collaboration are also encouraged.

3. Structure and Supervision

A group of 3-5 students shall work on the project where interdisciplinary team formation is encouraged. One Primary Mentors shall guide the project at least one from another discipline(s)/course(s) may be appointed where required. The project shall be conducted over one semester with the following suggested indicators:

1. Proposal Development and Approval
2. Literature Review and Conceptual Framework
3. Methodology Design
4. Implementation/Analysis
5. Mid-Term Review
6. Final Report Submission
7. Presentation and Viva-Voce

4. Proposal Guidelines

Each project proposal shall include

1. Title and thematic area.
2. Courses/disciplines integrated..
3. Problem statement and motivation.
4. Objectives and expected outcomes.
5. Brief literature review.
6. Methodology and tools.

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Credits: 06

Course Title : Project 1
Maximum Marks : 150
Internal Evaluation : 100
External Evaluation : 50

7. Timeline with milestones,
8. Ethical considerations (if applicable).

Approval shall be granted by the DYD Academic/Project Committee.

5. Evaluation Scheme (Credits-6) Marks: 150

a) Continuous Assessment - 40 Marks

Proposal quality and originality	10
Literature review	10
Methodology planning	10
Progress, logbook & mentor assessment	10

b) Final Report - 60 Marks

Problem formulation and clarity	10
Interdisciplinary integration	10
Methodology and analysis	20
Innovation and societal/technological relevance	10
Writing quality and references	10

c) Presentation & Viva Voce-50 Marks

Conceptual understanding	15
Implementation/results/outcome	15
Communication skills	5
Response to questions	10
Collaboration/team work	5

Students shall submit a hardbound copy of the project report, along with a soft copy containing the PDF of the report and all relevant datasets, source code, and design artefacts. In addition, students mast submit the presentation slides prepared for the project evaluation and a duly maintained project diary/logbook certified by the mentor(s).

6. Academic Integrity and Ethics

To meet academic integrity and professional ethics, proper citation and avoidance of plagiarism are mandatory. Also responsible use of AI tools must be declared.

7. Role of the DYD Project Committee

The committee shall approve project proposals, ensure interdisciplinary balance, monitor the progress. standardize evaluation procedures and maintain a repository of DYD projects.

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Course Code: UMJDTP-517
Credits: 06

Course Title	: Project 1
Maximum Marks	: 150
Internal Evaluation	: 100
External Evaluation	: 50

8. Timeline of the Project:

The project work is required to be initiated in the following phases:
Week 1-3: Proposal preparation and approval
Week 4-6: Literature review, data collection and methodology
Week 8-12: Implementation/Analysis
Week 13: Final submission and viva-voce.

9. Outcomes:

By the end of 8th semester, the students shall have atleast any one of the following outcomes:

a) Application for Intellectual Property Rights (IPR) such as design patent, copyright, etc.
b) Submission of a high-quality research article in a Scopus/SCI/SCIE indexed journal, with the manuscript accepted for review/publication.
c) Conversion of the idea into a start-up, including submission of an application to an incubator for start-up support.

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Course Code: UMJDTP-519
Credits: 06

Course Title : Project 2
Maximum Marks : 150
Internal Evaluation : 100
External Evaluation : 50

Guidelines for Interdisciplinary Major Projects:
To promote transdisciplinarity, experiential learning, skill development and local to global relevance the essence of the DYD program the BOS of SIIEDC resolves to have at least two semester long major projects carrying 150 marks each in semesters V to VIII.

1. Objectives

i. Integrate theoretical knowledge across disciplines.
ii. Encourage research-oriented and inquiry-driven learning.
iii. Develop analytical, digital, and communication competencies.
iv. local, regional, or global developmental challenges.
v. Enhance employability and innovation skills.

2. Nature and Scope of Projects

Projects may include interdisciplinary academic research, mathematical or computational modelling. design thinking and technological solutions, community engagement initiatives, policy analysis of educational innovation and entrepreneurship or sustainability-focused projects. Each project must clearly demonstrate integration of at least two courses of the current semester. Transdisciplinary project in collaboration are also encouraged.

3. Structure and Supervision:

A group of 3-5 students shall work on the project where interdisciplinary team formation is encouraged. One Primary Mentors shall guide the project at least one from another discipline(s)/course(s) may be appointed where required. The project shall be conducted over one semester with the following suggested indicators:

1. Proposal Development and Approval
2. Literature Review and Conceptual Framework
3. Methodology Design
4. Implementation/Analysis
5. Mid-Term Review
6. Final Report Submission
7. Presentation and Viva-Voce

4. Proposal Guidelines:

Each project proposal shall include

1. Title and thematic area.
2. Courses/disciplines integrated.
3. Problem statement and motivation.
4. Objectives and expected outcomes.
5. Brief literature review.
6. Methodology and tools.

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Course Code: UMJDTP-518
Credits: 06

Course Title : Project 2
Maximum Marks : 150
Internal Evaluation : 100
External Evaluation : 50

7. Timeline with milestones,
8. Ethical considerations (if applicable).

Approval shall be granted by the DYD Academic/Project Committee.

5. Evaluation Scheme (Credits-6) Marks: 150

a) Continuous Assessment - 40 Marks

Proposal quality and originality	10
Literature review	10
Methodology planning	10
Progress, logbook & mentor assessment	10

b) Final Report - 60 Marks

Problem formulation and clarity	10
Interdisciplinary integration	10
Methodology and analysis	20
Innovation and societal/technological relevance	10
Writing quality and references	10

c) Presentation & Viva Voce-50 Marks

Conceptual understanding	15
Implementation/results/outcome	15
Communication skills	5
Response to questions	10
Collaboration/team work	5

Students shall submit a hardbound copy of the project report, along with a soft copy containing the PDF of the report and all relevant datasets, source code, and design artefacts. In addition, students mast submit the presentation slides prepared for the project evaluation and a duly maintained project diary/logbook certified by the mentor(s).

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To meet academic integrity and professional ethics, proper citation and avoidance of plagiarism are mandatory. Also responsible use of AI tools must be declared.

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The committee shall approve project proposals, ensure interdisciplinary balance, monitor the progress. standardize evaluation procedures and maintain a repository of DYD projects.

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Course Code: UMJDTP-519
Credits: 06

Course Title : Project 2
Maximum Marks : 150
Internal Evaluation : 100
External Evaluation : 50

8. Timeline of the Project:

The project work is required to be initiated in the following phases:
Week 1-3: Proposal preparation and approval
Week 4-6: Literature review, data collection and methodology
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Week 13: Final submission and viva-voce.

9. Outcomes:

By the end of 8th semester, the students shall have atleast any one of the following outcomes:

a) Application for Intellectual Property Rights (IPR) such as design patent, copyright, etc.
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Semester VI
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Course Code: UMJDTT-611
Credits: 04
Contact Hours: 60

Course Title: Linear Logic: The Art of Optimization
Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

Course Description:
This course introduces students to the fundamentals of optimization and linear programming as core tools for intelligent decision-making. Students learn to model real-world AI and data-driven problems, such as resource allocation, scheduling, and logistics, as linear optimization problems. The course covers graphical and simplex methods, along with applications like transportation, assignment, and basic game theory. Emphasis is placed on interpreting solutions and understanding their relevance to AI systems. Hands-on use of computational tools supports analytical thinking and problem-solving skills essential for AI applications.

LEARNING OUTCOMES:
The objectives of the course on **"Linear Logic: The Art of Optimization"** include:
- formulating real-world decision problems as linear programming models (LPPs);
- solving LPPs using the graphical method and the simplex method, and interpreting results (optimality, infeasibility, unboundedness, multiple solutions);
- applying optimization models like transportation and assignment to practical scenarios such as logistics, scheduling, matching, and routing;
- using computational tools such as MATLAB and GeoGebra/Desmos to model, solve, and visualize optimization and strategy problems;
- fosteringanalytical reasoning, structured problem-solving, and decision-making skills through hands-on modeling tasks.

PREREQUISITES:
Basic knowledge of algebra and functions, and introductory familiarity with matrices and graphs; elementary programming exposure.

MODULE I: Optimization Begins Here-Turning Decisions Into Linear Models
Imagine managing a delivery service and having to decide how many vehicles to operate, how to allocate drivers, and how to minimise costs while meeting demand. This "best decision under constraints" idea is the heart of optimization, and Linear Programming is its most powerful starting tool.

- **Concept Of Optimization: Why "Best" Matters**
  Optimization is about selecting the best possible outcome (minimum cost/maximum profit) while respecting constraints like time, budget, and capacity.

- **Linear Programming Problems (LPP): Building The Model**
  Learn how to formulate an LPP from real situations:
  - decision variables (what you control)
  - objective function (what you optimize)
  - constraints (what limits you)
  - non-negativity conditions

- **Graphical Representation: Seeing Feasibility**
  When a problem has two decision variables, use graphs to locate the feasible region.
  Hands-On Activities
  1. Graphical representation of LPP using GeoGebra
  2. Identifying feasible region using GeoGebra

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Credits: 04
Contact Hours: 60

Course Title: Linear Logic: The Art of Optimization
Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

MODULE II: Graphical Optimization And Special Cases
Before moving to large-scale computation, it is essential to understand how optimal solutions behave visually and conceptually in low-dimensional problems.

- **Graphical Solution Of LPP**
  Solve LPPs with two decision variables and identify optimal solutions using corner-point method.

- **Special Outcomes In Optimization**
  Understand and interpret:
  - multiple optimal solutions
  - infeasible solutions
  - unbounded solutions

- **Decision Interpretation**
  Translate mathematical solutions into meaningful managerial or engineering decisions.

Hands-On Activities
- Identifying optimal solutions graphically using GeoGebra
- Visual interpretation of infeasibility and unboundedness

MODULE III : The Simplex Engine – Solving Bigger Problems Efficiently
When real-world problems involve many decision variables, graphical methods fail. The Simplex Method provides a systematic, scalable solution approach.

- **Standard Form And Basic Solutions: Setting The Stage**
  Convert problems into standard form and understand:
  - basic solution
  - basic feasible solution
- **Simplex Method In Action: Step-By-Step Optimization**
  Perform simplex iterations and interpret outcomes in different cases:
  - unique optimal solution
  - no feasible solution
  - multiple optimal solutions
  - unbounded solution
  - degeneracy

Hands-On Activities
1. Identifying optimal solution using GeoGebra
   Implementing the Simplex Method using MATLAB

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Course Title: Linear Logic: The Art of Optimization
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Guidelines for Assessment and Evaluation for Semesters V - VIII of FYUGP (DYD)

1 Assessment and Evaluation Model

Features of this Model of Assessment and Evaluation are:

- Domain knowledge: Tested through class tests and end-semester examination.
- Creativity: Assignments, seminars, open-ended examination questions.
- Hands-on experience: Practical tasks and project work to build real-world problem-solving skills.

Following scheme of assessment and evaluation shall be followed for the last two years of FYUGP (DYD):

1.1 Continuous Internal Assessment (CIA) - 40 Marks

This ensures sustained engagement and assessment beyond the final exam. CIA shall have the following components:

- Class Tests and Quizzes (10 Marks): This shall focus on concepts clarity, analytical ability comprising 2 or 3 short written or online tests.
- Assignments and Creative Tasks (10 Marks): This shall be focused on Problem-solving or reflective assignments and Open-ended questions to assess creativity.
- Practical and Hands-on Activities (15 Marks): This shall have the activities like Lab work, field tasks, coding assignments, design exercises, case study etc.
- Seminar and Presentation (5 Marks): This shall have individual or group presentation to be evaluated for communication, originality, creativity, and depth.

1.2 End-Semester Examination - 60 Marks

This is designed to test comprehensive domain knowledge and applications. The question paper shall have three sections:

- Section A - 20 Marks: Short answer questions to test fundamentals and breadth of domain knowledge.
- Section B - 20 Marks: Problem-solving and applications of the domain knowledge. The problems need to be conceptual numerical and case-based related to real world applications.
- Section C - 20 Marks: This is to be devoted to essay/analytical questions (choice-based) and must be Open-ended, requiring synthesis, critical thinking, and creativity.

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Course Code: UMJDTT-611
Credits: 04
Contact Hours: 60

Course Title: Linear Logic: The Art of Optimization
Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

RECOMMENDED TEXTBOOKS

Primary Textbooks:

1. H. A. Taha, Operations Research-An Introduction,10th Edition,Pearson Education, 2019.
2. F. S. Hillier, and G. J. Lieberman, Introduction to Operations Research, 12thEdition, McGraw Hill, 2024.

Supplementary Textbooks:

1. W. Winston, Operations Research: Applications and Algorithms, 4th Edition, Duxbury Press, 2004.
2. K. Swarup, P.K. Gupta, and M. Mohan, Operations Research, 20th Edition, Sultan Chand & Sons, New Delhi, 2020.

Video Lecture and Project Resources for Optimization:

1. Video Lectures: https://www.youtube.com/watch?v=a2QgdDk4Xjw
2. Video Lectures: https://www.youtube.com/watch?v=Q0cO3qyJd-o

Projects: https://aa222.stanford.edu/projects/past-final-projects/

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Course Code: UMJDTT-612

Course Title: Exploring Database Management Systems

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

Course Description:
This course introduces students to database systems as the backbone of data-driven and intelligent applications. Students learn database architecture, relational modeling, normalization, and SQL to design efficient and scalable data storage solutions. The course emphasizes transaction management, indexing, and query optimization to support high-performance AI and analytics workloads. Advanced topics such as NoSQL, distributed databases, and vector and graph databases provide exposure to modern data infrastructures used in AI and ML pipelines. Through hands-on labs and projects, students gain practical skills in designing and managing databases for real-world AI-driven decision support systems.

LEARNING OUTCOMES:
1. Understand DBMS architecture and operations
2. Design ER-models and transform them into schemas
3. Write and optimize SQL queries

MODULE I: Introduction to Database Systems
Database concepts and applications, File systems vs Database systems, Data abstraction and data independence, Database system architecture, Data models: Hierarchical, Network, Relational, Overview of DBMS components, Role of DBMS in AI-driven application.

Hands-on Activities
1. Real-World Context: College student database.
   Activity: Create a table to store student details and perform SQL operations like INSERT, UPDATE, DELETE, and SELECT. Demonstrates basic CRUD operations and primary key usage.
2. Real-World Context: Library management system.
   Activity: Create tables for books and borrowers with relationships. Perform queries to borrow/return books, search by author/title, and list overdue books, demonstrating joins and relational design.
3. Real-World Context: Online shopping platform.
   Activity: Create a product table and use SQL to filter products, update stock, and calculate total inventory value. Demonstrates queries, filtering, and aggregate functions.

MODULE II: Relational Model and SQL
Relational data model concepts, Relations, tuples, attributes, domains, Integrity constraints, Relational algebra and relational calculus, Structured Query Language (SQL), DDL, DML, DCL, and TCL commands, Nested queries and joins.

Hands-on Activities
1. Real-World Context: College or company database.
   Activity: Create tables with tuples, attributes, and domains. Apply primary key, foreign key, and other integrity constraints using SQL DDL commands to ensure data consistency.

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Course Title: Exploring Database Management Systems

Credits: 04

Contact Hours: 45

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

2. Real-World Context: Student or employee record management.
   Activity: Use SQL INSERT, UPDATE, DELETE, and SELECT commands along with COMMIT/ROLLBACK to manage records. Demonstrates practical data manipulation and transaction control.
3. Real-World Context: Library or e-commerce database.
   Activity: Write SQL queries using nested queries and JOINs to retrieve combined information from multiple tables. Demonstrates relational algebra concepts in real-life scenarios.

MODULE III: Database Design and Normalization

Database design process, Entity-Relationship (ER) model, ER diagrams and constraints, Mapping ER model to relational schema, Functional dependencies, Normal forms: 1NF, 2NF, 3NF, BCNF, Introduction to mathematical foundations of normalization

Hands-on Activities

1. Real-World Context: College or library database design.
   Activity: Identify entities, attributes, and relationships for a system and draw ER diagrams, including constraints like cardinality and participation. Demonstrates conceptual database modeling.
2. Real-World Context: Student or inventory management system.
   Activity: Convert an ER diagram into a relational schema, defining tables, primary/foreign keys, and constraints. Demonstrates translating conceptual design into a practical relational model.
3. Real-World Context: Employee or product database.
   Activity: Apply functional dependency rules to normalize tables into 1NF, 2NF, 3NF, and BCNF. Demonstrates eliminating redundancy and ensuring data integrity.

MODULE IV: Transaction Management and Database Internals

Transaction concepts, ACID properties, Concurrency control techniques, Locking protocols, Deadlocks and recovery techniques, Indexing and hashing, Query processing and optimization basics.

Hands-on Activities

1. Real-World Context: Banking or online payment systems.
   Activity: Simulate transactions in a C++ or SQL environment and demonstrate ACID properties using COMMIT and ROLLBACK commands. Shows how databases ensure consistency and reliability.
2. Real-World Context: Multi-user booking or ticketing systems.
   Activity: Implement simple locking protocols (shared/exclusive locks) to manage concurrent access and simulate deadlock detection and resolution. Demonstrates safe multi-user operations.
3. Real-World Context: E-commerce product search.
   Activity: Create indexes on database tables and perform queries to retrieve records efficiently. Compare query performance with and without indexes to demonstrate optimization techniques

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Course Title: Exploring Database Management Systems

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

MODULE V: Advanced Databases and AI Integration

NoSQL databases: Key-Value, Document, Column-oriented, Big data storage concepts, Introduction to distributed databases, Database security and authorization, Databases for AI and ML pipelines, Vector databases and graph databases (introductory), Mathematical foundations for data storage and retrieval

Hands-on Activities

1. Real-World Context: Online shopping carts or user session storage.
   Activity: Create a NoSQL key-value or document database (e.g., using MongoDB) to store user profiles or product data. Perform insert, update, delete, and query operations to understand flexible schema design.
2. Real-World Context: Big data analytics platforms.
   Activity: Store sample large datasets in a column-oriented database (e.g., Cassandra) or simulate a distributed database setup. Perform queries to analyze data efficiently. Demonstrates scalability and distributed storage concepts.
3. Real-World Context: Recommendation systems or social networks.
   Activity: Implement a small graph database to model relationships (e.g., social connections) or a vector database for similarity search. Demonstrates database usage in AI/ML applications.

MINOR PROJECTS DURING THE SEMESTER:

1. Real-World Context: Hospitals and clinics.
   Activity: Build a database to store patient vitals, medical history, and treatments. Integrate AI/ML modules to flag abnormal readings or suggest follow-ups for real-time decision support.
2. Real-World Context: Retail and e-commerce warehouses.
   Activity: Create a database to track stock levels and supplier info. Use predictive analytics to forecast inventory needs, reducing stockouts and overstocking.
3. Real-World Context: Online shopping platforms.
   Activity: Design a database for user profiles, purchase history, and products. Implement AI algorithms to suggest products based on user behavior for personalized experiences.
4. Real-World Context: Colleges and universities.
   Activity: Maintain a database of students, courses, grades, and attendance. Apply predictive analytics to identify at-risk students and support academic decision-making.

PEDAGOGY:

Mentor must introduce each database concept by linking it to real-life applications such as library management systems, hospital records, e-commerce platforms, or social media analytics. Concepts like ER modeling, relational design, normalization, SQL querying, and transaction management should be taught through a balance of theory and hands-on implementation using industry-standard tools like MySQL or PostgreSQL. Students should compare different database models and query languages to understand trade-offs in design and performance.

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Guidelines for Assessment and Evaluation for Semesters V - VIII of FYUGP (DYD)

1 Assessment and Evaluation Model

Features of this Model of Assessment and Evaluation are:

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RECOMMENDED TEXTBOOKS:

1. Bipin C. Desai, An Introduction to Database Systems
2. Ramez Elmasri & Shamkant B. Navathe, Fundamentals of Database Systems
3. C. J. Date, An Introduction to Database Systems

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Course Code: UMJDTT-613

Course Title: Architecting the Web: Modern Web Application Engineering

Credits: 04
Contact Hours: 45

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

Course Description:

This course offers a comprehensive and practice-oriented introduction to modern full-stack web development, emphasizing real-world problem solving and application-driven learning. It covers core frontend technologies such as HTML, CSS, and JavaScript, along with backend development using Node.js, API-based communication, and database integration. The course focuses on the design and development of responsive, secure, scalable, and data-driven web applications aligned with contemporary industry requirements.
A problem-based and hands-on pedagogy is adopted to foster critical thinking, logical reasoning, creativity, and innovation. Students analyze real-world use cases and implement functional solutions involving user interaction, data management, and system integration. The course introduces modern web development practices such as Progressive Web Applications (PWAs), service-based architectures, cloud-enabled deployment models, and API-driven systems, preparing students to design and deploy production-ready web applications. Continuous laboratory work and project-based learning ensure the development of industry-ready skills relevant to modern web technologies.

LEARNING OUTCOMES:

1. Understand web architecture, frontend/backend integration, and security practices.
2. Analyze, design, and implement *real-world web applications* by integrating frontend interfaces with backend services while ensuring secure and efficient data handling.
3. Develop full-stack, responsive, and interactive web applications that solve practical problems, handle real user data, and perform reliably across devices.
4. Build and optimize modern web to address real-world challenges including performance, availability, and maintainability.

MODULE – I : HTML for Real-World Web Applications

Introduction to the Web and Internet; client–server architecture; web browsers and web servers; HTTP/HTTPS basics; structure of a website; HTML5 fundamentals: elements, attributes, headings, paragraphs, links, images, lists, tables and forms.

Hands-On Activities:

1. Create multi-page websites with navigation for a real-world user experience.
2. Build a static portfolio or business website using HTML5 and semantic tags.
3. Develop interactive forms for tasks like registration or data collection.

MODULE –II : CSS for Modern Web Interfaces

CSS fundamentals: Elements of Style,selectors, properties and values; Linking a Style Sheet to an HTML Document, In-line Styles, External Style Sheets, Internal Style Sheets; box model; positioning and layouts.

Hands-On Activities:

1. Implement client-side form validation to ensure accurate data entry in real-world applications.

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2. Write JavaScript programs to handle real-world tasks like data validation, dynamic content updates, user interactions, and real-time feedback in web applications.
3. Create functions and event handlers to respond to user actions such as clicks, form submissions, and navigation.

MODULE – III JavaScript and Client-Side Programming

JavaScript fundamentals: variables, data types, operatos and control structures; functions and events; DOM manipulation; form validation.

Hands-On Activities:

1. Implement client-side form validation to ensure accurate data entry in real-world web applications.
2. Write JavaScript programs using variables, data types, operators, and control structures to handle calculations, dynamic content, and real-world application logic.
3. Create functions and handle user events such as clicks, form submissions, and navigation in interactive web applications.

MODULE – IV Web Backend Architecture and Development

Introduction to backend and server, role of backend in a website, Node.js basics, Express.js framework, handling requests and responses,

Hands-On Activities:

1. Implement a user login system with authentication to manage secure access inreal-world applications.
2. Set up a Node.js server and understand the request–response flow in real-world web applications.
3. Create routes using Express.js to handle GET and POST requests for interactive web features.

MODULE – V Integration of Frontend, Backend, and Database Systems

Introduction to full-stack development; frontend–backend communication using APIs; introduction to MongoDB, connecting database with backend, , basics of deployment and hosting.

Hands-On Activities:

1. Connect a frontend webpage to a backend API to fetch and display data in real-world web applications.
2. Integrate a MongoDB database with the backend to store, retrieve, and manage data efficiently.
3. Build a full-stack web application combining frontend, backend, and database for practical, real-world scenarios.

MINOR PROJECTS DURING THE SEMESTER:

1. Build an e-commerce full-stack web application.
2. Design a real-time chat application using Node.js and Express to handle multiple users.
3. Develop a web-based dashboard to display and manage data from a MongoDB database.
4. Create a blog platform with user authentication, post creation, and data storage using MongoDB.

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PEDAGOGY:

The mentor shall introduce each web development concept by anchoring it to real-world application scenarios such as building an e-commerce platform, a social networking website, or a live data-driven dashboard. Frontend and backend concepts will be delivered through progressive, hands-on projects that simulate real industry workflows. Emphasis will be placed on version control, collaborative development practices, performance optimization, secure data handling, and deployment methodologies. The teaching–learning process will adopt a "*How to Solve It*" problem-solving approach, enabling students to analyze requirements, design solutions, and implement functional web applications effectively.

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Contact Hours: 60

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RECOMMENDED TEXTBOOKS:

1. Jon Duckett – HTML and CSS: Design and Build Websites, 1st Edition, Wiley, 2014.
2. Estelle Weyl and Nicole Sullivan – CSS in Depth, 3rd Edition, Manning Publications, 2022.
3. David Flanagan – JavaScript: The Definitive Guide, 7th Edition, O'Reilly Media, 2020.
4. Addy Osmani – Learning JavaScript Design Patterns, 2nd Edition, O'Reilly Media, 2021.
5. Alex Banks and Eve Porcello – Learning React: Modern Patterns for Developing React Apps, 2nd Edition, O'Reilly Media, 2023.
6. Ethan Brown – Web Development with Node and Express, 2nd Edition, O'Reilly Media, 2019.
7. K. Scott – MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, 2020.
8. Raghu Ramakrishnan and Johannes Gehrke – Database Management Systems, 3rd Edition, McGraw-Hill Education, 2003.
9. Brad Traversy – Modern Full-Stack Development: Using React, Node.js, Express & MongoDB, Independently Published, 2021.
10. Martin Fowler – Patterns of Enterprise Application Architecture, 1st Edition, Addison-Wesley Professional, 2002.
11. Andrew S. Tanenbaum and Maarten van Steen – Distributed Systems: Principles and Paradigms, 2nd Edition, Pearson Education, 2017.
12. Martin Kleppmann – Designing Data-Intensive Applications, 1st Edition, O'Reilly Media, 2017.

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Semester VI
(For the session 2026, 2027, 2028)

Course Code: UMJDTT-614

Course Title : Computer Graphics and Visualization using Java

Credits: 04

Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

Course Description:

This course introduces the principles of computer graphics and visualization through hands-on Java programming. Students learn how graphical systems work, from basic Java constructs and GUI programming to drawing primitives and handling user interaction. The course covers core graphics algorithms, geometric transformations, viewing, clipping, and projection techniques used in visualization systems. Emphasis is placed on building interactive and visual Java-based applications to strengthen algorithmic understanding. The course prepares students to apply graphics and visualization techniques in areas such as simulations, user interfaces, and AI-driven visual systems.

LEARNING OUTCOMES:

1. Understand fundamental concepts of computer graphics and visualization.
2. Learn graphics programming using Java.
3. Implement foundational graphics algorithms and transformations.
4. Build interactive Java-based visual applications.
5. Apply visualization techniques for viewing, clipping, and animation.

MODULE I: Introduction to Java For Graphics Programming

Overview of Java and its role in Computer Graphics, Java program structure, Data types, variables, operators, Control statements (if, switch, loops). Methods and parameter passing, Introduction to Object-Oriented Programming: Classes and Objects, Constructors.

Hands-On Activities:

1. Implement a command-based tool selection system using switch statements to simulate how users select tools (line, circle, erase) in graphics software.
2. Design a shape validation module that checks input correctness (negative values, overlaps, limits) using conditional statements, as done in real design tools.
3. Design a rule-based validation system using conditional statements to ensure objects follow predefined constraints, similar to design rule checks in CAD tools.

MODULE II: Graphic Primitives

Java GUI basics: AWT & Swing overview, JFrame, JPanel, Event handling (Mouse & Keyboard events). Java 2D API, Graphics & Graphics2D classes.Drawing basic shapes: Lines, Rectangles, Circles, Polygons, Colors, Fonts, Stroke styles. Definition and applications of Computer Graphics, Raster vs Vector graphics, Pixels, resolution, frame buffer.

Hands-On Activities:

1. Develop a document annotation tool that allows users to draw shapes, highlight text, and add graphical notes on digital documents using mouse and keyboard events.

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2. Create a basic UI layout editor that renders buttons, text labels, and panels using Java 2D primitives to support rapid interface prototyping in software development.
3. Implement a digital form and poster design utility that uses colors, fonts, stroke styles, and vector shapes for real-world content creation and publishing tasks.

MODULE III: Fundamental Graphics Algorithms:

Scan conversion concepts, Line drawing algorithms: DDA, Bresenham. Circle drawing algorithm. Area filling techniques: Boundary fill, Scan-line fill. 2D transformations: Translation, Scaling, Rotation. Homogeneous coordinate system.

Hands-On Activities:

1. Implement scan conversion–based line and circle drawing algorithms to build a precision drawing component used in digital sketching, CAD drafting, and annotation tools.
2. Apply boundary fill and scan-line fill techniques to enable region coloring and highlighting features commonly used in image editing, document markup, and medical image annotation applications.
3. Develop an interactive 2D object manipulation feature using homogeneous coordinates to support translation, scaling, and rotation operations in layout design and UI editing tools.

MODULE – IV: Viewing, Projections And Clipping

Composite transformations. Viewing concepts. Projections: Orthographic, Isometric, Perspective. Line clipping: Cohen–Sutherland algorithm.

Hands-On Activities:

1. Develop a camera-based viewing system that applies composite transformations to position and orient objects as used in security monitoring, robotics vision, and game cameras.
2. Implement orthographic, isometric, and perspective projections to generate multiple visual views of the same object for engineering drawing and architectural design applications.
3. Apply Cohen–Sutherland line clipping to restrict rendering within a defined viewport for map interfaces, drawing tools, and screen-based visualization systems.

MODULE V: Three-Dimensional Object Representation

Curves and surfaces: Bezier curves. Hidden surface removal: Z-buffer, scan-line, Painter's algorithm, Shading models: Flat, Gouraud and Phong

Hands-On Activities:

1. Develop a 3D product preview application that renders objects using flat, Gouraud, and Phong shading models to enhance visual realism for e-commerce and marketing use cases.
2. Implement Z-buffer–based hidden surface removal to correctly display visible surfaces in a 3D scene for engineering and architectural visualization applications.

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3. Design an interactive Bezier curve editor for creating smooth paths and surface outlines used in animation, industrial design, and UI motion graphics.

MINOR PROJECTS DURING THE SEMESTER:

1. Interactive Floor Plan & Space Management Tool
2. Digital Examination & Answer Sheet Evaluation Tool
3. Interactive Graph & Network Exploration System
4. Physiotherapy Motion Analysis and Visual Feedback System
5. CCTV Camera Coverage and Surveillance Mapping System

PEDAGOGY:

Mentor must link each computer graphics concept to real-world uses such as drawing tools, interactive dashboards, or simple games. Topics like coordinate systems, transformations, and animation should be taught through progressive Java-based projects using AWT and Swing. Visualization should involve relatable datasets to make concepts tangible. The "How to Solve it" approach should guide problem breakdown, coding, debugging, and performance tuning, with emphasis on collaboration and version control.

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Guidelines for Assessment and Evaluation for Semesters V - VIII of FYUGP (DYD)

1 Assessment and Evaluation Model

Features of this Model of Assessment and Evaluation are:

- Domain knowledge: Tested through class tests and end-semester examination.
- Creativity: Assignments, seminars, open-ended examination questions.
- Hands-on experience: Practical tasks and project work to build real-world problem-solving skills.

Following scheme of assessment and evaluation shall be followed for the last two years of FYUGP (DYD):

1.1 Continuous Internal Assessment (CIA) - 40 Marks

This ensures sustained engagement and assessment beyond the final exam. CIA shall have the following components:

- Class Tests and Quizzes (10 Marks): This shall focus on concepts clarity, analytical ability comprising 2 or 3 short written or online tests.
- Assignments and Creative Tasks (10 Marks): This shall be focused on Problem-solving or reflective assignments and Open-ended questions to assess creativity.
- Practical and Hands-on Activities (15 Marks): This shall have the activities like Lab work, field tasks, coding assignments, design exercises, case study etc.
- Seminar and Presentation (5 Marks): This shall have individual or group presentation to be evaluated for communication, originality, creativity, and depth.

1.2 End-Semester Examination - 60 Marks

This is designed to test comprehensive domain knowledge and applications. The question paper shall have three sections:

- Section A - 20 Marks: Short answer questions to test fundamentals and breadth of domain knowledge.
- Section B - 20 Marks: Problem-solving and applications of the domain knowledge. The problems need to be conceptual numerical and case-based related to real world applications.
- Section C - 20 Marks: This is to be devoted to essay/analytical questions (choice-based) and must be Open-ended, requiring synthesis, critical thinking, and creativity.

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Course Title : Computer Graphics and Visualization using Java

Credits: 04

Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

RECOMMENDED TEXTBOOKS:

1. J. D. Foley, A. van Dam, S. K. Feiner, and J. F. Hughes, *Computer Graphics: Principles and Practice*, 3rd ed. Boston, MA, USA: Addison-Wesley Professional, 2013.
2. D. Hearn, M. P. Baker, and W. Carithers, *Computer Graphics with OpenGL*, 4th ed. Boston, MA, USA: Pearson Education, 2011.
3. F. S. Hill Jr., *Computer Graphics Using OpenGL*, 3rd ed. Upper Saddle River, NJ, USA: Pearson Education, 2007.
4. D. F. Rogers, *Procedural Elements for Computer Graphics*, 2nd ed. New York, NY, USA: McGraw-Hill, 1997.
5. A. Watt, *3D Computer Graphics*, 3rd ed. Harlow, U.K.: Addison-Wesley, 2000.
[6] E. Angel and D. Shreiner, *Interactive Computer Graphics: A Top-Down Approach with OpenGL*, 6th ed. Boston, MA, USA: Pearson Education, 2012.
[7] P. Shirley, S. Marschner, M. Ashikhmin, and M. Gleicher, *Fundamentals of Computer Graphics*, 4th ed. Boca Raton, FL, USA: CRC Press, 2018.

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Course Code: UMJDTT-615

Course Title: Data Structure Design Using Object Oriented Programming (C\C++)

Credits: 04
Contact Hours: 60

Maximum Marks : 100
Internal Evaluation : 40
External Evaluation : 60

Course Description:

This course provides a strong foundation in data structures and algorithms using C++, focusing on efficient problem-solving and performance-aware programming. Students learn to analyze algorithms using time and space complexity and apply appropriate data structures such as arrays, linked lists, stacks, queues, trees, graphs, and hashing. The course emphasizes selecting suitable structures and sorting techniques based on real-world constraints and computational efficiency. Through hands-on implementation and analysis, learners develop optimized C++ programs for fast data access and processing. This course forms a core computational backbone for advanced subjects in AI, machine learning, and systems design.

Learning outcomes:

1. Apply fundamental concepts of data structures and algorithms to solve computational problems efficiently using C++.
2. Analyze the time and space complexity of algorithms using asymptotic notations.
3. Design and implement linear and non-linear data structures for real-world applications.
4. Select appropriate data structures and sorting techniques based on problem constraints and performance requirements.
5. Develop optimized C++ programs using indexing and hashing techniques for efficient data access.

MODULE - I Fundamental Notations

Primitive and composite data types, self-referential structures, Algorithms, Types of data structures, Operations, Time and space complexity of algorithms, Asymptotic notation.

Hands-On Activities:

1. Real- World Context: Exam result calculation.
   Activity: Create a C++ program using structures to store student details and marks. Calculate and display total and average scores, demonstrating the use of primitive and composite data types with simple input/output operations.
2. Real-World Context: ATM cash withdrawal.
   Activity: Design an algorithm or pseudocode for PIN verification, balance check, and cash withdrawal, and optionally implement it in C/C++. Focuses on algorithm design and stepwise problem solving with simple logic.
3. Real-World Context: Mobile phone contact list.
   Activity: Implement a C++ program to store contact numbers in an array and search for a contact using linear search. Count comparisons to analyze time complexity (O(n)) and demonstrate basic operations on data structures.

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External Evaluation : 60

MODULE –II Linear Data Structures

Arrays, Linked lists, Stacks, Queues, operations and their complexities, Implementations, Applications.

Hands-On Activities:

1. Real-World Context: Supermarket billing system.
   Activity: Write a C++ program using arrays to store item prices, calculate the total bill and average price, and display all items. Demonstrates array traversal and basic operations.
2. Real-World Context: Web browser "Back" functionality.
   Activity: Implement a stack in C++ to store recently visited web pages, perform push/pop operations, and display the current page. Demonstrates stack operations and LIFO behavior.
3. Real-World Context: Bank or movie ticket counter.
   Activity: Implement a queue in C++ to manage customers, perform enqueue/dequeue operations, and display the order of service. Demonstrates queue operations and FIFO behavior.

MODULE - III Non-Linear Data Structures

Trees, Binary Trees,Binary search trees, Heaps, Graphs, Traversing graphs.

Hands-On Activities:

1. Real-World Context: College database storing student IDs.
   Activity: Implement a BST in C++ to store student IDs and names, perform insertion, search, and in-order traversal to display records in sorted order. Demonstrates binary trees, BSTs, and tree traversal.
2. Real-World Context: Task management system with priority-based tasks.
   Activity: Implement a max-heap in C++ to store tasks with priorities, insert new tasks, and extract the highest-priority task. Demonstrates heap operations and priority queue behavior.
3. Real-World Context: Social network connections.
   Activity: Represent a small graph using an adjacency list and perform DFS or BFS traversal from a selected node. Demonstrates graph representation and traversal techniques.

MODULE - IV Indexing Structures

B–trees, Hashing techniques for direct access, collision in hashing, collision resolution.

Hands-On Activities:

1. Real-World Context: Library database indexing books by ISBN.
   Activity: Implement a B-tree in C++ to store book ISBNs, perform insertions, and display the tree structure. Demonstrates balanced tree structures and efficient search.
2. Real-World Context: College student database for quick ID lookup.
   Activity: Implement a hash table in C++ using simple hashing to store student IDs and perform insertion and search. Demonstrates direct access using hashing techniques.
3. Real-World Context: Employee database in a company.
   Activity: Demonstrate collision resolution in a hash table using linear probing or chaining, inserting sample employee IDs and resolving collisions. Demonstrates handling collisions in real-world databases.

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MODULE - V Sorting

Internal and External sorts, Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort.

Hands-On Activities:

1. Real-World Context: Sorting student marks in a class.
   Activity: Implement Bubble Sort in C++ to arrange student marks in ascending or descending order. Demonstrates basic comparison-based sorting and step-by-step swapping.
2. Real-World Context: E-commerce platform sorting products by price.
   Activity: Implement Quick Sort in C++ to sort a small list of product prices efficiently. Demonstrates divide-and-conquer sorting and faster performance on larger datasets.
3. Real-World Context: Company HR sorting employees by ID or salary.
   Activity: Implement Merge Sort in C++ to sort employee records. Demonstrates recursive sorting, merging subarrays, and stable sorting behavior.

MINOR PROJECTS DURING THE SEMESTER:

1. Real-World Context: Food delivery apps like Swiggy or Zomato.
   Activity: Implement a C++ program to manage food items and customer orders using arrays, queues, or linked lists. Perform operations like add, update, cancel, and view orders.
2. Real-World Context: College course enrollment management.
   Activity: Create a C++ application to register/deregister courses for students using arrays or linked lists. Allow adding students, registering/dropping courses, and viewing registrations.
3. Real-World Context: Online cinema ticket booking platforms.
   Activity: Create a C++ program to manage movies, show timings, and seats using arrays or linked lists. Simulate booking, cancellation, and display of available tickets.
4. Real-World Context: Travel apps planning optimized trips.
   Activity: Use graphs in C++ to store destinations and travel paths. Implement DFS/BFS traversal to simulate visiting all places and optionally prioritize destinations.

PEDAGOGY:

Mentor must introduce each data structure by anchoring it to real-life problem contexts such as task scheduling, social networks, or file systems. Concepts like stacks, queues, trees, and graphs should be taught using both C and C++ implementations, allowing students to compare procedural and object-oriented design approaches. Emphasis should be placed on visualization, modular coding, and hands-on practice to strengthen problem-solving abilities. Through the "How to Solve it" approach, students should be encouraged to identify the most suitable data structure for a given scenario and design efficient, reusable code structures naturally—rather than learning them in isolation.

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- Section C - 20 Marks: This is to be devoted to essay/analytical questions (choice-based) and must be Open-ended, requiring synthesis, critical thinking, and creativity.

RECOMMENDED TEXTBOOKS:

1. YashavantKanetkar, Let Us C, BPB Publications (2016)
2. E. Balagurusamy, Object-Oriented Programming with C++, McGraw Hill (2007)
3. Supplementary Textbooks:
4. Michael T. Goodrich, R. Tamassia, Data Structures and Algorithms in C++, Wiley (2014)
5. Y. Langsam, M. Augenstein, A. Tenenbaum, Data Structures Using C and C++, Prentice Hall
6. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education.

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Course Code: UMJDTP-616
Credits: 06

Course Title: Project 1
Maximum Marks : 150
Internal Evaluation : 100
External Evaluation : 50

Guidelines for Interdisciplinary Major Projects:
To promote transdisciplinary, experiential learning, skill development and local to global relevance the essence of the DYD program the BOS of SIIEDC resolves to have at least two semester long major projects carrying 150 marks each in semesters V to VIII.

1. Objectives

i. Integrate theoretical knowledge across disciplines.
ii. Encourage research-oriented and inquiry-driven learning.
iii. Develop analytical, digital, and communication competencies.
iv. local, regional, or global developmental challenges.
v. Enhance employability and innovation skills.

2. Nature and Scope of Projects

Projects may include interdisciplinary academic research, mathematical or computational modelling, design thinking and technological solutions, community engagement initiatives, policy analysis of educational innovation and entrepreneurship or sustainability-focused projects. Each project must clearly demonstrate integration of at least two courses of the current semester. Transdisciplinary project in collaboration are also encouraged.

3. Structure and Supervision

A group of 3-5 students shall work on the project where interdisciplinary team formation is encouraged. One Primary Mentors shall guide the project at least one from another discipline(s)/course(s) may be appointed where required. The project shall be conducted over one semester with the following suggested indicators:

1. Proposal Development and Approval
2. Literature Review and Conceptual Framework
3. Methodology Design
4. Implementation/Analysis
5. Mid-Term Review
6. Final Report Submission
7. Presentation and Viva-Voce

4. Proposal Guidelines

Each project proposal shall include

1. Title and thematic area.
2. Courses/disciplines integrated.
3. Problem statement and motivation.
4. Objectives and expected outcomes.
5. Brief literature review.

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Credits: 06

Course Title : Project 1
Maximum Marks : 150
Internal Evaluation : 100
External Evaluation : 50

6. Methodology and tools.
7. Timeline with milestones.
8. Ethical considerations (if applicable).

Approval shall be granted by the DYD Academic/Project Committee.

5. Evaluation Scheme (Credits-6) Marks: 150

a) Continuous Assessment - 40 Marks

Proposal quality and originality	10
Literature review	10
Methodology planning	10
Progress, logbook & mentor assessment	10

b) Final Report - 60 Marks

Problem formulation and clarity	10
Interdisciplinary integration	10
Methodology and analysis	20
Innovation and societal/technological relevance	10
Writing quality and references	10

c) Presentation & Viva Voce-50 Marks

Conceptual understanding	15
Implementation/results/outcome	15
Communication skills	5
Response to questions	10
Collaboration/team work	5

Students shall submit a hardbound copy of the project report, along with a soft copy containing the PDF of the report and all relevant datasets, source code, and design artefacts. In addition, students mast submit the presentation slides prepared for the project evaluation and a duly maintained project diary/logbook certified by the mentor(s).

6. Academic Integrity and Ethics

To meet academic integrity and professional ethics, proper citation and avoidance of plagiarism are mandatory. Also responsible use of AI tools must be declared.

7. Role of the DYD Project Committee

The committee shall approve project proposals, ensure interdisciplinary balance, monitor the progress. standardize evaluation procedures and maintain a repository of DYD projects.

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Credits: 06

Course Title	: Project 1
Maximum Marks	: 150
Internal Evaluation	: 100
External Evaluation	: 50

8. Timeline of the Project:

The project work is required to be initiated in the following phases:
Week 1-3: Proposal preparation and approval
Week 4-6: Literature review, data collection and methodology
Week 8-12: Implementation/Analysis
Week 13: Final submission and viva-voce.

9. Outcomes:

By the end of 8th semester, the students shall have atleast any one of the following outcomes:

a) Application for Intellectual Property Rights (IPR) such as design patent, copyright, etc.
b) Submission of a high-quality research article in a Scopus/SCI/SCIE indexed journal, with the manuscript accepted for review/publication.
c) Conversion of the idea into a start-up, including submission of an application to an incubator for start-up support.

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Course Code: UMJDTP-617
Credits: 06

Course Title : Project 2
Maximum Marks : 150
Internal Evaluation : 100
External Evaluation : 50

Guidelines for Interdisciplinary Major Projects

To promote transdisciplinary, experiential learning, skill development and local to global relevance the essence of the DYD program the BOS of SIIEDC resolves to have at least two semester long major projects carrying 150 marks each in semesters V to VIII.

1. Objectives

i. Integrate theoretical knowledge across disciplines.
ii. Encourage research-oriented and inquiry-driven learning.
iii. Develop analytical, digital, and communication competencies.
iv. local, regional, or global developmental challenges.
v. Enhance employability and innovation skills.

2. Nature and Scope of Projects

Projects may include interdisciplinary academic research, mathematical or computational modelling. design thinking and technological solutions, community engagement initiatives, policy analysis of educational innovation and entrepreneurship or sustainability-focused projects. Each project must clearly demonstrate integration of at least two courses of the current semester. Transdisciplinary project in collaboration are also encouraged.

3. Structure and Supervision

A group of 3-5 students shall work on the project where interdisciplinary team formation is encouraged. One Primary Mentors shall guide the project at least one from another discipline(s)/course(s) may be appointed where required. The project shall be conducted over one semester with the following suggested indicators:

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4. Implementation/Analysis
5. Mid-Term Review
6. Final Report Submission
7. Presentation and Viva-Voce

4. Proposal Guidelines

Each project proposal shall include

1. Title and thematic area.
2. Courses/disciplines integrated.
3. Problem statement and motivation.
4. Objectives and expected outcomes.
5. Brief literature review.
6. Methodology and tools.