

**Department of Computer Science
Islamic University of Science & Technology**



**Four Year Under Graduate Programme
(FYUGP) in Computer Science**

2024 and onwards

COURSE STRUCTURE FOR FOUR YEAR UNDER GRADUATE PROGRAMME (FYUGP) IN COMPUTER SCIENCE 2024 Batch

Semesters Course	I	II	III	IV	V	VI	VII	VIII	With Research
	Certificate (42 + 4 Credits)		Diploma (83 + 4 Credits)		UG Degree 3-Year (123 Credits)		UG Hons. 4- Year	With Courses	
Major	4 Credits DCS201MJ Digital Electronics & Office Automation (3-0-1-0)	4 Credits DCS150MJ Computer Organization and Architecture (3-1-0-0)	8 Credits DCS201MJ Data Structures (3-0-1-0) DCS202MJ Operating System (3-1-0-0)	16 Credits DCS251MJ Database Management System (3-0-1-0) DCS252MJ Web Development (3-0-1-0) DCS303MJ Data Analytics (3-1-0-0) DCS304MJ Computer Algorithms (3-1-0-0) DCS254MJ Data Communication & Computer Networks (3-1-0-0)	16 Credits DCS301MJ Web Application Development (3-0-1-0) DCS302MJ Programming in JAVA (3-0-1-0) DCS303MJ Data Analytics (3-1-0-0) DCS304MJ Software Engineering (3-1-0-0)	12 Credits + 4 credits Internship DCS351MJ Theory Of Computation & Formal Languages (4) (3-1-0-0) DCS352MJ Information security (3-1-0-0) DCS353MJ (1-3-0-0) Project * (4)	16 Credits	16 Credits	16 Credits (163 Credits)
Minor	4 Credits Python Programming	4 Credits Programming in C/C++	4 Credits Principles of AI	4 Credits Machine Learning (4)	4 Credits Deep Learning	4 Credits Natural Language Processing (4)	4 Credits	4 Credits	4 Credits
Vocational (Extra 4 Credits to be earned		4 Credits IT specific vocational courses/ internship		4 Credits IT specific vocational courses/ internship					

FYUGP Computer Science

			If Exiting with Certificate		If Exiting with Diploma							
Multidisciplinary	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets								
Ability Enhancement Courses (AEC)	3 Credits	3 Credits	3 Credits	3 Credits								
Skill Enhancement Courses (SEC)/ Internship/ Dissertation	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets			4 Credit Internship course				12 Credits * Research Project/ Dissertation	
Value Added Courses (VAC)	2+2 Credits Digital and Technological Solutions (2) Health and Wellness (2)	2+2 Credits Environmental Science (2) Understanding India (2)	2+2 Credits									
Total Credits	21Credits	21 Credits	21 Credits	21 Credits	20 Credits	20 Credits	20 Credits	20 Credits	20 Credits	20 Credits	20 Credits	20 Credits


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COURSE STRUCTURE FOR FOUR YEAR UNDER GRADUATE PROGRAMME (FYUGP) IN COMPUTER SCIENCE 2025 Batch

Semesters Course	I	II	III	IV	V	VI	VII	VIII	With Research
	Certificate (42 + 4 Credits)		Diploma (83 + 4 Credits)		UG Degree 3-Year (123 Credits)		UG Hons. 4- Year	With Courses	
							(163 Credits)		
Major	4 Credits DCS101MJ Computer Literacy and Application (3-0-1-0)	4 Credits DCS151MJ Computer Organization and Architecture (3-1-0-0)	8 Credits DCS201MJ Data Structures (3-0-1-0) DCS202MJ Operating System (3-1-0-0)	16 Credits DCS251MJ Database Management System (3-0-1-0) DCS252MJ Web Development (3-0-1-0) DCS253MJ Design & Analysis of Computer Algorithms (3-1-0-0) DCS254MJ Data Communication & Computer Networks (3-1-0-0)	16 Credits DCS301MJ Web Application Development (3-0-1-0) DCS302MJ Programming in JAVA (3-0-1-0) DCS303MJ Data Analytics (3-1-0-0) DCS304MJ Software Engineering (3-1-0-0)	12 Credits + 4 credits Internship DCS351MJ Theory Of Computation & Formal Languages (4) (3-1-0-0) DCS352MJ Cyber Security and Information Assurance (3-1-0-0) DCS353MJ (1-3-0-0) Project * (4) ~	16 Credits	16 Credits	16 Credits
Minor	4 Credits Python Programming	4 Credits Programming in C/C++	4 Credits Principles of AI	4 Credits Machine Learning (4)	4 Credits Deep Learning	4 Credits Natural Language Processing (4)	4 Credits	4 Credits	4 Credits
Vocational (Extra 4 Credits to be earned		4 Credits IT specific vocational courses/ internship		4 Credits IT specific vocational courses/ internship					

FYUGP Computer Science

			If Exiting with Certificate		If Exiting with Diploma							
Multidisciplinary	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets								
Ability Enhancement Courses (AEC)	3 Credits	3 Credits	3 Credits	3 Credits								
Skill Enhancement Courses (SEC)/ Internship/ Dissertation	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets	3 Credits To be chosen from the MD Baskets				4 Credit Internship course			12 Credits * Research Project/ Dissertation	
Value Added Courses (VAC)	2+2 Credits Digital and Technological Solutions (2) Health and Wellness (2)	2+2 Credits Environmental Science (2) Understanding India (2)										
Total Credits	21Credits	21 Credits	21 Credits	21 Credits	20 Credits	20 Credits	20 Credits	20 Credits	20 Credits	20 Credits	20 Credits	20 Credits

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Dr. P.

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COURSE STRUCTURE FOR FOUR YEAR UNDER GRADUATE PROGRAMME (FYUGP) IN COMPUTER SCIENCE 2026 Batch

Semesters Course	I	II	III	IV	V	VI	VII	VIII	With Research
	Certificate (42 + 4 Credits)		Diploma (83 + 4 Credits)		UG Degree 3-Year (123 Credits)		UG Hons. 4- Year	With Courses	
							(163 Credits)		
Major	4 Credits DCS101MJ Computer Literacy & Application (3-0-1-0) (2025)	4 Credits DCS151MJ Computer Organization and Architecture (3-1-0-0)	8 Credits DCS201MJ Data Structures (3-0-1-0) DCS202MJ Operating System (3-1-0-0)	16 Credits DCS251MJ Database Management System (3-0-1-0) DCS252MJ Web Development (3-0-1-0) DCS253MJ Design & Analysis of Computer Algorithms (3-1-0-0) DCS254MJ Data Communication & Computer Networks (3-1-0-0)	16 Credits DCS301MJ Web Application Development (3-0-1-0) DCS302MJ Programming in JAVA (3-0-1-0) DCS303MJ Data Analytics (3-1-0-0) DCS304MJ Software Engineering (3-1-0-0)	12 Credits + 4 credits Internship DCS351MJ Theory Of Computation & Formal Languages (4) (3-1-0-0) DCS352MJ Cyber Security and Information Assurance (3-1-0-0) DCS353MJ (1-3-0-0) DCS351MJ Project * (4)	16 Credits	16 Credits	16 Credits (163 Credits)
Minor	4 Credits Python Programming	4 Credits Programming in C/C++	4 Credits Principles of AI	4 Credits Machine Learning (4)	4 Credits Deep Learning (4)	4 Credits Natural Language Processing (4)	4 Credits	4 Credits	4 Credits
Vocational (Extra 4 Credits to be earned		4 Credits IT specific vocational courses/ internship		4 Credits IT specific vocational courses/ internship					

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Semester - I

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FYUGP Computer Science Syllabus – DOCS, IUST

Course Outline FYUGP Computer Computer Science - Semester I

Semester-I (20 Credits)									
Course Code	Course Name	Paper category	Total Credit	Credit Hours				Hours per week	
				L	T	P	S		
Major Courses (4 Credits)									
DCS101MJ	Digital Electronics & Office Automation (Applicable for 2024 batch only) Computer Literacy and Applications (Applicable for 2025 batch & onwards only)	Major	4	3	0	1	0	05	
Minor Courses (4 Credits) to be offered by CAI									
Python Programming									
Multidisciplinary (3 Credits)									
To be chosen from MD Basket									
		MD	3						
Ability Enhancement Course (3 Credits)									
To be chosen from AEC Basket									
		AEC	3						
Skill Enhancement Course (3 Credits)									
To be chosen from SEC Basket									
		SEC	3	2	0	0		3	
Value Added Course (4 Credits)									
DCS100VA	Digital and Technological Solutions	VAC	2	2	0	0	0	2	
	Health and Wellness	VAC	2	2	0	0		2	
Audit Course (2 credits)									
DCS102A	Mathematics for Logical and Computational Thinking	AC	2	2	0	0	0	2	
Total			21						

FYUGP Computer Science Syllabus – DOCS, IUST

Course Title: Digital Electronics & Office Automation
Semester: 1st
Credits: 04
Marks Distribution: (Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)
L T P S: 3 0 1 0

Course Code: DCS101MJ
Paper Type: Major
Max Marks: 100

COURSE OBJECTIVES:

- *Foundation in Digital Systems and Boolean Logic*
- *Design and Analysis of Combinational and Sequential Circuits*
- *Proficiency in Microsoft Word and PowerPoint*
- *Data Management and Analysis using Microsoft Excel.*

UNIT I

Introduction to Digital Systems, Number representation: Signed Binary numbers, 1's and 2's Complement. Binary Arithmetic, Logic Gates: AND, OR, NOT NOR, NAND & XOR & their Truth tables Logic diagrams. Boolean Postulates and Laws- Principal of Duality, Minimization of Boolean Expression: Introduction, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS), Karnaugh map Minimization upto 4 variables. Don't Care Conditions.

UNIT II

Error Detection and Correction: single parity and block parity check, hamming code, Combinational Logic: Introduction to Adders, Half Adder, Full Adder, Subtractors - Half Subtractor, Full Subtractor, Multiplexer, De-multiplexer, Decoders, Encoder. Sequential Logic - Definition & Basic sequential circuits. Flip-flops: SR-Flip Flop, D-Flip Flop, JK flip-flop, T flip-flop, Counters: Basics of Asynchronous & Synchronous counters,

UNIT-III

Microsoft Word

Fundamentals: Introduction to MS Word, understanding its interface, creating and saving documents, basic text editing (cut, copy, paste, paste special, undo).

Document Formatting: Page Formatting (paper size, orientation, margins), Paragraphs formatting (different types of alignments, indentation, line spacing, paragraph spacing), Text Formatting (font, font size, font color), bullets and numbering

Well Known Features: Document views (Print Layout, Web Layout, Outline, read mode), tables, inserting images, shapes, SmartArt, headers and footers, Page numbering, columns, sections, breaks, find and replace.

Advanced Features: Mail Merge, Track changes and comments.

Microsoft PowerPoint

Fundamentals: Introduction to PowerPoint, creating and saving presentation, ribbon, slide pane, notes section, slide adding, deleting, rearranging, basic slide design, text and image insertion, slide transitions and animations.

Well-known Features: Themes and templates, slide layout and design, inserting charts, tables and SmartArt, animation and transitions.

UNIT-IV

Microsoft Excel

Fundamentals: Introduction to MS Excel, understanding its interface (ribbons, formula bar, name box, worksheet, cell, range, row and column headers), adding and deleting sheets, sheet tabs (change name and color), data entry (text, numbers, dates), cell formatting (borders, foreground and background colour, text wrapping, merging, shrinking, alignments (horizontal, vertical, rotation), find, replace, search, protection (cell, worksheet), naming ranges,

Data Formatting and Management: Data formatting types (general, number, text, date, scientific, currency, percentage, custom), data filtering, comments, data filtering and sorting, freezing panes, cell range, generating data series (using autofill handle, using fill command, flashfill).

Basic Cell Functions and Formulas: Understanding formulas, difference between cell contents and formulas, using operators (arithmetic, conditional, logical), precedence of operators, cell referencing (absolute, relative, mixed), excel functions (SUM, AVERAGE, MIN, MAX, COUNT, CONCATENATE, LEFT, RIGHT, UPPER, LOWER, IF, OR, AND, COUNTIF, SUMIF, TODAY, NOW, IFERROR, IFBLANK, VLOOKUP, HLOOKUP, XLOOKUP, INDEX, MATCH), formula errors (#VALUE!, #N/A, #NAME?, #NULL!, #NUM!, #REF!, #DIV/0!), Formula Bar (uses, creating and editing complex formulas).

COURSE OUTCOMES:

At the end of the course student will be able to:

- To have the basic understanding of data representation
- To get the fundamental understanding of sequential and digital circuits
- To understand the concept minimum Boolean expression and its impact on digital circuits
- To understand the basics of flip flops being used in registers and counters
- Understand the fundamental concepts and interface of Microsoft Word, PowerPoint, and Excel.
- Create, format, and manage Word documents for various purposes, such as reports, letters, and resumes.
- Design professional-looking presentations using PowerPoint, incorporating multimedia, animations, and transitions.
- Apply basic to intermediate Excel functions and formulas for data analysis and management.
- Use practical features like Mail Merge in Word, Conditional Formatting in Excel, and Slide Show settings in PowerPoint for enhanced productivity.
- Protect and share documents, presentations, and spreadsheets securely using built-in tools.

Text Books:

1. Digital Fundamentals, Floyd and Jain, 8th Edition Pearson Education.

References:

1. M. Morris Mano. "Digital Logic and Computer Design",
2. Modern Digital Electronics, 3rd Edition by R.P Jain .
3. Digital Electronics: principles, Devices & Applications, Wiley by Anil K Maini.
4. Official documentation for Microsoft Word, Excel and PowerPoint from <https://support.microsoft.com>

FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Computer Literacy and Application	Course Code:	DCS101MJ
Semester:	1 st	Paper Type:	Major
Credits:	04	Max Marks:	100
Marks Distribution:	(Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)		
L T P S:	3 0 1 0		

COURSE OBJECTIVES:

- To develop fundamental understanding of computers and digital systems.
- To introduce concepts of data communication, networking, and information security.
- To develop practical skills in Microsoft Word and PowerPoint.
- To build competency in Microsoft Excel.

UNIT I

Introduction to computers including history, characteristics, and applications. Types of computers. Computer system components including input, output and processing. Computer Memory and Classifications. Concepts of system software, application software, and utility programs. Basics of operating systems and their functions. Data Representations and Processing. Introduction to number systems: binary, decimal, octal, and hexadecimal; conversion between number systems. Logic gates: AND, OR, and NOT with symbolic representation and truth tables. Binary addition and subtraction.

UNIT II

Data communications and computer networks: Basic Elements of a Communication System, Data Transmission Modes, Data Transmission Speed, Data Transmission Media (wired, wireless). Network topologies & Network devices. Types of Networks. The Internet: Electronic Mail, File Transfer Protocol (FTP), Telnet. Physical & Logical addresses. URLs, domain names.

Information Security: Potential attacks to computer systems, active & passive attacks. Cryptography – Basic concepts, terminology and requirements. Symmetric & Asymmetric Cryptosystems. Cloud Computing: Cloud and grid computing, Applications of Cloud & Computing. Database: File based approach vs database approach (DBMS), Advantages, Data warehouse.

E-governance: Issues, Challenges & Applications. Geo-informatics applications. Bioinformatics

UNIT III

Microsoft Word covering document creation, editing, and saving; basic text and paragraph formatting; insertion of images, tables, and lists; page setup and printing.

Microsoft PowerPoint covering creation of presentations, insertion of text, images, and charts; slide design and layout; application of transitions and animations; and presenting a basic slideshow.

UNIT IV

Microsoft Excel including interface overview, worksheets, cells, rows, and columns; data entry and formatting; use of basic formulas and functions such as SUM, AVERAGE, MIN, MAX, and IF; sorting and filtering of data; creation of simple charts; and preparation of workbooks for printing and saving.

COURSE OUTCOMES:

At the end of the course student will be able to:

- Demonstrate a basic understanding of computer systems, components, and software types.
- Perform basic file and folder management operations using a graphical user interface and command-line interface.

FYUGP Computer Science Syllabus – DOCS, IUST

- Apply number system conversions and basic binary arithmetic for digital literacy purposes.
- Use internet and email services effectively and responsibly, adhering to proper digital ethics and safety practices. Understand the basics of cloud technologies.
- Create, format, and print professional documents using Microsoft Word.
- Design and deliver basic presentations using Microsoft PowerPoint.
- Organize and analyze data using Microsoft Excel, including the use of basic formulas, functions, and charts.

Text Books:

1. P.K Sinha & Priti Sinha, "Computer Fundamentals", 8PB Publications'
2. V. Rajaraman, "Fundamentals of Computers", PHI Learning Pvt. Ltd'

References:

1. Norton, P. (2019). Introduction to Computers (9th ed.). McGraw-Hill Education.
2. Shelly, G. B., & Vermaat, M. E. (2018). Discovering Computers: Digital Technology, Data, and Devices. Cengage Learning.
3. Nelson, S. (2022). Microsoft Office 365 All-in-One for Dummies (3rd ed.). Wiley.
4. Curtin, D. P., Foley, K., Sen, C., & Morin, C. (2018). Information Technology: The Breaking Wave (8th ed.). McGraw-Hill.



FYUGP Computer Science Syllabus – DOCS, IUST

Course Title: *Digital and Technological Solutions*
Semester: 1st
Credits: 02
Marks Distribution: (Mid Term:15, End Term:25, Assignment /Attendance/ Presentations:10)
L T P S: 2 0 0 0

Course Code: DCS100VA
Paper Type: VAC
Max Marks: 50

COURSE OBJECTIVES:

- To gain familiarity with digital paradigms
- To sensitize about role & significance of digital technology
- To provide a know how of communications & networks
- To bring awareness about e-governance and Digital India initiatives
- To provide a flavor of emerging technologies - Cloud, Big Data , AI 3D printing.

COURSE CONTENT:

UNIT I

Introduction & Evolution of Digital Systems. Role & Significance of Digital Technology. Information & Communication Technology & Tools. Computer System & its working, Software and its types. Operating Systems: Types and Functions. Problem Solving: Algorithms and Flowcharts. Communication Systems: Principles, Model & Transmission Media. Computer Networks & Internet: Concepts & Applications, WWW, Web Browsers, Search Engines, Messaging, Email, Social Networking. Computer Based Information System: Significance & Types. E-commerce & Digital Marketing: Basic Concepts, Benefits & Challenges.

UNIT II

Digital India & e-Governance: Initiatives, Infrastructure, Services and Empowerment. Digital Financial Tools: Unified Payment Interface, Aadhar Enabled Payment System, USSD, Credit/Debit Cards, e-Wallets, Internet Banking, NEFT/RTGS and IMPS, Online Bill Payments and PoS. Cyber Security: Threats, Significance, Challenges, Precautions, Safety Measures, & Tools. Emerging Technologies & their applications: Overview of Cloud Computing, Big Data, Internet of Things, Virtual Reality, Blockchain, Robotics, Artificial Intelligence, 3-D Printing. Future of Digital Technologies.

COURSE OUTCOMES:

At the end of the course student will:

- Have knowledge about digital paradigm.
- Will realize the importance of digital technology, digital financial tools, ecommerce.
- Know-how of communication and networks.
- Familiarize with the e-governance and Digital India initiatives
- Have an understanding of use & applications of digital technology.
- Have basic knowledge of AI, machine learning and big data.

Text Books:

1. Digital Fundamentals by Floyd & Jain (11th Edition) – Comprehensive coverage of basic digital concepts and systems.

FYUGP Computer Science Syllabus – DOCS, IUST

2. Computer Systems: A Programmer's Perspective by Bryant & O'Hallaron (3rd Edition) - Explains computer systems architecture, operating systems, and software development.
3. Introduction to Communication Systems by Haykin (5th Edition) - Provides an in-depth understanding of communication principles and technologies.
4. India in the Digital Age: Challenges and Opportunities by ESCAP (United Nations) - Comprehensive overview of India's digital initiatives and challenges.
5. Handbook of Financial Technology by Ron Bird (2nd Edition) - Explains various digital financial tools and their applications.
6. Cybersecurity: Principles and Practice by William Stallings (5th Edition) - In-depth guide to cybersecurity threats, risks, and mitigation strategies.

References:

1. Understanding Digital Technology by Bradley (6th Edition) - Explores the social and ethical implications of digital technologies.
2. Operating System Concepts by Abraham Silberschatz et al. (10th Edition) - Delves deeper into different operating system types and functions.
3. Internet & World Wide Web: How to Program by Deitel & Deitel (5th Edition) - A practical guide to understanding the internet and web development.
4. Digital India: A New Era of Governance by Amitabh Kant & NITI Aayog - Explores the vision and implementation of Digital India.
5. Emerging Technologies: Impacts and Implications by David P. Sheren (2nd Edition) - Discusses the potential and challenges of emerging technologies.
6. The Future of Technology by Martin Ford - A thought-provoking look at how technology will continue to shape the future.

FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Mathematics for Logical and Computational Thinking	Course Code:	DCS102A
Semester:	1 st	Paper Type:	Audit
Credits:	02	Max Marks:	50
Distribution:	(Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)		
L T P S:	2 0 0 0		

Course Objectives

- Introduce students to fundamental mathematical ideas that support logical reasoning and problem solving.
- Develop an understanding of mathematical structures commonly used in computing and data science.
- Encourage analytical and computational thinking through simple mathematical models.
- Enable students from diverse academic backgrounds to appreciate the role of mathematics in modern technology and real-world applications.

Unit I

Sets and Functions: Idea of sets and set operations (union, intersection, complement); applications of sets in data classification and databases; functions as mappings; types of functions (one-to-one, onto, bijective); composition and inverse of functions; growth of functions (linear, quadratic, exponential).

Sequences and Summations: Introduction to sequences and patterns; arithmetic and geometric sequences; special integer sequences such as Fibonacci; summation notation and simple summation formulas; applications in algorithmic thinking and counting problems.

Relations and Order Structures: Binary relations and their representation; properties of relations (reflexive, symmetric, transitive); equivalence relations and partitions; introduction to partial orders; real-life examples such as ranking systems and hierarchies.

Unit II

Logic and Reasoning: Propositions and logical connectives; truth tables and logical equivalences; quantifiers and simple predicate logic; rules of inference and reasoning; introduction to proof ideas; mathematical induction (conceptual understanding).

Counting Techniques and Combinatorics: Basic counting principles; pigeonhole principle; permutations and combinations; binomial coefficients and Pascal's triangle; applications in probability and computing.

Introduction to Graphs and Networks: Basic graph terminology; types of graphs (simple, weighted); paths and circuits; trees and spanning trees; applications in networks and social media structures.

Recurrence Relations and Patterns: Idea of recurrence relations; simple linear recurrences; Fibonacci sequence as an example; generating patterns from recurrence relations; applications in algorithms and growth models.

FYUGP Computer Science Syllabus – DOCS, IUST

Course Outcomes

- Understand basic mathematical structures used in computing, data science, and logical reasoning.
- Apply simple logical reasoning techniques to analyze and solve problems.
- Identify mathematical patterns and relationships in sequences, functions, and combinatorial situations.
- Use basic counting principles and graph-based representations in practical contexts.
- Develop an appreciation of the role of mathematics in modern computational and technological applications.

Text Books:

1. KENNETH H. ROSEN "Discrete Mathematics & Its Applications, Tata McGraw – Hill
2. Ralph P. Grimaldi, Discrete And Combinatorial Mathematics An Applied Introduction

References:

1. LIU "Elements of Discrete Mathematics " Tata McGraw Hill
2. SCHAUMS "Discrete Mathematics" Tata McGraw Hill
3. KOLMAN/REHMAN "Discrete Mathematical Structures" Pearson Education
4. NICODEMI "Discrete Mathematics" CB



Semester - II

FYUGP Computer Science Syllabus – DOCS, IUST

Course Outline FYUGP Computer Applications - Semester II

Semester-II (21 + 4 Credits)									
Course Code	Course Name	Paper category	Total Credit	Credit Hours				Hours per week	
				L	T	P	S		
Major Courses (4 Credits)									
DCS150MJ	Computer Organization and Architecture	Major	4	4	0	0	0	04	
DCS151MJ <i>(Applicable for 2026 batch and onwards)</i>	Computer Organization and Architecture	Major	4	4	0	0	0	04	
Minor Courses (4 Credits)									
	Programming in C/C++	Minor	4						
Minor Vocational (Extra 4 Credits to be earned if exiting with Certificate)									
		MV	4						
Multidisciplinary (3 Credits)									
	To be chosen from MD Basket	MD	3						
Ability Enhancement Course (3 Credits)									
	Urdu/ Arabic/ Kashmiri Language	AEC	3						
Skill Enhancement Course (3 Credits)									
	To be chosen from Skill Basket	SEC	3	3	0	0		3	
Value Added Course (4 Credits)									
	Environmental Science	VAC	2	2	0	0		2	
	Understanding India	VAC	2	2	0	0		2	
Audit Course (2 credits)									
DCSS152A	Probability and Statistics for Computational Thinking <i>(Applicable for 2026 batch & onwards)</i>	AC	2	2	0	0	0	2	
Total			21 + 4						

FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Computer Organization and Architecture	Course Code:	DCS150MJ /DCS151MJ Applicable to 2026 & onwards
Semester:	2 nd	Paper Type:	Major
Credits:	04	Max Marks:	100
Marks Distribution:	(Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)		
L T P:	4 0 0 0		

COURSE OBJECTIVES:

- To know and understand the main components of a computer system and the considerations in their design.
- To acquire tools for comparison among alternatives.
- To know and understand performance measures, as well as their impact on system architecture.
- To understand the interplay among system components, design trade-offs, etc..

COURSE CONTENT:

UNIT I

Evolution & interpretation of the concept of Computer Architecture at different levels of abstraction. The concept of Computer Architecture at Multilevel Hierarchical Framework. Register Organization. Interconnection Structures, Bus Interconnections, Integer/Floating Point Arithmetic & Representation, Instruction Cycle & Interrupts. Instruction Set Characteristics & Functions. Addressing Modes & Formats.

UNIT II

Processor Organization: ALU, Design of Arithmetic Circuit, Design of Logic Circuit & Design of ALU. Processor Unit: Design of Accumulator/Control Organization: Hardwired / MicroProgrammed Control, Control Memory, Address Sequencing, Design of Control Unit & MicroProgram Examples.

UNIT III

Memory Hierarchy, Main Memory: RAM/ROM Chips. Memory Address Map, Memory Connection to CPU, Associative Memory, Hardware Organization – Match Logic, Read/Write Operation, Cache Memory, Virtual Memory, Memory Management – Associated Hardware, I/O Organization. Peripheral Devices: I/O Interfaces, Asynchronous Data Transfer, Modes of Transfer, Direct Memory Access & I/O Processor.

UNIT IV

RISC Architectures – their characteristics & comparison to CISC, Introduction to Parallel Processing, Basic Parallelization Techniques. Pipelining – Arithmetic & Instruction Pipelining, RISC Pipeline, Vector & Array Processors. Multiprocessor System Architectures & their Characteristics, Interconnection Structures, Inter-processor Arbitration, Inter-processor Communication & Synchronization, Cache Coherence Issues. Introduction to Super Scalar Processors

FYUGP Computer Science Syllabus – DOCS, IUST

COURSE OUTCOMES:

At the end of the course student will be able to:

- Explain computer architecture concepts, instruction sets, register organization, and arithmetic representation.
- Design and analyze ALU, processor units, and control units (hardwired & microprogrammed).
- Evaluate memory hierarchy, cache, virtual memory, and I/O organization.
- Compare RISC & CISC architectures and analyze pipelining, parallel processing, and multiprocessor.

Text Books:

1. W. Stallings, "computer organization & architecture".

References:

1. V.C. Hamacher, A.G. Vranesic & S.G. Zaky, "Computer Organization", Tata McGraw Hill
2. J.P Hayes, "Computer Architecture & Organization", Tata McGraw Hill
3. Morris Mano, "Computer System Architecture", PHI.
4. W. Stallings, "computer organization and architecture".
5. M. J. Flynn, "Computer Architecture", Narosa
6. David A. Patterson, John L. Hennessey, "Computer Organization"
7. GovindaRajalu, "Computer Architecture & Design " TMH



FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Probability and Statistics for Computational Thinking	Course Code:	DCS152A
Semester:	2 nd	Paper Type:	VA
Credits:	02	Max Marks:	50
Marks Distribution:	(Mid Term:15, End Term:25, Viva/Assignment / Presentations:10)		
L T P S:	2 0 0 0		

Course Objectives

- Introduce students to probabilistic thinking as a framework for reasoning under uncertainty.
- Develop intuition for using probability and statistics as tools for analyzing real-world and computational problems.
- Expose students to basic statistical reasoning useful for interpreting data and decision making.
- Prepare students interested in pursuing graduate studies in computer science, artificial intelligence, and data science.

Course Content

Unit I: Foundations of Probabilistic Thinking and Data — Understanding uncertainty and randomness, random experiments, sample space and events, intuitive idea of probability, conditional probability and independence, examples from computing and real life, introduction to data, types of data, data visualization (histograms, bar charts, scatter plots), descriptive statistics including mean, median and variance, interpreting patterns and variability in data.

Unit II: Probability and Statistics in Computational Contexts — Random variables (discrete and continuous), expectation and variance, common distributions such as Bernoulli, Binomial and Normal (conceptual overview), sampling and population, bias in data collection, law of large numbers (intuition), correlation versus causation, probabilistic reasoning in computer science, examples from machine learning, recommendation systems, randomized algorithms, and decision making under uncertainty.

Course Outcomes

- Demonstrate the ability to reason about uncertainty using basic probability concepts.
- Interpret and summarize datasets using fundamental statistical measures.
- Apply probabilistic thinking to simple computational and real-world problems.
- Recognize the role of probability and statistics in modern computer science applications such as AI, machine learning, and data-driven decision systems.

Text Books:

1. Ross Sheldon M., Introduction to Probability Models, 12th Edition, Elsevier, 2019.
2. Trivedi, K. S., Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd edition, Wiley, 2015.
3. Ian F. Blake, An Introduction to Applied Probability, John Wiley..

References:

1. Johnson James L., Probability and Statistics for Computer Science, 6th edition, Wiley, 2004.
2. Forsyth David, Probability and Statistics for Computer Science, 1st edition, Springer, 2019.
3. Freund J. E., Mathematical Statistics with Applications, 8th edition, Pearson Education, 2013.

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4. Devore Jay L., Probability and Statistics for Engineering and the Sciences, 9th edition, Cengage Learning, 2020.





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Semester-III (21 Credits)									
Course Code	Course Name	Paper category	Total Credit	Credit Hours				Hours per week	
				L	T	P	S		
Major Courses (8 Credits)									
DCS201MJ	Data Structures	Major	4	3	0	1	0	05	
DCS202MJ	Operating System	Major	4	3	1	0	0	04	
Minor Courses (4 Credits)									
	Principles of AI	Minor	4						
Multidisciplinary (3 Credits)									
	To be chosen from MD Basket	MD	3						
Ability Enhancement Course (3 Credits)									
	To be chosen from AEC Basket	AEC	3						
Skill Enhancement Course (3 Credits)									
	To be chosen from SEC Basket	SEC	3						
Audit Course (2 credits)									
DCS203A	Mathematical Thinking and Linear Algebra for Everyday Applications (Applicable for 2026 batch & onwards only)	AC	2	2	0	0	0	2	
Total			21						

FYUGP Computer Science Syllabus – DOCS, IUST

Course Title: Data Structures
Semester: 3rd
Credits: 04
Marks

Course Code: DCS201MJ
Paper Type: Major
Max Marks: 100

Distribution: (Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)

L T P: 3 0 1 0

COURSE OBJECTIVES:

- Introduction to Basic and Advanced Data Structures
- Understanding Linear and Non-Linear Data Structures with Applications
- Analysis of Data Storage Methods and Their Advantages & Disadvantages
- Practical Implementation and Performance Evaluation of Data Structures.

COURSE CONTENT:

UNIT I

Algorithms: Introduction & Analysis of Algorithms. Data Structures: Overview & Significance, Linear & Non-Linear Data Structures. Array & Strings, Application of Arrays. Searching & Sorting: Linear & Binary Search, Bubble Sort, Selection Sort & Insertion Sort. Sparse Matrix. Recursion & Applications.

UNIT II

Stack: Operations & Applications, Polish Expressions. Queue: Operations & Applications, Circular Queue. Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, Operations & Application of Linked Lists, Linked implementation of Stack & Queue, Polynomial Addition.

UNIT III

Trees: Basics, Terminology & Representation of a Tree. Binary Tree, Binary Search Tree, Tree Traversal Techniques, AVL Trees, Threaded Binary Tree, Red Black Trees, B Trees, B* Trees, Application of Trees. BST Sort, Heap Sort, Quick Sort, and Merge Sort.

UNIT IV

Graph: Introduction, Definition and Representations, Traversal, Connected Components Spanning Trees. Shortest Paths: Single Source Shortest Path, Dijkstras Algorithm, Bellman-Ford Algorithm. All Pair Shortest Paths, Transitive Closure, Floyd-Warshall Algorithm. Minimum Cost Spanning Trees, Prims & Kruskal Algorithm. Hashing: Overview, Hashing Functions, Collision Resolution Techniques.

COURSE OUTCOMES:

At the end of the course students will be able to:

- Develop some simple applications using Linear Data structures.
- Identification and Implementation of suitable data structure for a given problem
- Implementation of graph algorithms in various real-life applications.

Text Books:

1. Fundamentals of Data Structures, Horwitz & Sahni, 2nd Ed.

References:

1. J. P. Tremblay, P. G. Sorenson, "An Introduction to Data Structures with Applications", Second Edition, Tata McGraw Hill, 1981
2. Horowitz, Sahni and Anderson, "Fundamentals of Data Structures in C" Silicon Press 2007.
3. Langsam, M. J. Augenstein and A. N. Tanenbaum, "Data Structure Using C and C++", Pearson
4. Robert L. Kruse, Bruce P. Leung, Clovis L. Tondo, "Data Structures and Program Design in C",

FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Operating System	Course Code:	DCS202MJ
Semester:	3 rd	Paper Type:	Major
Credits:	04	Max Marks:	100
Marks Distribution:	(Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)		
L T P S:	3 10 0		

COURSE OBJECTIVES:

- To learn the fundamentals of Operating Systems.
- To learn the mechanisms of OS to handle processes and threads and their communication
- To learn the mechanisms involved in memory management I/O management and file management in OS
- To gain knowledge on Mutual exclusion algorithms, deadlock detection algorithms
- To know the components and management aspects of concurrency management
- To implement the concepts learnt through case studies of different operating systems.

COURSE CONTENT:

UNIT I

Introduction to Operating Systems: Structure of OS, Goals of the OS, OS as a resource manager and as an extended machine. Services and functions provided by the operation system.

Types of Operating Systems based on Historical evolution of OS: Batch processing Systems, Time-sharing systems, Distributed and network operating systems, Real-time systems (hard vs soft real-time), Embedded operating systems (Android, IoT devices), Cloud and Virtualized OS environments.

Performance and Design Considerations: Efficiency vs fairness vs security trade-offs, Concepts of multiprogramming, multitasking, and multiprocessing, Scalability and concurrency issues, Introduction to performance metrics: throughput, turnaround time, response time)

System Structures: System Components: Process management, memory management, file systems, I/O subsystems, protection and security, System Calls & APIs: Interface between user programs and the kernel, POSIX standards and Linux system call examples

Virtualization & Modern Trends: Virtual Machines (VMs) and Hypervisors, Type I vs Type II hypervisors, VMware, Xen, KVM examples, Containerization (Docker, Kubernetes) and lightweight OS concepts, The role of operating systems in cloud computing and edge computing.

UNIT II

Process Fundamentals: Concept of a Process, Definition of a process as a program in execution. Process attributes (text, data, heap, stack). Process States: Five-state model (new, ready, running, waiting, terminated). Advanced models: suspended processes, zombie & orphan processes.

Process Control Block (PCB): PCB structure: process ID, program counter, registers, scheduling information, accounting data, I/O status Threads and Concurrency: Thread vs Process, Lightweight processes, benefits of threading. User-level vs Kernel-level threads. Hybrid threading models. Multithreading

Models: Many-to-One, One-to-One, Many-to-Many. CPU Scheduling: Basic Concepts, Scheduling criteria: CPU utilization, throughput, turnaround time, waiting time, response time. Preemptive vs non-preemptive scheduling. Scheduling Algorithms: First Come First Serve (FCFS) Gantt chart illustrations.

Shortest Job First (SJF) Non-preemptive and preemptive. Priority Scheduling (Aging and starvation). Round Robin (RR) (Time quantum selection and performance trade-offs). Multilevel Queue Scheduling (Static vs Dynamic feedback). Multilevel Feedback Queue.

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Inter-Process Communication (IPC): Direct and Indirect Communication, Message passing: synchronous vs asynchronous. Shared Memory Systems, Synchronization primitives: semaphores, monitors.

Deadlocks: Conditions for Deadlock, Coffman's conditions: mutual exclusion, hold-and-wait, no preemption, circular wait. Deadlock Prevention: Resource ordering, preemption, avoidance of hold-and-wait. Deadlock Avoidance: Safe state, resource-allocation graph. Banker's Algorithm. Deadlock Detection & Recovery: Detection algorithms. Recovery techniques: process termination, resource preemption.

UNIT III

Logical vs Physical Address Space: Memory abstraction and the need for address spaces, Memory Management Unit (MMU) and address translation, Relocation, protection, and sharing mechanisms, Address binding: compile-time, load-time, and execution-time.

Contiguous Allocation, Fragmentation, and Compaction: Fixed and dynamic partitioning schemes, Internal vs external fragmentation, First-fit, Best-fit, Worst-fit algorithms and analysis, Compaction and relocation techniques, Performance trade-offs in contiguous allocation.

Paging, Segmentation, and Virtual Memory Concepts: Paging: Page table structures: single-level, multi-level, inverted page tables, Translation Lookaside Buffer (TLB), Segmentation: Concept of segments. Virtual Memory: Demand paging and lazy loading, Copy-on-write, shared libraries.

Page Replacement Algorithms: FIFO, Optimal (MIN), and LRU, Clock (Second Chance), Enhanced Clock, LFU. Working through reference string examples Thrashing and the Working Set Model: Definition. Definition and causes of thrashing, Degree of multiprogramming vs CPU utilization graph

UNIT IV

File System Fundamentals: File System Structure, Concepts of file, metadata, and inode-based structures, File attributes (size, type, ownership, permissions, timestamps).

File Operations: Create, open, read, write, close, delete, append, File Access Methods: Sequential access, Direct (random) access, Indexed access, Comparison of access methods with performance trade-offs.

Disk fundamentals: Disk Structure Disk Scheduling and Storage Management:

Disk Scheduling Algorithms: FCFS (First Come First Serve), SSTF (Shortest Seek Time First), SCAN and C-SCAN (elevator algorithms), LOOK and C-LOOK, Performance Analysis: Seek time, rotational latency, transfer time, Throughput vs. response time trade-offs, Modern Storage Trends: SSDs vs. HDDs scheduling, NVMe and flash storage optimizations

I/O Systems: I/O Devices: Device controllers, device drivers, Block vs. character devices, I/O Techniques: Programmed I/O, Interrupt-driven I/O, Direct Memory Access (DMA), I/O Buffering & Spooling: Single/double buffering, Circular buffers, Spooling in print servers and job queues

Security and Protection in File & I/O Systems: Protection Models: Access Matrix model, Capability lists vs. access lists, Passwords, encryption for file systems (e.g., ext4 with LUKS), Common Threats: Unauthorized access, Trojan horses, ransomware, buffer overflows, Side-channel attacks on I/O systems, Modern Security Approaches: File system auditing and logging, Secure I/O channels (e.g., TLS/SSL for networked file systems).

COURSE OUTCOMES:

At the end of the course student will be able to:

- Master understanding of design issues associated with operating systems.
- Master various process management concepts including scheduling, synchronization, and deadlocks.
- Be familiar with various types of operating systems including UNIX.

Text Books:

1. Tanenbaum, A.S., "Modern Operating System", PHI

2. Peterson, J.L. Abraham, Silberschatz, "Operating System Concepts", Addison Wesley

References:

1. Dietel H.M. "An Introduction To Operating System", Addison Wesley
2. Karnetkar, "UNIX Shell Programming", BPB
3. W.Stallings, "Operating systems"
4. Dhamdhere, "An Operating System –Design & principles"
5. Madnick E, Donovan J, "Operating Systems", TMH
6. Marko Gergent, "Learning android", O'rielly



FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Mathematical Thinking and Linear Algebra for Everyday Applications	Course Code:	DCS203VA
Semester:	3 rd	Paper Type:	VA
Credits:	02	Max Marks:	50
Marks Distribution:	(Mid Term:15, End Term:25, Viva/Assignment / Presentations:10)		
L T P S:	2 0 0 0		

Course Objectives

- To develop quantitative reasoning and logical thinking skills.
- To introduce basic matrix and vector concepts in an intuitive and application-oriented manner.
- To enable students to formulate and solve simple real-life problems using linear algebra tools.
- To build awareness of the role of mathematics in AI, economics, biology, engineering and social sciences.
- To support multidisciplinary learning in line with NEP 2020.

Course Content

UNIT I: Matrices and Systems of Equations (15 Hours)

Concept and classification of matrices; matrix operations including addition, multiplication and transpose; determinants of order 2×2 and 3×3 with geometric interpretation; inverse of a matrix (restricted to the 2×2 case); formulation of systems of linear equations arising from real-life contexts; solution of systems using simplified row reduction (Gauss elimination method); interpretation of solution sets (unique, infinitely many or no solution); applications to mixture problems, basic economic input-output models and balancing of equations.

UNIT II: Vectors and Linear Transformations (15 Hours)

Vectors in two and three dimensions with geometric interpretation; linear combinations, span and linear independence (intuitive approach); concept of basis and dimension; linear transformations in the plane including rotation, scaling and reflection; matrix representation of linear transformations; introductory idea of eigenvalues and eigenvectors (conceptual treatment for 2×2 matrices); applications to image transformations, simple population models and basic data representation.

Course Outcomes

- Perform basic matrix operations and interpret their results in applied contexts.
- Solve simple systems of linear equations using matrix methods and row reduction.
- Explain vector concepts such as span, independence, basis and dimension intuitively.
- Interpret and apply basic linear transformations and their matrix representations.
- Recognize the role of eigenvalues and eigenvectors in simple applied settings.
- Apply mathematical reasoning to model and interpret real-world problems involving data and systems.

Text Books:

1. Strang, Gilbert. Introduction to Linear Algebra, 5th Edition, Wellesley-Cambridge Press.
2. Kreyszig, Erwin. Advanced Engineering Mathematics, 10th Edition, Wiley, 2015.
3. Strang, Gilbert. Linear Algebra and Learning from Data, 1st Edition, Wellesley-Cambridge Press.
4. Jain R. K., Iyengar S. R. K. Advanced Engineering Mathematics, 5th Edition, Narosa, 2016

References:

1. Deisenroth, Marc Peter, Faisal A. Aldo and Ong Cheng Soon. Mathematics for Machine Learning, Cambridge University Press, 2020.
2. Lipschutz, Seymour and Lipson, Marc. Schaum's Outline of Linear Algebra, 6th Edition, McGraw Hill, 2017..

Semester - IV



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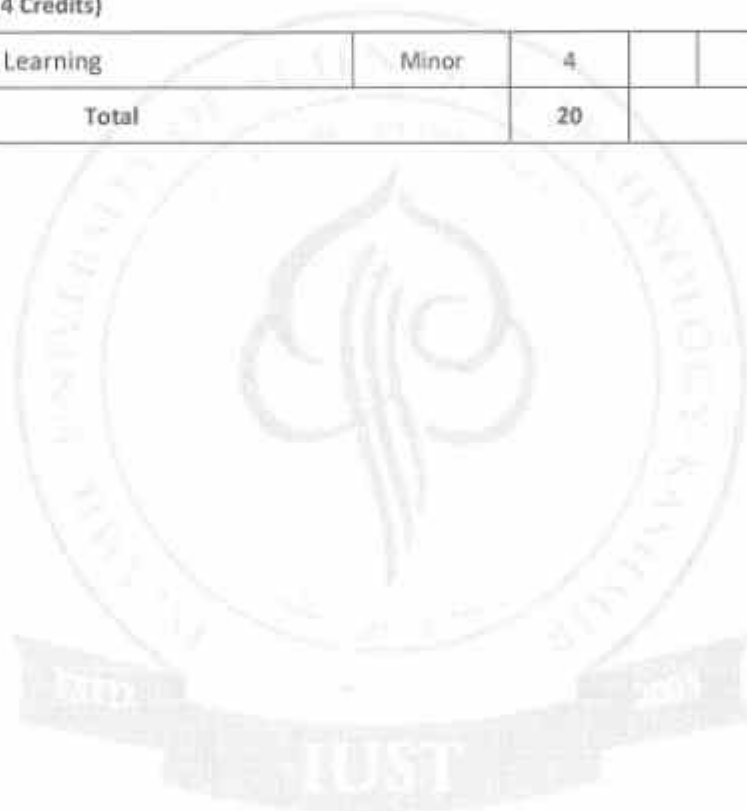
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FYUGP Computer Science Syllabus – DOCS, IUST

Semester-IV (20 Credits)									
Course Code	Course Name	Paper category	Total Credit	Credit Hours				Hours per week	
				L	T	P	S		
Major Courses (8 Credits)									
DCS251MJ	Database Management System	Major	4	3	0	1	0	05	
DCS252MJ	Web Development	Major	4	3	0	1	0	05	
DCS253MJ	Design & Analysis of Computer Algorithms	Major	4	3	1	0	0	04	
DCS254MJ	Data Communication & Computer Networks	Major	4	3	1	0	0	04	
Minor Courses (4 Credits)									
	Machine Learning	Minor	4						
Total			20						









FYUGP Computer Science Syllabus – DOCS, IUST

Course Title: Database Management System
Semester: 4th
Credits: 04
Marks Distribution: (Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)
L T P S: 3 0 1 0

Course Code: DCS2S1MJ
Paper Type: Major
Max Marks: 100

COURSE OBJECTIVES:

- To understand the role of a database management system in an Organization.
- To understand basic database concepts including the structure and Operation of the relational data model.
- To construct simple and moderately advanced database queries using Structured Query Language (SQL).
- To understand and successfully apply logical database design principles, including E-R diagrams and database normalization.

COURSE CONTENT:

UNIT I

Overview of Database Management: Introduction, Data Processing versus Data Management, Data Models: Network Model, Relational Model, Hierarchical Model, Instance and Schema, View of Database system, File Oriented Approach vs Database Oriented Approach, Data Independence, DBMS Architecture

Database Design and E-R Model: Introduction, Entity, Strong and weak entities, Relationship, Cardinality, Attributes, Concept of keys: Super key, Candidate key, Primary key, Alternate key, Foreign key, ER Diagram, Constraints in Database, Codd's Rules, Converting an E-R model into relational Schema.

UNIT II

Relational Database Design and Operations: Introduction, Dependencies: Functional dependencies, Multivalued Dependencies, Join dependencies, Database anomalies, Decomposition, Normalization: Normal forms 1NF, 2NF, 3NF, BCNF, 4NF, 5NF, De-normalization. Relational Algebra: Select operation, Projection operation, Union operation, Cartesian Product operation, Intersection operation, Join operation, Different types of joins (Inner join, Outer join, Self join).

UNIT III

Transaction Management: Transaction concept and transaction states, desirable properties of transactions (ACID properties), schedules – serial and parallel schedules. Serializability – conflict and view serializability, testing serializability. Concurrency problems such as lost update, dirty read, unrepeatable read, and phantom read. Concurrency control techniques including lock-based protocols (Two-Phase Locking), timestamp-based protocols, and validation-based protocols. Recoverable schedules – recoverable, cascade less, and strict schedules

UNIT IV

Introduction to SQL, Data Types in SQL, DDL Commands DDL- Create, Drop, Alter, Desc, Truncate, Commit, Rollback, DML Commands Insert, Update, Delete, Select

Clauses :Where clause Like Clause in clause Order by clause Having clause Group by clause. Operators:AND OR BETWEEN <>, <= >=, =, !=, <>. Aggregation Functions: Count Min, Max Avg, Sum. Conditions:not in is null not null distinct String Operations:Concatenation Length Replace Sub-String In String Join/Union:inner Join Self Join Cross Join/ Cartesian product Left Outer join Right Outer Full outer Join

FYUGP Computer Science Syllabus – DOCS, IUST

COURSE OUTCOMES:

At the end of the course student will be able to:

- Introduces the role of a database management system, basic database concepts, including the structure and operation of the relational data model.
- Familiarize themselves with the concepts of integrity constraints, relational algebra, relational domain & tuple calculus, data normalization.
- Construct simple and moderately advanced database queries using Structured Query Language (SQL).
- Have knowledge of database transaction including concurrency control, backup and recovery, and data object locking.
- Design and implementation of a small database project using Oracle.

Text Books:

1. Korth, Silberschatz, "Database System Concepts", TMH
2. Elmsari & Navathe, "Fundamentals of Database Systems", A. Wesley
3. Ullman J. D., "Principles of Database Systems", Galgotia Publications

References:

1. Steve Bobrowski, "Oracle & Architecture", TMH
2. Date C. J., "An Introduction to Database Systems", Narosa Publishing
3. William Page, "Using Oracle 8i – Special Edition", Que/PHI
4. Ivan Bayross, "SQL & PL/SQL Using Oracle 8i & 9i with SQL*", BPB
5. Desai, B., "An introduction to Database Concepts", Galgotia Publications

FYUGP Computer Science Syllabus – DOCS, IUST

Course Title: Web Development

Semester: 4th

Credits: 04

Marks Distribution: (Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)

LTPS: 3 0 1 0

Course Code: DCS252MJ

Paper Type: Major

Max Marks: 100

COURSE OBJECTIVES:

- To provide knowledge on web architecture, web services, client side and server side scripting technologies.
- To focus on the development of web-based information systems and web services.
- To design interactive web pages using HTML and Style sheets.
- To provide skills to design interactive and dynamic web sites.
- To provide knowledge for implementing web applications using JavaScript.

COURSE CONTENT:

UNIT I

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols, Introduction, Concept of Internet- History of Internet, Protocols of Internet, World Wide Web, Web browsers, web servers, MIME, URL, HTTP, URL, Web Clients, Web Server, Web sites, Web Applications, types of Web applications, HTTP request-response message.

UNIT II

HTML- Introduction, History of HTML, Versions-Basic XHTML Syntax and Semantics, Structure of HTML Document: HTML Tags, open and closed tags, HTML Editors, Elements, Attributes, Styles, Formatting, working with formatting, form, tables, frames, links, images, lists, multimedia: Audio, video, Graphics: Canvas and SVG, HTML APIs: Geolocation, Drag/Drop, web storage.

UNIT III

Cascading Style Sheets: Introduction, syntax, selectors, colors, backgrounds, borders, Margins, padding, outline, text, Fonts, Icons, Lists, Tables, Display, Max-width, position, CSS Responsive: Viewport, Grid-view, media Queries, Images, video, frameworks and templates.

UNIT IV

Introduction to JavaScript, controls statements, Arrays and functions, pattern matching, Element Access, Event Handling.

Fundamentals of DBMS in Web Applications, Relational Databases and SQL, Database Schema Design SQL Queries and CRUD Operations: Create, Read, Update and Delete Data, Database Connectivity using local server/servers.

COURSE OUTCOMES:

At the end of the course student will be able to:

- Understand & Apply (X)HTML(S)+CSS programming
- Demonstrate dynamic webpage development using java script and DHTML
- Design a well formed / valid XML document
- Create a server side ASP application using database

Text Books:

1. HTML5 Black Book by Dreamtech
2. HTML & CSS: Design and Build Web Sites by Jon Duckett, Wiley
3. Web Programming By Chris Bates, Wiley Publications

References:

1. Mastering HTML, CSS & Javascript Web Publishing by Laura Lemay, BPB Publications
2. HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, by Dreamtech Press
3. HTML & CSS: The Complete Reference, Fifth Edition by Thomas Powell, McGraw Hill Education

FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Design and Analysis of Computer Algorithms	Course Code:	DCS253MJ
Semester:	4 th	Paper Type:	Major
Credits:	04	Max Marks:	100
Marks Distribution:	(Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)		
LTPS:	3 1 0 0		

COURSE OBJECTIVE:

- To develop an understanding of fundamental algorithm design techniques and their application in solving computational problems.
- To enable students to design and implement efficient algorithms using different algorithmic strategies.
- To provide knowledge of performance analysis of algorithms, including time and space complexity using asymptotic notations.
- To help students verify the correctness of algorithms and understand their theoretical foundations.

COURSE CONTENT:

UNIT I

Algorithms: Introduction, Characteristics and Importance. Performance Analysis of Algorithms. Growth of Functions and Asymptotic Notations: Big-O, Big-Ω, Big-Θ. **Solving Recurrences:** Substitution Method, Recursion Tree Method, Master Theorem. **Review of Data Structures:** Stacks, Queues, Trees, Graphs and Hashing.

UNIT II

Divide & Conquer: General Method, Binary Search, Min-Max Problem, Merge Sort, Quick Sort. **Greedy Method:** General Method, Fractional Knapsack Problem, Minimum Cost Spanning Trees, Single Source Shortest Paths. **Network Flow:** Ford-Fulkerson Algorithm for Maximum Flow. **String Matching Algorithms:** Knuth-Morris-Pratt Algorithm.

UNIT III

Dynamic Programming: General Method, Fibonacci Sequence, Multistage Graphs, All Pair Shortest Paths, Travelling Salesman Problem. **Backtracking:** General Method, N-Queen Problem, Sum of Subsets Problem, Graph Colouring, 0-1 Knapsack Problem.

UNIT IV

Branch & Bound: General Method, Least Cost Branch & Bound, 8-Queen Problem. **Lower Bound Theory:** Comparison Trees, Lower Bounds through Reductions. **Computational Complexity:** Basic concepts of P and NP, NP-Complete Problem and NP-Hard Problem. **Parallel and Distributed Algorithms:** Basic Concepts of Parallelism, Parallel Architectures, Parallel Searching and Parallel Sorting.

COURSE OUTCOMES:

At the end of the course student will be able to:

- Analyze algorithm efficiency by evaluating and comparing time and space complexity using asymptotic notations and recurrence relations.
- Design and implement algorithms using major design paradigms such as Divide and Conquer, Greedy Method, Dynamic Programming, and Backtracking.
- Apply standard algorithms for solving practical problems related to searching, sorting, graph processing, string matching, and network flow.
- Understand advanced algorithmic concepts, including hashing techniques, computational complexity (P, NP, NP-Complete), and parallel and distributed algorithm models such as MapReduce.

Text Books:

1. Introduction to Algorithms, by Cormen, Leiserson, Rivest, and Stein, MIT Press, Third Edition, 2009.

References:

1. Algorithms, by Dasgupta, Papadimitrou and Vazirani, McGraw-Hill Education, 2006.
2. Computer Algorithms, by Horowitz, Sahni, and Rajasekaran, Silicon Press, 2007.
3. Algorithm Design, by Kleinberg and Tardos, Pearson, 2005.
4. Algorithm Design, by Goodrich and Tamassia, Wiley, 2001.



FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Data Communication & Computer Networks	Course Code:	DCS254MJ
Semester:	4th	Paper Type:	Core
Credits:	04	Max Marks:	100
Marks Distribution: (Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)			
LTPS: 3 1 0 0			

COURSE OBJECTIVES:

- To understand networking concepts and basic communication model.
- To understand network architectures and components required for data communication.
- To analyze the function and design strategy of physical, data link, network layer and transport layer
- To acquire basic knowledge of various application protocol for internet security issues and services.

COURSE CONTENT

UNIT I

Principles of Data Communication, Data Communication Model & Tasks, Concept of Bandwidth & Channel Capacity, Nyquist's Law & Shannon's Law for Quantification of Capacity, Data Rate Versus Baud Rate, Sampling & its types, Nyquist Criterion for Sampling, Data Transmission Concepts, Characteristics of Signals: Digital Signals, Analog Signals (Amplitude, Frequency, Period, Wavelength, Signal to Noise Ratio).

UNIT II

Data Encoding: NRZ-L, NRZ-I Encoding, Multilevel Binary & Biphasic Encoding Techniques & their implementations: ASK, FSK, PSK & QPSK. PCM: Sampling & Quantization & Modulation, Delta Modulation, Amplitude Modulation. Reliable Transmission of Data: Asynchronous & Synchronous Transmission, Multiplexing: Concepts & Types (FDM, Synchronous & Statistical TDM). Error Detection: Parity Based, CRC-Based, Checksum Based. Error Control & Recovery Techniques, Concept of ARQ Standard & its Versions.

UNIT III

Goals & Applications of Computer Network. OSI model. TCP/IP protocol suite. LAN: Ethernet & Token Ring. WAN: Concept, Characteristics, & Architecture: WAN subnet. Internetworking Concept & Architectural Model, Connection Oriented & Connectionless Approaches, Packet switching & Circuit switching. Concept of Autonomous Systems. Internet Layer Protocols: IP (Addressing: Classful & classless IP Addressing, IP Multicasting, Routing, Fragmentation & Reassembly).

UNIT IV

ICMP, ARP, RARP. Routing Protocols: Routing, Static & Dynamic Routing, Distant vector routing, Link state routing, (OSPF), (BGP). Transport Layer Protocols: TCP & UDP. Socket API for Network Programming: Concept of Port & Sockets. Basic Server Architectures: TCP Server & Client. UDP Server & Client. Network Security: Principles of Security, Firewalls, Cryptographic Algorithms (DES, AES, and RSA).

COURSE OUTCOMES:

At the end of the course student will be able to:

- Describe how to connect machines in a network.
- Describe data communication between machines at various locations.
- Familiarize with LAN connecting devices and Network Layer.
- Learn different Network Layer Protocols.
- Understand the concept of Domain Name System (DNS).

Text Books:

1. Computer Networks ,A.S. Tanenbaum, Pearson Education
2. Data Communications & Networking ,Forouzan, Tata McGraw Hill Company

References:

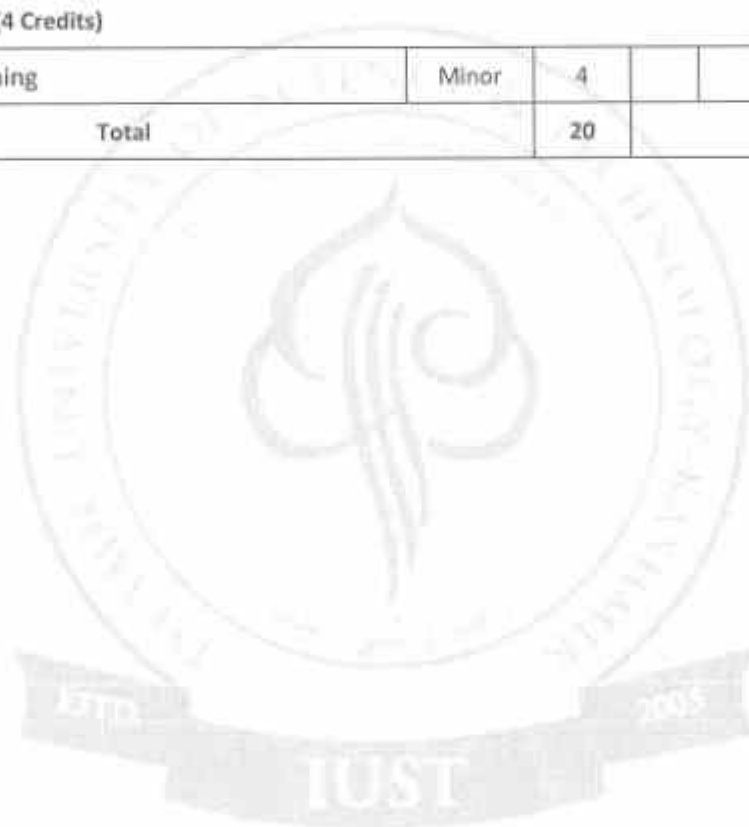
1. Computer Network, S.S.Shinde, New Age International Publisher.
2. Data & Computer Communication , Shashi Banzai , Firewall media
3. Data & Computer communication, William Stallings, Pearson





FYUGP Computer Science Syllabus – DOCS, IUST

Semester-V (20 Credits)								
Course Code	Course Name	Paper category	Total Credit	Credit Hours				Hours per week
				L	T	P	S	
Major Courses (8 Credits)								
DCS301MJ	Web Application Development	Major	4	3	0	1	0	05
DCS302MJ	Programming in Java	Major	4	3	0	1	0	05
DCS303MJ	Data Analytics	Major	4	3	1	0	0	04
DCS304MJ	Software Engineering	Major	4	3	1	0	0	04
Minor Courses (4 Credits)								
	Deep Learning	Minor	4					
Total			20					








FYUGP Computer Science Syllabus – DOCS, IUST

Course Title: Web Application Development
Semester: 5th
Credits: 04
Marks Distribution: (Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)
LT PS: 3 0 1 0

Course Code: DCS301MJ
Paper Type: Major
Max Marks: 100

COURSE OBJECTIVES:

- To understand the architecture and working of server-side web applications.
- To develop dynamic, database-driven web applications.
- To implement form handling, session management, and authentication mechanisms.
- To design and develop RESTful web services using modern frameworks

COURSE CONTENT:

UNIT I

Introduction to server-side scripting, Client-Server architecture, Static vs Dynamic web pages, Introduction to PHP / Node.js, Variables, Data Types, Operators, Control Structures, Functions, Handling Forms (GET and POST methods), File Handling Basics

UNIT II

Introduction to Databases, RDBMS concepts, Introduction to MySQL, SQL: DDL, DML, DCL Commands, CRUD , Operations, Connecting Server-side Script with Database, Prepared Statements, Transactions, Error Handling,

UNIT III

HTTP and Stateless Protocol, Cookies and Sessions, Session Tracking Mechanisms, User Authentication & Authorization, Password Hashing, Form Validation (Client-side & Server-side), Introduction to Web Security Concepts, Common Vulnerabilities (SQL Injection, XSS), Basic Prevention Techniques

UNIT IV

Introduction to MVC Architecture, Introduction to RESTful Services, Building REST APIs, JSON and API Communication, Introduction to Frameworks: Express.js, Django, Deployment Basics, Hosting and Introduction to Cloud Deployment

COURSE OUTCOMES:

At the end of the course student will be able to:

- Explain client-server architecture and server-side programming concepts.
- Develop dynamic web applications using server-side scripting and databases.
- Implement authentication, session management, and data validation techniques.
- Design and deploy basic REST-based web applications using modern frameworks.

Text Books:

1. Web Technologies: Black Book – Kogent Learning Solutions Inc.
2. PHP and MySQL Web Development – Luke Welling & Laura Thomson

References:

1. Node.js, MongoDB and Angular Web Development – Brad Dayley
2. Learning Web Design – Jennifer Robbins
3. RESTful Web APIs – Leonard Richardson & Mike Amundsen

FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Programming in JAVA	Course Code:	DCS302MJ
Semester:	5 th	Paper Type:	Major
Credits:	04	Max Marks:	100
Marks	(Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)		
Distribution:			
LTPS:	3 0 1 0		

COURSE OBJECTIVES:

- To cover OOPS concepts like inheritance, polymorphism, overriding etc.
- To introduce exceptional handling.
- To learn about file handling, multithreading
- To know about database connectivity .

COURSE CONTENT:

Unit I

Fundamental Programming structures in Java: A simple java program, comments, data type, variables, operators, string, input & output, control flow, big numbers, arrays. Objects & Classes: introduction to Object Oriented programming, using predefined classes, defining your own classes, static fields & methods, method parameters, object construction, packages, the class path, documentation comments, Wrapper class.

Unit II

Exception handling - Exception as objects, Exception hierarchy, Try catch finally, Throw, throws IO package - Input streams, Output streams, Object serialization, Deserialization, Sample programs on IO files, Filter and pipe streams Multi-threading - Thread Life cycle, multi-threading advantages and issues, Simple thread program Thread synchronization.

Unit III

JDBC architecture, Establishing connectivity and working with connection interface, Working with statements, Creating and executing SQL statements .

Unit IV

Overview of JSP; JSP Architecture & life cycle, Components of Java Server Pages, Implicit Objects & Standard JSP Tags, Scope of JSP objects, EJB overview & Architecture, Features of EJB.

COURSE OUTCOMES:

At the end of the course student will be able to:

- Describe the features of Java
- Design classes with object-oriented features
- Describe advanced features of Java like exception handling, jdbc, jsp etc.
- Write programs in JAVA featuring its core capabilities

Text Books:

1. Core Java Volume 1-Fundamentals by Cay S.horstman 10th edition Publisher: Prentice Hall
2. . Java server programming, Ivan Bayross SPD
3. . Java Programming Language Ken Arnold Pearson

References:

1. Java the complete reference by Herbert Schield 10th edition Publisher:Tata Mc Graw Hill
2. Java How to program Dietel and Dietel

FYUGP Computer Science Syllabus – DOCS, IUST

Course Title: Data Analytics

Semester: 5th

Credits: 04

Marks Distribution: (Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)

LTPS: 3 1 0 0

Course Code: DCS303MJ

Paper Type: Major

Max Marks: 100

COURSE OBJECTIVES:

- To learn big data challenges in different domains including social media
- To learn MAP-REDUCE programming model for better scalability and performance
- To analyze the capability of No-SQL systems
- To apply machine learning algorithms for big data analytics

COURSE CONTENT:

UNIT I

Introduction to Big Data; Big Data - Definition, overview of Big Data, Big Data Characteristics Volume, Velocity, Variety and other Vs, Issues and challenges of Big Data, Stages of analytical evolution, Big Data Architecture, Space of Big Data: Transactions, Interactions, Observations; Big data Technological approaches and Potential use cases for Big Data. Storage: A General Overview of High-Performance Architecture; HDFS, MapReduce, Map Reduce Programming Model, Overview of HBase, Hive and PIG, Spark Framework – Spark Data frames, Importing and saving data.

UNIT II

Data collection and management: Introduction, Sources of data, Data collection and APIs, data quality and issues with data collection systems with examples from business; Cleaning and treatment of missing data, principles of data visualization, and different methods of presenting data in business analytics. Introduction to Statistics - Measures of central tendencies and distributions, Analysis of variance, Correlation analysis. Distribution properties and arithmetic. Basic analysis techniques - Statistical hypothesis generation and testing.

UNIT III

Machine Learning: Introduction, Supervised Learning, Unsupervised Learning. Classification: Decision Trees - Overview of a Decision Tree, Evaluating a Decision Tree, Confusion matrix. NoSQL Databases Review of traditional Databases, Need for NoSQL Databases, Columnar Databases, Failover and reliability principles, working mechanisms of NoSQL Databases HBase, Cassandra, Couch DB, Mongo DB.

UNIT IV

Data Science - Introduction, Terminology, data science process, data science toolkit. Applications of Data Science, Data Formats – CSV/JSON/AVRO/Parquet. Data Visualization - Technologies for visualization, Tools and libraries for Big Data visualization (e.g., Matplotlib/Seaborn/Tableau/Power-BI), Effective communication of Big Data Insights through visualizations.

COURSE OUTCOMES:

At the end of the course student will be able to:

- Preparing for data summarization, query, and analysis.
- Applying data modelling techniques to large data sets
- Creating applications for Big Data analytics
- Building a complete business data analytic solution

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Text Books:

1. Big Data – A Primer, H. Mohanty, P. Bhuyan, D. Chenthati (Eds.), Springer , Studies in Big Data, vol. 11, 2015.
2. Big Data Analytics with Rand Hadoop, Vignesh Prajapati, PACKT Publishing

References:

1. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, Cambridge Universities Press, 2012.
2. Big Data at Work: Dispelling the Myths, Uncovering the Opportunities Book by Thomas H. Davenport



FYUGP Computer Science Syllabus – DOCS, IUST

Course Title: Software Engineering

Course Code: DCS304MJ

Semester: 5th

Paper Type: Major

Credits: 04

Max Marks: 100

Marks Distribution: (Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)

LTPS: 3 1 0 0

COURSE OBJECTIVES:

- To familiarize students with the fundamentals of software engineering.
- To introduce students to the basic concepts and principles of structured software engineering.
- To make students understand the software management issues.
- To introduce the students to the basic concepts of OOSE.
- To study advanced concepts in software engineering like Reverse engineering, Reengineering, etc.

COURSE CONTENT:

Unit I

Software Engineering: Definition & Evolution, its Role & Impact in Computer Science. Software Process, Characteristics of a SW Process, CMMI, TSP & PSP, Software Product, Characteristics of a Good Software Product, Software Process Models, Comparative Study & Applications. Basic concepts of Agile Process. Software Requirements Analysis (SRA): Requirements - Types, Steps Involved in SRA. SW Requirements Specification (SRS): Need & Characteristics for an SRS, Components of an SRS, Prototype for a Good SRS. Structured Analysis: DFD'S, Control Flow Diagrams, Data Dictionary, State Transition Diagrams, & Entity - Relationship Diagrams.

Unit II

Software Design: Concepts & Principles, Design Considerations & Good Design. Characterization of Effective Modular Design (Functional Independence, Cohesion, Coupling). Design: Architectural Design, Procedural Design, Interface Design, & Data Design. SW Architecture Styles: (Dataflow, Call & Return Architectures, Independent Process Architectures, Virtual Machine Architectures). Concept of Verification & Validation. Goals of SW Testing, Testing Principles.

Unit III

Approaches to the Design of Test Cases: Black Box & White Box Testing, Techniques used by these Approaches: Basis Path & Loop Testing, Graph Based Testing, Equivalence Partitioning, Cyclomatic Complexity, Phases in Testing Activity: Unit, Integration, Validation & System Tests. Software Project Management, Phases of Management, Project Planning & Control, Scheduling, Organization & Team Structures, Project Estimation Techniques – KLOC, FP & COCOMO.

Unit IV

Object Oriented Software Engineering: Object Oriented Paradigm, Concepts - Classes & Objects, Inheritance, Abstraction, Polymorphism, etc. OOA & OOD. Design Methodology – Dynamic Modeling, Functional Modeling. Advanced Concepts: Software Reuse, Re-engineering, Reverse Engineering, Restructuring, Client/Server Software Engineering.

COURSE OUTCOMES:

At the end of the course student will be able to:

- Describe software engineering layered technology and process framework.
- Understand theories, models, and techniques that provide a basis for the software development life cycle.
- Understand software testing approaches including verification and validation, static analysis, reviews, inspections, and audits.
- Understand the role of project management including planning, scheduling, risk management, etc.
- Work as an individual and/or in team to develop and deliver quality software.

Text Books:

1. Pressman, Roger, "Software Engineering- A Practitioners Approach", McGraw Hill

References:

1. Gheezi, Jazayeri Et Al, "Fundamentals Of Software Engineering", PHI
2. Ian Sommerville, "Software Engineering", Pearson Education
3. Pankaj Jalote, "An Integrated Approach To Software Engineering", Narosa
4. Peters & Pedrycz, "Software Engineering an Engineering Approach", Wiley



Semester - VI



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Semester-VI (20 Credits)									
Course Code	Course Name	Paper category	Total Credit	Credit Hours				Hours per week	
				L	T	P	S		
Major Courses (12 Credits)									
DCS351MJ	Theory of Computation & Formal Languages	Major	4	3	1	0	0	04	
DCS352MJ	Cyber Security and Information Assurance	Major	4	3	1	0	0	04	
DCS353MJ	Mini Project	Major	4	0	0	4	0	08	
Minor Courses (4 Credits)									
	Natural Language Processing	Minor	4						
Internship (4 Credits)									
Total			20						



FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Theory of Computation & Formal Languages	Course Code:	DCS351MJ
Semester:	6 th	Paper Type:	Major
Credits:	04	Max Marks:	100
Marks Distribution:	(Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)		
LTPS:	3 1 0 0		

COURSE OBJECTIVES:

- To be able to construct finite state machines and the equivalent regular expressions.
- To understand the class of languages described by finite state machines and regular expressions.
- To understand and construct pushdown automata and the equivalent context free grammars.
- To understand the concept of construct Linear bounded automata and the equivalent context Sensitive grammars.
- To understand the concept of Turing Machine and Universal Turing machine

COURSE CONTENT:

UNIT I

INTRODUCTION TO SET THEORY (BASIC CONCEPTS). CONCEPTS USED IN AUTOMATA THEORY. ALPHABETS, STRINGS, AND LANGUAGES. BASIC STRING OPERATIONS, KLEENE STAR AND KLEENE PLUS. INTRODUCTION TO FINITE AUTOMATA. DETERMINISTIC FINITE AUTOMATON (DFA): DEFINITION AND REPRESENTATION USING TRANSITION DIAGRAM AND TRANSITION TABLE. DESIGN OF SIMPLE DFA FOR PATTERN RECOGNITION. INTRODUCTION TO NON-DETERMINISTIC FINITE AUTOMATON (NFA) AND BASIC COMPARISON OF DFA AND NFA.

UNIT II

FINITE AUTOMATA: BASIC CONCEPTS AND APPLICATIONS. REGULAR EXPRESSIONS: DEFINITION AND BASIC REGULAR EXPRESSIONS. CONVERSION BETWEEN REGULAR EXPRESSIONS AND FINITE AUTOMATA (BASIC IDEA). REGULAR LANGUAGES: DEFINITION AND SIMPLE PROPERTIES. PUMPING LEMMA FOR REGULAR LANGUAGES (BASIC IDEA ONLY). LIMITATIONS OF FINITE AUTOMATA.

UNIT III

INTRODUCTION TO FORMAL GRAMMARS. OVERVIEW OF CHOMSKY HIERARCHY. CONTEXT-FREE GRAMMAR (CFG): DEFINITION AND SIMPLE EXAMPLES. PARSE TREES AND BASIC DERIVATIONS (LEFTMOST AND RIGHTMOST). BASIC CONCEPT OF AMBIGUOUS GRAMMAR. INTRODUCTION TO PUSHDOWN AUTOMATA (PDA) AND RELATION WITH CFG (CONCEPTUAL).

UNIT IV

INTRODUCTION TO TURING MACHINE AND ITS BASIC MODEL. SIMPLE CONCEPT OF CONFIGURATION AND ACCEPTANCE. OVERVIEW OF COMPILER DESIGN. BASICS OF LEXICAL ANALYSIS AND SYNTAX ANALYSIS. INTRODUCTION TO TOP-DOWN PARSING AND BOTTOM-UP PARSING (BASIC CONCEPTS).

COURSE OUTCOMES:

At the end of the course student will be able to:

- Describe the mathematical model of machines.
- Understand the concept of formal language and corresponding automaton.
- Introduces the concept of ambiguity, derivations and parse tree in grammar.
- Apply the acquired knowledge of formal languages to the engineering areas like Compiler Design
- Apply the acquired knowledge of finite automata theory and to design discrete problems to solve by computers.

Text Books:

1. Finite Automata and Formal Languages"- A Simple Approach, A.M Padma Read Pearson Education

References:

1. Hopcroft, J., & Ullman, J., "Introduction to Automata Theory, Languages & Computation", Pearson Education
2. Hopcroft J, R. Motwani, & J. Ullman, "Introduction to Automata Theory, Languages & Computation", Pearson Education
3. P. Linz, "Introduction to Formal Languages & Automata", Jones & Barlett PWS Publishing Company
4. Donald Knuth, "The Art of Computer Programming", Prentice Hall



FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Cyber Security and Information Assurance	Course Code:	DCS352MJ
Semester:	6 th	Paper Type:	Major
Credits:	04	Max Marks:	100
Marks Distribution:	(Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)		
LTPS:	3 1 0 0		

COURSE OBJECTIVES:

- To develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.
- To Gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.
- Develop a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- Develop an understanding of security policies (such as authentication, integrity and confidentiality), as well as protocols to implement such policies in the form of message exchanges.

COURSE CONTENT:

UNIT I

Foundations of Information Security: Definition and Need of information security, Security Basics: Confidentiality, Integrity, Availability, Accountability, Non-Repudiation and Reliability. **Risk and Threat Analysis:** Assets, Vulnerability, Threats, Risks, Countermeasures. **Threat to Security:** Viruses, Phases of Viruses, Types of Virus, Dealing with Viruses, Worms, Trojan Horse, Intruders, Insiders. **Type to Attacks:** Active and Passive attacks, Denial of Service, DDOS, Backdoors and Trapdoors, Sniffing, Spoofing, Man in the Middle, Replay, TCP/IP Hacking, Encryption attacks.

UNIT II

Identification and Authentication: User name and Password, Guessing password, Password attacks-Piggybacking, Shoulder surfing, Dumpster diving, Biometric authentication techniques, **Access controls:** Definition, Authentication Mechanism, principle-Authentication, Authorization, Audit, Policies: DAC, MAC, RBAC.

Cryptography: **Introduction:** Plain Text, Cipher Text, Cryptography, Cryptanalysis, Cryptology, Encryption, Decryption.

Substitution Techniques: Classical cryptographic techniques-Overview. **Symmetric and Asymmetric cryptography:** Introduction to Symmetric encryption, DES (Data encryption Standard) algorithm, Asymmetric key cryptography: Digital Signature.

UNIT III

Firewall: Need of Firewall, types of firewall- Packet Filters, Stateful Packet Filters, Application Gateways, Circuit gateways. Firewall: Policies, Configuration, limitations, DMZ. **Intrusion Detection System:** Vulnerability Assessment, Misuse detection, Anomaly Detection, Network-Based IDS, Host-Based IDS, Honeypots. Kerberos authentication mechanism. **IP Security:** Overview, Protocols- AH, ESP, Modes- transport and Tunnel. Email security: SMTP, PEM, PGP. Public key infrastructure (PKI and digital certificates)

UNIT IV

Defining Cyberspace, Concept of cyber security, Issues and challenges of cyber security, Classification of cybercrime, Cyber Criminals-Types. Cybercriminals modus-operandi, Common cybercrimes Cybercrime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft and Fraud, Cyber terrorism, Cyber Defamation.

COURSE OUTCOMES:

At the end of the course student will be able to:

- *Evaluate the security treats in modern computer era*
- *Define and identify firewall and network filtering*
- *List and recognize various VPN*
- *Identify different technique of sandboxing*
- *Distinguish various ethical hacking and testing procedures*

Text Books:

1. William Stallings, "Cryptography & Network Security", Pearson Education
2. Dieter Gollmann, "Computer Security" Wiley Publication, New Delhi,
3. Atul Kahate, "Cryptography and Network Security", McGraw Hill Education, New Delhi
4. Harish Chander, "Cyber Laws And IT Protection", PHI Publication, New Delhi,
5. Alan Calder Van, "Implementing Information Security based on ISO 27001 / ISO 27002 (Best Practice)", Haren Publishing

References:

1. Pflieger C.P., Pflieger S.L., Margulies J. Security in Computing, 5th edition, Prentice Hall, 2015.
2. Mark Sportack, "IP Routing Fundamentals", Pearson Education
3. Gerard J. Holzmann, "Design & Validation Computer Protocols", Prentice Hall
4. Stallings W., "Network security essentials Applications and Standards", 6th edition, Pearson Education, 2018.
5. Whitman M.E., Mattord H.J., "Principle of Information Security", 6th edition, Cengage Learning, 2017.
6. Bishop M., "Computer Security: Art and Science", 2nd Revised edition, Pearson Education, 2019.
7. Anderson R.J., "Security Engineering: A guide to building Dependable Distributed Systems", 2 nd edition, John Wiley & Sons, 2008.



FYUGP Computer Science Syllabus – DOCS, IUST

DOCS100MD	Fundamentals of Computers	Major	3	3	1	0	04
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FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Fundamentals of Computers	Course Code:	DOCS100MD
Semester:	03	Paper Type:	MD
Credits:	03	Max Marks:	75
Marks Distribution:	(Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)		

L T P S: 3 0 0 0

COURSE OBJECTIVES:

- The course introduces the students to basic computer concepts.
- Emphasis of the course is on providing the students with an introduction to computers, overview of computer software, data communication- tools and techniques.
- Fundamentals of networking and network protocols.
- The course also introduces the students to current trends in information technology.

COURSE CONTENT:

UNIT I

Introduction to Computer: Generations, Characteristics of computers, uses of computers, components of a digital computer, types of computers. Block Diagram of a Computer Functions of the Different Units (Input unit, Output unit, CPU (ALU+CU)).

Memories: Memory hierarchy, Registers and Types, Cache Memory, Primary Memory (RAM, How data is stored in a RAM) DRAM and SRAM. Secondary Memories, Hard drive (HD), Solid State Drive (SSD), CD /DVD.

Software: System Software and Application Software, Computer Languages: Machine language, Assembly language, High level language, Program Language Translators, Compiler, Assembler Interpreter

Operating system: Definition, Functions, Types, Classification, Elements of command based and GUI based operating system.

UNIT II

Problem solving concept: Algorithms – Introduction, Definition, Characteristics, Limitations. Flowchart representation. Computer Arithmetic & Number System: Bit, Nibble, Byte, Word, Binary Number, Computer Arithmetic, Positional number system – Binary, Octal and hexadecimal number systems; Methods of base conversions.

Database: Overview, features, design, models, RDBMS.

UNIT III

Computer Network: Definition, criteria, model, Types (LAN, WAN and MAN), Data communication topologies.

Transmission media: guided and unguided media. Internet: Overview, Architecture, Functioning, Basic services like WWW, Search engines, E-mail, Web Browsers. Cloud Computing: Its nature and benefits.

Cyber Security: Threats, Significance, Challenges, Precautions, Safety measures & Tools.

Overview of Emerging Technologies: Artificial intelligence, Deep-learning, Big-data analytics, Internet of Things (IoT), large language models.

COURSE OUTCOMES:

At the end of the course student will be able to:

- Understand fundamental concepts of computer systems, memory, software, and operating systems.
- Apply problem-solving techniques using algorithms, flowcharts, and number system conversions.
- Describe database fundamentals and RDBMS concepts.
- Explain computer networks, internet services, cybersecurity, cloud computing, and emerging technologies.



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Text Books:

1. Rajaraman V., "Fundamentals of Computers", Prentice-Hall of India.
2. Norton P., "Introduction to Computers", McGraw Hill Education.
3. Goel A., "Computer Fundamentals", Pearson.
4. Balagurusamy E., "Fundamentals of Computers", McGraw Hill.
5. Thareja R., "Fundamentals of Computers", Oxford University Press.
6. Bindra J., "The Tech Whisperer- on Digital Transformation and the Technologies that Enable it", Penguin.

References:

1. RajaRaman, "Introduction to Computers", TMH
2. Peter Norton, "Introduction to Computers", TMH
3. P.K. Sinha, "Computer Fundamentals", BPB, New Delhi.



Skill



FYUGP Computer Science Syllabus – DOCS, IUST

DCS152SE	Office Automation Tools	Skill	3	2	0	1	0	05
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FYUGP Computer Science Syllabus – DOCS, IUST

Course Title:	Office Automation Tools	Course Code:	DCS152SE
Semester:	-	Paper Type:	SEC
Credits:	03	Max Marks:	75
Marks Distribution:	(Mid Term:30, End Term:50, Viva:10, Assignment / Presentations:10)		
L T P S:	2 0 1 0		

COURSE OBJECTIVES:

- Understand the fundamental concepts and interface of Microsoft Word, PowerPoint, and Excel.
- Create, format, and manage Word documents for various purposes, such as reports, letters, and resumes.
- Design professional-looking presentations using PowerPoint, incorporating multimedia, animations, and transitions.
- Apply basic to intermediate Excel functions and formulas for data analysis and management.
- Use practical features like Mail Merge in Word, Conditional Formatting in Excel, and Slide Show settings in PowerPoint for enhanced productivity.
- Protect and share documents, presentations, and spread sheets securely using built-in tools

COURSE CONTENT:

UNIT I

Microsoft Word : Introduction to MS Word & User Interface; Creating, saving, and managing documents; Text editing tools: Cut, Copy, Paste, Undo/Redo; Page setup: paper size, orientation, margins; Text formatting: fonts, font size, color, bold, italics; Paragraph formatting: alignment, indentation, line spacing, Bullets and numbering, Headers, footers, and page numbering, Inserting tables, images, and Smart Art, Find and Replace; Using Styles and Themes for consistent formatting; Navigation Pane and outline view for long documents; Inserting Hyperlinks and Bookmarks; Creating Table of Contents; Converting Word to PDF and vice versa.

UNIT II

Microsoft PowerPoint: Introduction to PowerPoint & Interface; Creating, saving, and organizing slides; Applying themes and templates; Slide design and layout; Inserting text, images, charts, and Smart Art; Slide transitions and basic animations; Using Slide Master for consistent design; Embedding Videos and Audio; Presenting tools: Presenter View, Laser Pointer; Collaborating in PowerPoint (sharing, commenting); Design Ideas / AI-based slide suggestions; Exporting to PDF or Video; Creating Info-graphics with Smart Art.

UNIT III

Microsoft Excel: Introduction to Excel & interface; Creating, saving, and managing workbooks; Data entry and basic formatting (font, alignment, borders); Cell referencing: Relative, Absolute, Mixed; Common functions: SUM, AVERAGE, MIN, MAX, COUNT; Logical Functions: IF, AND, OR; Lookup Function: VLOOKUP (Intro); Sorting and Filtering data; Freeze Panes; Formula bar and handling basic errors; Using Excel Templates (budgets, attendance, etc.); Creating Charts and Graphs (Column, Pie, Line); Data Validation (Drop-downs, restrictions); Conditional Formatting; Intro to Pivot Tables (basic analysis); Flash Fill and Quick Analysis Tool; Excel on Mobile / Cloud (Excel Online / One Drive basic).

COURSE OUTCOMES:

At the end of the course student will be able to:

- Understand fundamental concepts of computer systems, memory, software, and operating systems.
- Apply problem-solving techniques using algorithms, flowcharts, and number system conversions.
- Describe database fundamentals and RDBMS concepts.

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- Explain computer networks, internet services, cybersecurity, cloud computing, and emerging technologies.

Text Books:

7. Rajaraman V., "Fundamentals of Computers", Prentice-Hall of India.
8. Norton P., "Introduction to Computers", McGraw Hill Education.
9. Goel A., "Computer Fundamentals", Pearson.
10. Balagurusamy E., "Fundamentals of Computers", McGraw Hill.
11. Thareja R., "Fundamentals of Computers", Oxford University Press.
12. Bindra J., "The Tech Whisperer- on Digital Transformation and the Technologies that Enable it", Penguin.

References:

4. Official documentation for Microsoft Word, Excel and PowerPoint from <https://support-microsoft.com>
5. Office Automation: Concepts and Applications by K. K. Aggarwal
6. Office Automation by Girji S. and Rashim Gupta.



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