Program: B Tech/MBA Tech Information Technology, B Tech/MBA Tech Computer Engineering, B Tech/MBA Tech Artificial Intelligence, B. Tech CSE- (Cybersecurity), B Tech CSBS, B Tech Computer Science	**Semester :** III, V, VI
Course : Software Engineering	**Code :** 702IT0C016

Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks- 50)**	**Term End Examinations (TEE) (Marks- 100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Prerequisite: Programming for Problem Solving

Course Objective

The objective of the course is to familiarize the students with Software engineering principles, practices and standards required to develop a quality software. The course also intends to develop the ability and skills for the task of requirement analysis, design and modelling.

Course Outcomes

After completion of the course, the student will be able to -

1. Explain the characteristics of various process models used in the development of a Software project
2. Demonstrate an understanding of various Analysis and Design models that provide a basis for the software development
3. Apply UML concepts for modeling software functionality for a given scenario
4. Create test cases for validating the working of the software developed

Detailed Syllabus

Unit	**Description**	**Duration**
1.	**Importance of Software Engineering** Role of Software, Categories of Software, Legacy Software, Software Myth.	**03**
2.	**Prescriptive Process Models** Process Framework, Capability Maturity Model Integration, Waterfall Model, Incremental & RAD Models, Prototyping, Spiral Model, Concurrent Development Model. **Agile Process Models** Agility, Agile Process, Extreme Programming, Adaptive Software Development, SCRUM	**07**
3.	**UML Modeling** Visual modeling with UML, Use case model, Modeling with classes, Identifying classes and objects of real world problems, Defining events and attributes, process of creating class diagram. State diagram, Activity diagram, Modeling interaction and behaviour, Sequence and Collaboration Diagram.	**08**

4.	**Requirement Analysis & Design** Requirement Engineering tasks, Elements of Analysis Model, Data Modeling Concepts, Data Flow Model, and Control Flow Model.	**03**
5.	**Architectural Design** Software Architecture, Data Design, Architectural Styles, Representing System in Context, Refining Architecture into Components, Mapping Data Flow into a Software Architecture.	**03**
6.	**User Interface Design** Golden Rules for User Interface Design, Interface Analysis & Design, Interface Design Steps.	**02**
7.	**Testing Strategies & Software Quality** Test Strategies for Software, Verification & Validation Testing, Unit Testing, Integration Testing, System Testing. McCall's Software Quality Factors, ISO 9126 Quality Factors, Process & Project Metrics, Metrics for Software Quality, SQA Activities, CMMI.	**04**
	Total	**30**

Text Books

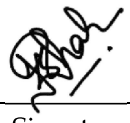
1. Pressman and Roger S., *Software engineering: a practitioner's approach*, 9th Edition, McGraw Hill, 2019.

Reference Books

1. Sommerville and Ian., *Software engineering*, 10th Edition, Pearson Education, 2017.

Laboratory Work

8 to 10 programming exercises (and a practicum) based on the syllabus.



Signature
(Head of the Department)

Program : B Tech / MBA Tech [EXTC/ Information Technology/ Computer Engineering/ Computer Science/ CSE(DS)-311(VT)]				**Semester : V / VI / VII**	
Course : Image and Video Processing				**Code :** 702EX0E004	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks - 100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Signals and Systems, Discrete Time Signal Processing

Course Objective

This course introduces concepts, methodologies and performance metrics for still image and motion picture processing. It also helps to develop a foundation for further study and research in the signal processing domain.

Course Outcomes

After completion of the course, students will be able to -

1. Apply spatial domain enhancement techniques on grey images
2. Analyze various frequency domain transforms to process an image
3. Interpret the use of various morphological operations on images
4. Evaluate segmentation techniques for object detection
5. Illustrate video processing

Detailed Syllabus

Unit	Description	Duration
1.	**Image fundamentals** Basics of sampling and quantization, representing digital image, spatial and gray level resolution, basic relationships between pixels.	**02**
2.	**Image enhancement** Point processing techniques - digital negative, contrast stretching, thresholding, gray level slicing, bit plane slicing, log transformation, power law transformation, neighborhood processing-smoothing spatial filters, sharpening spatial filters, histogram processing-histogram equalization.	**06**
3.	**Image transforms** Walsh transform, Hadamard transform, discrete cosine transform.	**06**
4.	**Morphological image processing** Dilation, erosion, opening, closing, Hit–or-Miss transformation, basic morphological algorithms- boundary extraction on binary images, skeletonization, thinning, thickening.	**05**
5.	**Image segmentation** Detection of discontinuities- point, line and edge detection, edge linking and boundary detection using local processing, segmentation using thresholding, region based segmentation- region growing, region splitting and merging.	**06**

6.	**Fundamentals of digital video** Video representation- digital video sampling, temporal correlation, video frame classifications, I, P and B frames, digital video quality measure.	**02**
7.	**Digital video processing techniques** Fundamentals of motion estimation, motion estimation algorithms- exhaustive search block matching, 2D-log search method and 3 step search method.	**03**
	Total	**30**

Text Books

1. R.C Gonzalez and Richard Woods, *Digital Image Processing*, Pearson publication, 4th Edition, 2018.
2. Ling Guan, *Multimedia Image and Video Processing*, CRC Press, 3rd Edition, 2017.

Reference Books

1. Bernd Jehne, *Digital Image Processing and Image Formation*, Springer, 6th Edition, 2022.
2. Wilhelm Burger and Mark J. Burge, *Digital Image Processing: An Algorithmic Introduction*, Springer publications, 2nd Edition, 2022.

Laboratory Work

8 to 10 practical exercises (and a practicum) based on the syllabus.

Signature
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Program: B Tech /MBA Tech (Computer Engineering and Artificial Intelligence), B Tech (AI and DS, AI and ML, Computer Science)				**Semester:** III/ V	
Course: Operating Systems				**Code**:	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (marks -50)**	**Term End Examinations (TEE) (marks -100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Prerequisite: Programming, Computer Organization and Architecture, Data Structures and Algorithms

Course Objective

The objective of this course is to provide an introduction to functions of the computer operating system.

Course Outcomes

After completion of the course, students will be able to -

1. Describe the fundamental concepts of Operating system
2. Apply process management strategies
3. Simulate memory management, I/O management and file management strategies.

Detailed Syllabus

Unit	Description	Duration
1	**Operating System Overview:** Operating system objectives and functions, evolution of operating system, basic concepts: Processes, Files, System Calls, Layered structure v/s Monolithic structure of OS	**02**
2	**Process and Process Scheduling:** Process Description, Process Control Block (PCB), Threads, Thread management, comparison between Processes and threads, Process Scheduling: Types, study and comparison of various scheduling algorithms	**06**
3	**Process Concurrency:** Principles of Concurrency, Mutual Exclusion-Hardware Approaches, Semaphores, Monitors, Message Passing, Classical IPC Problems: Reader's / Writer's Problem, Producer / Consumer Problem	**06**
4	**Deadlock:** Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery, Dining Philosopher Problem	**05**

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5	**Memory Management:** Memory Management Requirements, Memory Partitioning, Paging, Segmentation, Page Replacement algorithms	**06**
6	**I/O Management and Disk Scheduling:** I/O devices, organization of I/O function, I/O buffering, Disk structure, Disk scheduling algorithms	**03**
7	**File Management:** Overview, File Organization, File Directories, File Sharing	**02**
	Total	**30**

Text Books

1. Silberschatz A. Galvin, *Operating Systems Principles*, 10th Edition, P Wiley Publications, 2018.
2. William Stallings, *Operating Systems: Internals and Design Principles*, 8th Edition, Pearson Education, 2015.

Reference Books

1. Andrew S. Tannenbaum, *Modern Operating System*, 4th Edition, PHI, 2014.

Laboratory Work:

8 to 10 experiments (and a practicum where applicable) based on the syllabus.

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(Prepared by Concerned Faculty/HOD) AY 2023-24

Program: B. Tech and MBA Tech (Computer Engineering) / B Tech Computer Science				**Semester:** V	
Course: Advanced Web Programming				Module Code: 702CO0E004	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks -100)**
2	2	0	3	Marks Scaled to 50	Practical examination Marks Scaled to 50
*Practical exam will be conducted at school level (Non-University Examination)					
Prerequisite: Web Programming					

Course Objective

This course is designed to enhance skills in web programming and develop web applications.

Course Outcomes

After completion of the course, students will be able to -

1. Develop client-side of the web applications
2. Develop server-side scripting for web applications
3. Implement a backend database for web applications
4. Create and host real time web applications

Detailed Syllabus

Unit	Description	Duration
1	**Angular JS** Introduction to Angular JS, Single Page Application, Angular features, Expressions, Modules, Directives, Model, controllers, Data bindings, Scopes, Tables, AngularJS Forms and validation, Services, HTTP, Dependency Injection.	**08**
2	**JSON** Introduction, Syntax, JSON vs XML, Data Types, Parse, Stringify, objects, Arrays, JSON HTML, JSON PHP, JSONP.	**04**
3	**AJAX (Asynchronous JavaScript and XML)** Introduction, Use of Ajax in Web Applications, XML, Http Request and Response, Ajax XML file, Ajax implementation using PHP as server side scripting language.	**05**
4	**Node JS** Introduction, Modules, HTTP module, URL module, File system, NPM, Events and Event Emitter, Exception handling.	**05**

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5	**MYSQL database with Node.js** Introduction, Express.js, create database, create table, insert, update select, delete, where, order by, drop table.	**03**
6	**MongoDB** Introduction to NoSQL databases, MongoDB Overview, data types, data modeling, CRUD Operations in MongoDB, Indexing and Aggregation, MongoDB with Node JS.	**05**
	Total	**30**

Text Books

1. Amos Q. Haviv, Adrian Mejia, Robert Onodi, *Web Application Development with MEAN*, Illustrated Edition, Packt Publishing, 2017.
2. Colin J Ihrig , Adam Bretz, *Full Stack JavaScript Development With MEAN: MongoDB, Express, AngularJS, and Node.JS*, 1st Edition, Sitepoint, 2015.

Reference Books

1. David Stokes, *MySQL and JSON: A Practical Programming Guide*, 1st Edition, McGraw Hill, 2017.
2. Greg Lim, *Beginning Node JS, Express and Mongo Development*, 1st Edition, 2019.
3. DT Editorial Services, *HTML5 Black book, covers CSS 3, Javascript, XML, XHTML, AJAX, PHP and JQuery*, 2nd edition, Dreamtech Press/Wiley India Pvt. Ltd., 2016.

Laboratory Work:

8 to 10 experiments (and a practicum where applicable) based on the syllabus.

Signature

(Prepared by Concerned Faculty/HOD) AY 2023-24

Program: B. Tech and MBA Tech (Computer Engineering) / B Tech Computer Science				**Semester:** V	
Course: Operations Research				Module Code: 702CO0E003	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks - 100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Prerequisite: NA

Course Objective

To provide knowledge of the basic techniques and tools of Operations Research and apply these techniques constructively to make effective business decisions.

Course Outcomes

After completion of the course, students will be able to -

1. Solve problems using concepts of Linear Programming and integer programming
2. Solve problems based on Transportation Models and Assignment Models
3. Apply operations research techniques in industrial optimization problems
4. Model and analyze conflicting situations using game theory

Detailed Syllabus

Unit	Description	Duration
1	**Introduction to OR** Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach.	**01**
2	**Linear Programming Problem** Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP. Hyperplane, Convex set, Convex polyhedron, Extreme points, Basic feasible solutions. Graphical method: Special cases – infeasibility, unboundedness, redundancy & degeneracy. Simplex Algorithm –computational details, Big-M method, identification and resolution of special cases through simplex iterations. Sensitivity analysis. Duality – formulation, results, dual-simplex and primal-dual algorithms.	**07**
3	**Integer Programming Problem**	**04**

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	Gomory cutting plane method, branch and bound algorithm, applications.	
4	**Transportation and Assignment problems** Transportation Problems -Formulation, minimization and maximization models, Solution methods – NWCR, Least cost and VAM, test for optimality (MODI method), variations in Transportation problem (Unbalanced, Degeneracy, Alternate solution, Prohibited routes) Assignment Problem - Formulation, Balanced & unbalanced situations, Hungarian method, variations in Assignment problem (Multiple solution, Maximization case, Restrictions on assignment).	**06**
5	**Network Analysis** CPM Project definition, Project scheduling techniques –PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off.	**05**
6	**Game Theory** Introduction - Characteristics of Game Theory, two-person zero-sum games with and without saddle-points, pure and mixed strategies.	**04**
7	**Simulation Methodology** Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation– clock, event list, Application in Scheduling, Queuing systems and Inventory systems. Introduction, Processing n jobs through two machines, Processing n jobs through 3 machines, Processing n jobs through m machines**.**	**03**
	Total	**30**

Text Books

1. D.S. Hira and P.K. Gupta, "*Operations Research*", 7th revised edition, S. Chand & CO Ltd , 2017.
2. H.A. Taha, "*Operations Research: An Introduction*", 10th edition, Pearson Education,2019.

Text Books

1. F.S. Hiller and G.J. Lieberman, "*Introduction to Operations Research*", 3rd Edition, McGraw Hill Education, 2017.

Laboratory Work:

8 to 10 experiments (and a practicum where applicable) based on the syllabus.

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Mukesh Patel School of Technology Management and Engineering

Program: B Tech Computer Science				**Semester:** V	
Course: Compiler Design				**Code:** 702CS0C004	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Prerequisite: Programming for Problem Solving, Data Structures & Algorithm, Theoretical Computer Science

Course Objective

The course educates students on the basic principles of compiler design. It also covers phases of compiler, lexical analysis, syntactic analysis, and code-generation as well as basic optimizations.

Course Outcomes

After completion of the course, students will be able to -

1. Describe the fundamental concepts of Compiler Design
2. Analyze the working of lexical and syntax analyser
3. Illustrate the working of Code Generator & Code Optimization

Detailed Syllabus

Unit	Description	Duration
1.	**Introduction** Introduction to Compilers & Translators, Phases of Compiler, Compiler Construction tools	02
2.	**Lexical Analyzer** Tokens, lexical analysis, role of lexical analyser, Input buffering, specification of tokens	03
3.	**Syntax Analysis** Role of Parser, Top-Down Parsing, Recursive Descent Parsing, Bottom-Up parsing, Shift Reduce Parsing, Operator Precedent Parsing, LR Parsers, SLR Parser, Canonical LR Parser & LALR Parser	09
4.	**Intermediate Code Generation** Syntax directed translator, Three Address Code, Types & Declaration, Translation of Expression, Type Checking, Control Flow, Backpatching, Switch statements, Intermediate code for procedures	06
5.	**Code Generation**	05

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	Issues the design of code generator, The target machine, runtime storage management, basic blocks and flow graphs, next use information, A simple code generator, DAG representation of basic blocks, Peephole Optimization	
6.	**Code Optimization & Runtime Environment** Introduction, Principal sources of Optimization, Optimization of basic blocks, Introduction to global data flow analysis, runtime environment, allocation strategies, Access to non-local names, Parameter passing	05
	Total	**30**

Text Books

1. Alfred Aho, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles Techniques and Tool", 2nd edition, Pearson Education India, 2013 (Classic).

Reference Books

1. Keith D. Cooper, Linda Torczon, "Engineering a Compiler", 3rd edition, Morgan Kaufmann Publication, 2022.
2. Rajkumar Y, Sudha Rani S, Karthi M, "Compiler Design", 1st edition, Dreamtech Press, 2019.
3. Allen I Holub, "Compiler Design in C", 1st edition, Pearson Education India, 2015.

Laboratory Work

8 to 10 experiments (and a practicum where applicable) based on the syllabus.

Signature
(Head of the Department)

Signature
(Dean)

SVKM's NMIMS Deemed-to-be University

Mukesh Patel School of Technology Management and Engineering

Program: B Tech Computer Science				**Semester:** V	
Course: Mobile Computing (Department Elective I)				**Code:** 702CS0E001	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Prerequisite: Computer Networks

Course Objective

The course educates students on the basic concepts of Mobile Computing. It also covers mobility, mobile internet and mechanisms of adhoc networks to implement various protocols.

Course Outcomes

After completion of the course, students will be able to -

1. Describe the mobile computing architecture and its applications,
2. Simulate medium access control protocols,
3. Apply the concepts of Physical and logical Mobility for Mobile Computing,
4. Analyze heterogeneous networks, concepts of WAP and mobile ad hoc network.

Detailed Syllabus

Unit	Description	Duration
1.	**Introduction** Introduction to mobile computing, application examples, mobile computing architecture, mobile devices	02
2.	**Medium Access Control** Motivation for special MAC: Hidden & Exposed Terminal, Near & Far Terminal. Collision avoidance, MACA, Polling	03
3.	**Logical Mobility** Process migration, steps in process migration, advantages and application of process migration, alternatives to process migration, mobile agents, characteristics of mobile agents, requirements for mobile agent systems, Mobile agent Platform (Aglets object and event model, aglet communication)	04
4.	**Physical Mobility** Mobile IP, goals assumption and requirement, Entities and terminology , IP packet delivery, agent advertisement and discovery, Registration, tunneling and encapsulation , Optimizations, Reverse tunneling, Implications on mobility, indirect TCP, snooping TCP, Mobile TCP, Transaction oriented TCP,TCP over 2.5/3G wireless networks	07
5.	**Wireless Communication** Components of Wireless Communication Systems, Bluetooth, Application, Protocol Stack, Services, Frame Structure, Architecture of Mobile Communication Systems, Wireless Networking Standards, WLAN	04
6.	**Mobile Internet and Wireless web** WAP programming model, WAP protocol stack, WAP 2.0	02
7.	**Mobile Ad-hoc Networks**	08

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	MANET characteristics, classification of MANETs, Routing in MANETs, DSDV, DSR, AODV, Zone routing protocol, hierarchical State routing protocol, power aware routing metrics	
	Total	**30**

Text Books

1. Koushik Sinha, Sasthi C. Ghosh, Bhabani P. Sinha," Wireless Networks and Mobile Computing", 2nd Edition, CRC Press, 2019.
2. Rajkumar Banoth, Aruna Kranthi Godishala, "Mobile adhoc networks", 1st Edition, Scholars' Press, 2020.

Reference Books

1. Clint Smith, Daniel Collins, "Wireless Networks", 3rd Edition, McGraw Hill, 2016.
2. Kum Kum Garg," Mobile Computing Theory and Practice", 1st Edition, Pearson Education, 2010.

Laboratory Work

8 to 10 experiments (and a practicum where applicable) based on the syllabus.

Signature
(Head of the Department)

Signature
(Dean)

SVKM's NMIMS Deemed-to-be University
Mukesh Patel School of Technology Management & Engineering

Program: B Tech Data Science,), B Tech Computer Science , CSE(DS) 311 (Non VT)				**Semester:** V, VII	
Course: Advanced Database Management Systems				**Code:** 702IT0E026	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Prerequisite: Database Management Systems

Course Objective

This course provides in depth exploratory skills in distributed and parallel databases. It covers a number of advanced topics like query optimization including online query and adaptive query processing. The specific topics include advanced transaction models and models of spatial data.

Course Outcomes

After completion of the course, the student will be able to -

1. Analyse different database modelling and management techniques
2. Evaluate measures of query cost, processing and optimization techniques
3. Create programs to execute on XML and relational database systems
4. Explain advance database application and database administration

Detailed Syllabus

Unit	Description	Duration
1	**The Extended Entity Relationship Model and Object Model** The ER model revisited, Motivation for complex data types, User defined abstract data types and structured types.	2
	The Extended Entity Relationship Model and Object Model Subclasses, super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and generalization.	2
2	**Procedural Language/Structured Query language (PL/SQL)** Introduction to PL/SQL, Disadvantages of SQL and advantages of PL/SQL.	2
	Procedural Language/Structured Query language (PL/SQL) PL/SQL block structure, block data types, block variable declaration, exception handling, Cursors, types of cursors, functions, procedures, triggers.	2
3	**Object Oriented Databases** Overview of object-oriented concepts, object identity, object structure and type constructions, Encapsulation of operations, Method and persistence.	2
	Object Oriented Databases Type hierarchies and Inheritance, Type extents and queries, Complex objects; Database schema design for OODBMS; OQL, Persistent programming language; OODBMS architecture and storage issues; Transaction and Concurrency control, example of ODBMS.	2
4	**Parallel and Distributed Databases and Client-Server Architecture** Architectures for parallel database, Parallel query evaluation, Parallelizing individual operations, Sorting, Joins, Distributed Database Concepts, Data	2

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	Fragmentation, Replication, and allocation techniques for distributed database design.	
	Parallel and Distributed Databases and Client-Server Architecture Query processing in distributed databases; Concurrency control and Recovery in distributed databases.	2
5	**Databases on the web and Semi-Structured Data** Web interfaces of the web. Overview of XML; data XML applications.	2
	Databases on the web and Semi-Structured Data The semi structured data model, Implementation issues, Indexes for data.	2
6	**Enhanced data models for Advanced applications** Active database concepts, Temporal database concepts, Spatial database concepts and architecture, Deductive databases and Query processing.	2
	Enhanced data models for Advanced applications Mobile databases, Geographic information systems.	2
7	**NoSQL Database** Overview, and History of NoSQL Databases Definition of the Four Types of NoSQL Database. Comparison of relational databases to new NoSQL stores, MongoDB, Challenges of NoSQL approach.	2
	NoSQL Database NoSQL Key/Value databases using MongoDB, Document Databases, Features, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use.	2
8	**Case Study** Based on distributed database, GIS, Mobile databases.	2
	Total	**30**

Text Books

1. Hennery Korth and Abraham Silberschatz, *Database System Concepts*, Paperback, 7th Edition, McGraw Hill, 2021.
2. Elmarsi and Navathe, *Fundamentals of Database Design*, 7th Edition, Pearson Education India, 2015.

Reference Books

1. Paperback, *DB2 11 for z/OS Database Administration: Certificate Study guide*, Study Guide edition, July 2016 or Higher Edition.
2. R. Ramakrishnan, *Database Management System*, 3rd Edition, McGraw Hill, 2014.

Laboratory Work

8 to 10 experiments (and a practicum) /Programming exercises (and a practicum) based on the syllabus.

Signature
(Head of the Department)