



III Year I Semester	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Outcome(s):

This course will help students understand basic principles and concepts of Internet-of-Things use cases, applications, architecture and technologies. Students will get an overview of an end to end IoT system encompassing the edge, cloud and application tiers. This course will build upon the foundations created in the pre-requisite courses and will equip the students to architect a complete IoT application on their own. The lab exercises will consist of hands-on experiments that will lead to building an IoT application end-to-end. Some of the specialized topics will be covered via student seminars where students are expected to research and present their findings in a seminar format.

UNIT– I

Introduction to IoT and Use cases: Understanding basic concepts of IoT, Consumer IoT vs Industrial Internet, Fundamental building blocks, Use Cases of IoT in various industry domains.

UNIT- II

Architecture: IoT reference architectures, Industrial Internet Reference Architecture, Edge Computing, IoT Gateways, Data Ingestion and Data Processing Pipelines, Data Stream Processing.

UNIT-III

Sensors and Industrial Systems: Introduction to sensors and transducers, integrating sensors to sensor processing boards, introduction to industrial data acquisition systems, industrial control systems and their functions.

UNIT-IV

Networking and Communication for IoT: Recap of OSI 7 layer architecture and mapping to IoT architecture, Introduction to proximity networking technologies (ZigBee, Bluetooth, Serial Communication), Industrial network protocols (Modbus, CANbus), Communicating with cloud applications (web services, REST, TCP/IP and UDP/IP sockets, MQTT, WebSockets, protocols. Message encoding (JSON, Protocol Buffers).

UNIT –V

IoT Data Processing and Storage: Time Series Data and their characteristics, time series databases, basic time series analytics, data summarization and sketching, dealing with noisy and missing data, anomaly and outlier detection.

IoT Seminars: Selected topics in IoT should be handled via student seminars. Recommended that students form a group do research on at least one of the following topics and present it through seminars. They are expected to do a literature survey of the topic and present their survey paper to the class. The suggested topics are –



a) IoT Applications

- Smart Cities
- Connected Vehicles and Telematics
- Smart Grids
- Smart Homes

b) IoT data visualization

c) Survey of cloud based IoT platforms

d) Low power wide area networks for IoT

e) IoT device management

f) Survey of chips, embedded modules and development boards for IoT devices

g) Embedded and real-time operating systems for IoT

h) IoT Security

- Security risks in IoT
- Securing IoT endpoint devices and secure communication protocols for IoT
- Security and Privacy of IoT data

Text Books:

1. The Internet of Things, Samuel Greengard, MIT Press Essential Knowledge Series,

Reference Books / Links:

1. Industrial Internet Reference Architecture - <http://www.iiconsortium.org/IIRA.htm>
2. World Economic Forum Report on Industrial Internet of Things - <https://www.weforum.org/reports/industrial-internet-things>
3. 50 Sensor Applications for a Smarter World - http://www.libelium.com/resources/top_50_iot_sensor_applications_ranking/
4. Visualizing Data-Exploring and Explaining Data with the Processing Environment, By Ben Fry, Publisher: O'Reilly Media
5. Raspberry Pi Computer Architecture Essentials, by Andrew K Dennis
6. Getting Started with Arduino, M. Banzi, O Reilly Media
7. GSMA IoT Security Guidelines & Assessment - <https://www.gsma.com/iot/future-iot-networks/iot-security-guidelines/>



III Year I Semester	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage technologies

UNIT-I

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT-II

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus.

BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT-III

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion). Creating tables with relationships, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non-updatable), relational set operations.

UNIT-IV

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3NF), concept of surrogate key, Boyce-Codd normal form (BCNF), MVD, Fourth normal form (4NF), Fifth Normal Form (5NF).



UNIT-V

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lockbased, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+Trees, operations on B+Trees, Hash Based Indexing

Text Books:

1. Data base Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2,3,4)
2. Database System Concepts, 5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

Reference Books:

1. Introduction to Database Systems, 8th edition, CJDate, Pearson.
2. Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, PeterRobb, Cengage Learning.

Web-Resources:

- 1.<https://nptel.ac.in/courses/106/105/106105175/>
- 2.https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview



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(R23 – IIIrd YEAR COURSE STRUCTURE & SYLLABUS)

III Year I Semester	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

Course Outcomes:

Upon completing this course, the student will be able to

1. To understand the selection procedure of Processors in the embedded domain.
2. Design Procedure for Embedded Firmware.
3. To visualize the role of Real time Operating Systems in Embedded Systems.
4. To evaluate the Correlation between task synchronization and latency issues

UNIT-I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT-II

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT-III

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator UNIT-, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT-IV

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.



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UNIT-V

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets,

Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS.

Text Books:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

Reference Books:

1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013
4. An Embedded Software Primer - David E. Simon, Pearson Education.



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III Year I Semester	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course are to introduce

- Software life cycle models
- Software requirements and SRS document.
- How to plan for a project.
- The quality control and how to ensure good quality software.
- Testing methods of software, use of CASE tools
- Implementation issues, validation and verification procedures.

Course Outcomes:

CO	Course Outcomes	Knowledge Level(K) #
CO1	Compare and analyse various process models	K1
CO2	Develop SRS document and estimate the modularity of the project	K2
CO3	Develop data flow diagrams and compare the user interface design	K2
CO4	Compare testing strategies and analyse the software quality	K3
CO5	Apply Computer Aided Software Engineering tools and analyse the components of software maintenance and reuse.	K2

#basedon suggested Revised BTL

UNIT- I

INTRODUCTION: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

SOFTWARE LIFE CYCLE MODELS: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model and Spiral model.



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UNIT-II

SOFTWARE PROJECT MANAGEMENT: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, and risk management.

REQUIREMENTS ANALYSIS AND SPECIFICATION: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT- III

SOFTWARE DESIGN: Overview of the design process, How to characterise a good software design? Layered arrangement of modules, Cohesion and Coupling.approaches to software design.

FUNCTION-ORIENTED SOFTWARE DESIGN:

Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

USER INTERFACE DESIGN: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT-IV

CODING AND TESTING: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing, Testing object-oriented programs, Smoke testing, and Some general issues associated with testing.

SOFTWARE RELIABILITY AND QUALITY MANAGEMENT: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000.SEI Capability maturity model. Few other important quality standards, and Six Sigma.

UNIT-V

COMPUTER-AIDED SOFTWARE ENGINEERING (CASE): CASE and its scope, CASE environment, CASE support in the software life cycle, Other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.

SOFTWARE MAINTENANCE: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

SOFTWARE REUSE: What can be reused? Why almost no reuse so far? Basic issues in any reuse program, A reuse approach, and Reuse at organisation level.



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Text Books:

1. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.

Reference Books:

1. Software Engineering A practitioner's Approach, Roger S. Pressman, Ninth Edition, Mc Graw Hill International Edition.
2. Software Engineering, Ian Sommerville, Tenth Edition, Pearson Education.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

e-Resources:

1. <https://nptel.ac.in/courses/106/105/106105182/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview



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III Year I Semester	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

CourseObjectives:

- To acquire the knowledge about various architectures and applications of Sensor Networks
- To understand issues, challenges and emerging technologies for wireless sensor networks
- To learn about various routing protocols and MAC Protocols
- To understand various data gathering and data dissemination methods
- To Study about design principals, node architectures, hardware and software required for implementation of wireless sensor networks.

CourseOutcomes: Upon completion of the course, the student will be able to:

- Analyze and compare various architectures of Wireless Sensor Networks
- Understand Design issues and challenges in wireless sensor networks
- Analyze and compare various data gathering and data dissemination methods.
- Design, Simulate and Compare the performance of various routing and MAC protocol

UNIT-I

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

UNIT-II

Mobile Adhoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

UNIT-III

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC Protocol, IEEE 802.15.4 standard and ZigBee

UNIT-IV

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

UNIT-V

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication and Internet to WSN Communication. Single –node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to Tiny OS and nesC.

TextBooks:

1. Ad-Hoc Wireless Sensor Networks - C.Siva Ram Murthy, B.S.Manoj, Pearson
2. Principles of Wireless Networks – Kaveh Pahlevan and P.Krishna Murthy, 2002, PE



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Reference books:

1. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
2. Wireless Communications – Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.
4. Wireless Communication and Networking – William Stallings, 2003, PHI.



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III Year I Semester	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Outcome(s):

This course introduces students to the basic knowledge representation, problem solving, and learning methods of artificial intelligence.

UNIT-I

Introduction, Overview of Artificial intelligence: Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Problem Solving, Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

UNIT-II

Search techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search

UNIT-III

Constraint satisfaction problems: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT-IV

Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.



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UNIT-V

Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques

Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.

Home Assignments:

Assignments should include problems related to the topics covered in lectures, like heuristics, optimal search, and graph heuristics. Constraint satisfaction problems, k-nearest neighbors, decision trees, etc. can be included in home assignments.

Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach
2. Artificial Intelligence, Russel, Pearson

Reference Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
3. Logic & Prolog Programming, Saroj Kaushik, New Age International
4. Expert Systems, Giarranto, VIKAS



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III Year I Semester	CRYPTOGRAPHY & NETWORK SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand the basic categories of threats to computers and networks
- Discusses the Mathematics of Cryptography
- Discuss the fundamental ideas of Symmetric and Asymmetric cryptographic Algorithms
- Discusses the Network layer, Transport Layer and Application layer Protocols Enhanced security mechanisms

Course Outcomes: At the end of the course, student will be able to

CO	Course Outcomes	Knowledg Level (K) [#]
CO1	Student will be able to understand security issues related to computer networks and learn different symmetric key techniques	K2
CO2	Students will be able learn mathematic of cryptography for symmetric and Asymmetric algorithms and apply this knowledge to understand the Cryptographic algorithms	K3
CO3	Students will be able learn different types of symmetric and Asymmetric algorithms	K3
CO4	Students will be able learn different algorithms of Hash functions, message authentication and digital signature and their importance to the security	K4
CO5	Students will be able learn different Enhanced security protocols of Application Layer, Transport Layer and Network layer	K4

#Based on suggested Revised BTL



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Mapping of course outcomes with program outcomes

	PO1	PPO2	PPO3	PPO4	PPO5	PPO6	PPO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	1	1	1	1		1		2	2	2	2
CO2	3	1	1	2	2	2	1	2		3	3	2	3	2	1
CO3	2	2	2	1	2	1	1	1		2		3	1		
CO4	3	2	3	2	3	2	1	1		2	1	2	2	1	
CO5	3	2	3	1	2	2	1	1		2	2	2	1	2	1

(Please fill the above with Levels of Correlation, viz., L-1, M-2, H-3)

UNIT- I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Stenography.

UNIT- II

Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, GF(2^n) fields, Polynomials. **Mathematics of Asymmetric cryptography:** Primes, Checking For Primeness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.

UNIT-III

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5. **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT-IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA). **Message Authentication Codes:** Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S, MAC'S Based On Hash Functions: HMAC, MAC'S Based On Block Ciphers: DAA And CMAC.

Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.



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UNIT-V

Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH.
IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol.
Electronic-Mail Security: Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

Text Books:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015

Reference Books:

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.
3. Modern Cryptography: Theory and Practice By Wenbo Mao. Pearson



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III Year I Semester	INTERNET OF THINGS AND EMBEDDED SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing and I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IoT).
- To build a small, low-cost embedded IoT system using Arduino/Raspberry Pi/open platform.
- To apply the concept of the Internet of Things in real-world scenarios.

Course Outcomes:

CO1: Explain the architecture of embedded processors.

CO2: Write embedded C programs.

CO3: Design simple embedded applications.

CO4: Compare the communication models in IoT.

CO5: Design IoT applications using Arduino/Raspberry Pi/open platform.

LIST OF EXPERIMENTS:

1. Write 8051 Assembly Language experiments using a simulator.
2. Test data transfer between registers and memory.
3. Perform ALU operations.
4. Write basic and arithmetic programs using Embedded C.
5. Introduction to Arduino platform and programming.
6. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth).
7. Introduction to Raspberry Pi platform and Python programming.
8. Interface sensors with Raspberry Pi.
9. Communicate between Arduino and Raspberry Pi using any wireless medium.
10. Set up a cloud platform to log the data.



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11. Log data using Raspberry Pi and upload to the cloud platform.

12. Design an IoT-based system.



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III Year I Semester	DATABASE MANAGEMENT SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives: This Course will enable students to:

- Populate and query a database using SQL DDL/DML Commands.
- Declare and enforce integrity constraints on a database.
- Write queries using advanced concepts of SQL.
- Program PL/SQL including procedures, functions, cursors, and triggers.

Experiments covering the topics:

- DDL, DML, DCL commands.
- Queries, nested queries, built-in functions.
- PL/SQL programming-control structures.
- Procedures, Functions, Cursors, Triggers.
- Database connectivity-ODBC/JDBC.

Sample Experiments:

1. Creation, altering, and dropping of tables and inserting rows into a table (use constraints while creating tables). Examples using SELECT command.
2. Queries (along with sub-queries) using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, Constraints. Example: Select the roll number and name of the student who secured the fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX, and MIN), GROUP BY, HAVING, and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number, to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr, instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date).
5. i. Create a simple PL/SQL program which includes declaration section, executable section, and exception-handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found).

ii. Insert data into student table and use COMMIT, ROLLBACK, and SAVEPOINT in PL/SQL block.



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6. Develop a program that includes the features NESTED IF, CASE, and CASE expression.
The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT-IN Exceptions, USER-defined Exceptions, RAISE-APPLICATION ERROR.
8. Program development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements, and write complex functions.
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT OF clause, and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers, and INSTEAD OF Triggers.
12. Create a table and perform the search operation on table using indexing and non-indexing techniques.
13. Write a Java program that connects to a database using JDBC.
14. Write a Java program to connect to a database using JDBC and insert values into it.
15. Write a Java program to connect to a database using JDBC and delete values from it.

Textbooks/Suggested Reading:

- Oracle: The Complete Reference by Oracle Press.
- Nilesh Shah, "Database Systems Using Oracle," PHI, 2007.
- Rick F. Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007.



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B.Tech CSE – Internet of Things (IoT)

(R23 – IIIrd YEAR COURSE STRUCTURE & SYLLABUS)

III Year I Semester	FULL STACK DEVELOPMENT – 2	L	T	P	C
		0	1	2	2

Course Outcomes:

At the end of the Course, Student will be able to:

- CO1:** Make use of router, template engine and authentication using sessions to develop applications in Express JS.
- CO2:** Build a single page application using RESTful APIs in Express JS.
- CO3:** Make use of components, props, stats and render data in ReactJS.
- CO4:** Apply router and hooks in designing ReactJS application.
- CO5:** Make use of MongoDB queries to perform CRUD operations on document database.

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	2	2	3		2				2	2		2
CO	2	3	2		2				2	2		2
CO	2	2	3		2				2	2		2
CO	2	3	2		2				2	2		2
CO	2	2	3		2				2	2		2

List of Experiments:

Experiment 1: Node.js

- a. Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.
- b. Write a program to transfer data over http protocol using http module.
- c. Create a text file src.txt and add the following content to it. (HTML, CSS, Javascript, Typescript, MongoDB, Express.js, React.js, Node.js)
- d. Write a program to parse an URL using URL module.
- e. Write a program to create an user-defined module and show the workflow of Modularization of application using Node.js



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Experiment 2: Typescript

- a. Write a program to understand simple and special types.
- b. Write a program to understand function parameter and return types.
- c. Write a program to show the importance with Arrow function. Use optional, default and REST parameters.
- d. Write a program to understand the working of typescript with class, constructor, properties, methods and access specifiers.
- e. Write a program to understand the working of namespaces and modules.
- f. Write a program to understand generics with variables, functions and constraints.

Experiment 3-15:

Augmented Programs: (Any 2 must be completed from Experiment 3-5)

1. Write a CSS program, to apply 2D and 3D transformations in a web page.
2. a web page with new features of HTML5 and CSS3.
3. Design a to-do list application using JavaScript.

Experiment 6:

ExpressJS – Routing, HTTP Methods, Middleware

- a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.
- b. Write a program to accept data, retrieve data and delete a specified resource using http methods.
- c. Write a program to show the working of middleware.
- d.

Experiment 7:

ExpressJS – Templating, Form Data

- a. Write a program using templating engine.
- b. Write a program to work with form data.

Experiment 8:

ExpressJS – Cookies, Sessions, Authentication

- a. Write a program for session management using cookies and sessions.
- b. Write a program for user authentication



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Experiment 9:

ExpressJS – Database, RESTful APIs

- a. Write a program to connect MongoDB database using Mongoose and perform CRUD operations.
- b. Write a program to develop a single page application using RESTful APIs

Experiment 10:

ReactJS – Render HTML, JSX, Components – function & Class

- a. Write a program to render HTML to a web page.
- b. Write a program for writing markup with JSX.
- c. Write a program for creating and nesting components (function and class).

Experiment 11:

ReactJS – Props and States, Styles, Respond to Events

- a. Write a program to work with props and states.
- b. Write a program to add styles (CSS & Sass Styling) and display data.
- c. Write a program for responding to events.

Experiment 12:

ReactJS – Conditional Rendering, Rendering Lists, React Forms

- a. Write a program for conditional rendering.
- b. Write a program for rendering lists.
- c. Write a program for working with different form fields using react forms

Experiment 13:

ReactJS – React Router, Updating the Screen

- a. Write a program for routing to different pages using react router.
- b. Write a program for updating the screen.



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Experiment 14:

ReactJS – Hooks, Sharing data between Components

a. Write a program to understand the importance of using hooks.

b. Write a program for sharing data between components

Experiment 15:

ReactJS Applications – To-do list and Quiz

a. Design to-do list application

Experiment 16:

MongoDB – Installation, Configuration, CRUD operations

a. Install MongoDB and configure ATLAS

b. Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()

Experiment 17:

MongoDB – Databases, Collections and Records

a. Write MongoDB queries to Create and drop databases and collections.

b. Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate()

Experiment 18-20:

Augmented Programs: (Any 2 must be completed)

18. Design a to-do list application using NodeJS and ExpressJS.

19. Design a Quiz app using ReactJS.

20. Complete the MongoDB certification from MongoDB University website.



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Text Books:

1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.
2. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, A Press, O'Reilly.

Web Links:

1. ExpressJS - <https://www.tutorialspoint.com/expressjs>
2. ReactJS - <https://www.w3schools.com/REACT> (and) <https://react.dev/learn#>
3. MongoDB - <https://learn.mongodb.com/learning-paths/introduction-to-mongodb>



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III Year I Semester	UI DESIGN-FLUTTER LAB	L	T	P	C
		0	0	2	1

Course Objectives:

- Learns to Implement Flutter Widgets and Layouts
- Understands Responsive UI Design and with Navigation in Flutter
- Knowledge on Widges and customize widgets for specific UI elements, Themes
- Understand to include animation apart from fetching data

List of Experiments:

Students need to implement the following experiments

1. a) Install Flutter and Dart SDK.
b) Write a simple Dart program to understand the language basics.
2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
b) Implement different layout structures using Row, Column, and Stack widgets.
3. a) Design a responsive UI that adapts to different screen sizes.
b) Implement media queries and breakpoints for responsiveness.
4. a) Set up navigation between different screens using Navigator.
b) Implement navigation with named routes.
5. a) Learn about stateful and stateless widgets.
b) Implement state management using set State and Provider.
6. a) Create custom widgets for specific UI elements.
b) Apply styling using themes and custom styles.
7. a) Design a form with various input fields.
b) Implement form validation and error handling.
8. a) Add animations to UI elements using Flutter's animation framework.
b) Experiment with different types of animations (fade, slide, etc.).



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9. a) Fetch data from a REST API.
- b) Display the fetched data in a meaningful way in the UI.
10. a) Write UNIT- tests for UI components.
- b) Use Flutter's debugging tools to identify and fix issues.

Text Book:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st Edition, Apres