MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
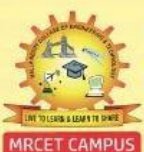(AUTONOMOUS INSTITUTION - UCG, GOVT. OF INDIA)
(Affiliated to JNTUH; Approved by AICTE - Accredited by NBA & NAAC - 'A' Grade, ISO 9001:2008 Certified)
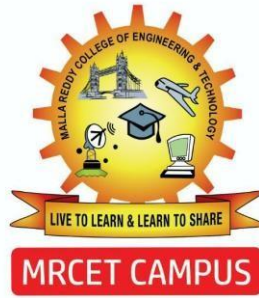Maisammaguda, Dhulapally, Secunderabad - 500100.

MRCET CAMPUS

R22
REGULATION

INTERNET OF THINGS - IOT

Department of ComputerScience&Engineering

COURSE STRUCTURE AND SYLLABUS
Version: R22-V2-IOT-22.07.2023

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS INSTITUTION - UGC, GOVT. OF INDIA)
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MRCET CAMPUS

EAMCET/PGECET/ICET CODE: MLRD

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)

BACHELOR OF TECHNOLOGY
CSE (Internet of Things)
COURSE STRUCTURE & SYLLABUS (R22)
(Batches admitted from the academic year 2022 - 2023)

R22

Department of
COMPUTER SCIENCE & ENGINEERING
(EMERGING TECHNOLOGIES-IOT)
Updated Version: R22/V-2/22.07.2023

M R C E T CAMPUS

(Autonomous Institution – UGC, Govt. of India)
(Affiliated to JNTU, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – _A' Grade - ISO 9001:2015 Certified)
Maisammaguda, Dhulapally (Post Via. Kompally), Secunderabad – 500100, Telangana State, India.
Contact Number: 040-23792146/64634237, E-Mail ID: mrcet2004@gmail.com, website: www.mrcet.ac.in

Note: The regulations here under are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already pursuing the program) as may be decided by the Academic Council.

PRELIMINARY DEFINITIONS AND NOMENCLATURES

➢ Autonomous Institution /College‖- means an institution/college designated as autonomous institute / college by University Grants Commission (UGC), as per the UGC Autonomous College Statutes.

➢ Academic Autonomy -‖means freedom to the College in all aspects of conducting its academic programs, granted by the University for promoting excellence.

➢ Commission - means University Grants Commission.

➢ AICTE - means All India Council for Technical Education.

➢ University - The Jawaharlal Nehru Technological University, Hyderabad.

➢ College – means Malla Reddy College of Engineering & Technology, Secunderabad unless indicated otherwise by the context.

➢ Program - means:
- Bachelor of Technology (B.Tech) degree program
- UG Degree Program: B.Tech

➢ Branch means specialization in a program like B.Tech degree program in Computer Science and Engineering, B.Tech degree program in Electronics & Communication Engineering etc.

➢ Course or Subject means a theory or practical subject, identified by its course–number and course-title, which is normally studied in a semester.

➢ T–Tutorial, P–Practical, D–Drawing, L-Theory, C-Credits

FOREWORD

The autonomy is conferred on Malla Reddy College of Engineering & Technology (MRCET) by UGCbased on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the UGC in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

Malla Reddy College of Engineering & Technology (MRCET CAMPUS) is proud to win the credence of all the above bodies monitoring the quality of education and has gladly accepted the responsibility of sustaining, and also improving upon the values and beliefs for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studiesare constituted with the guidance of the Governing Body of the College and recommendations of the JNTU Hyderabad to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several experts drawn from academics, industry and research, in accordance with the vision and mission of the college which reflects the mindset of the institutionin order to produce quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications, if needed, are to be sought at appropriate time with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stakeholders is sought for the successful implementation of the autonomous system in the larger interests of the institution and brighter prospects of engineering graduates.

"A thought beyond the horizons of success committed for educational excellence"

PRINCIPAL

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)

Vision of the Department

"To be at the forefront of Emerging Technologies and to evolve as a Centre of Excellence in Research, Learning and Consultancy to foster the students into globally competent professionals useful to the Society."

Mission **of the Department**

The department of CSE (Emerging Technologies) is committed to:

- To offer highest Professional and Academic Standards in terms of Personal growth and satisfaction.
- Make the society as the hub of emerging technologies and thereby capture opportunities in new age technologies.
- To create a benchmark in the areas of Research, Education and Public Outreach.
- To provide students a platform where independent learning and scientific study are encouraged with emphasis on latest engineering techniques.

QUALITY POLICY
- To pursue continual improvement of teaching learning process of Undergraduate and Post Graduate programs in Engineering & Management vigorously.
- To provide state of art infrastructure and expertise to impart the quality education and research environment to students for a complete learning experiences.
- Developing students with a disciplined and integrated personality
- To offer quality relevant and cost effective programmes to produce engineers as per requirements of the industry need.

For more information: www.mrcet.ac.in

BACHELOR OF TECHNOLOGY (B.Tech)

IOT

COURSE STRUCTURE (R22)

(Batches admitted from the academic year 2022 - 2023)

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

B TECH – CSE (INTERNET OF THINGS) - R22 - COURSE STRUCTURE

I Year B. Tech - CSE (INTERNET OF THINGS) – I Semester

S.No	Subject Code	SUBJECT (S)	L	T	P	C	MAX. MARKS INT	EXT
1	R22A0001	English	2	0	0	2	40	60
2	R22A0023	Mathematics –I	3	1	0	4	40	60
3	R22A0021	Applied Physics	3	0	0	3	40	60
4	R22A0022	Engineering Chemistry	2	0	3	4	40	60
5	R22A0501	Programming for Problem Solving	3	0	0	3	40	60
6	R22A0082	Applied Physics/Engineering Chemistry Lab	-	0	2	1	40	60
7	R22A0083	Engineering and Computing Hardware Workshop	-	0	3	1.5	40	60
8	R22A0581	Programming for Problem Solving Lab	-	0	3	1.5	40	60
9	R22A0003	Human Values and Professional Ethics	2	0	0	0	40	60
		Total	15	1	11	20	360	540

I Year B. Tech - CSE (INTERNET OF THINGS) – II Semester

S.No	Subject Code	SUBJECT(S)	L	T	P	C	MAX. MARKS INT	EXT
1	R22A0002	Professional English	2	0	0	2	40	60
2	R22A0024	Mathematics – II	3	1	0	4	40	60
3	R22A0201	Principles of Electrical and Electronics Engineering	3	1	0	4	40	60
4	R22A0301	Computer Aided Engineering Graphics	3	0	0	3	40	60
5	R22A0502	Problem Solving using Python Programming	3	0	0	3	40	60
6	R22A0081	English Language and Communication Skills Lab	-	0	3	1.5	40	60
7	R22A0281	Principles of Electrical and Electronics Engineering Lab	-	0	3	1.5	40	60
8	R22A0582	Problem Solving using Python Programming Lab	-	0	2	1	40	60
9	R22A0004	Environmental Science	2	0	0	0	40	60
		Total	16	2	8	20	360	540

II Year B. Tech - CSE (INTERNET OF THINGS) – I Semester

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0503	Data Structures	3	0	0	3	40	60
2	R22A0504	Database Management Systems	3	0	0	3	40	60
3	R22A1261	Computer Organization & Architecture	3	1	0	4	40	60
4	R22A0509	Operating Systems	3	0	0	3	40	60
5	R22A0026	Probability, Statistics and Queuing Theory	3	1	0	4	40	60
6	R22A0583	Data Structures Lab	0	0	2	1	40	60
7	R22A0584	Database Management Systems Lab	0	0	2	1	40	60
8	R22A0587	Operating Systems Lab	0	0	2	1	40	60
9	*R22A0005	Foreign Language: French*	2	0	0	0	100	-
		Total	**17**	**2**	**6**	**20**	**420**	**480**

*Mandatory course: Non-credit course, 50% of scoring is required for the award of the degree

II Year B. Tech - CSE (INTERNET OF THINGS) – II Semester

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0507	Object Oriented Programming through Java	3	0	0	3	40	60
2	R22A0505	Software Engineering	3	0	0	3	40	60
3	R22A0028	Discrete Mathematics	3	0	0	3	40	60
4	R22A0506	Design and Analysis of Algorithms	3	1	0	4	40	60
5	R22A6902	Sensors and Devices	3	0	0	3	40	60
6	R22A6981	Sensors and Devices Lab	0	0	2	1	40	60
7	R22A0586	Object Oriented Programming through Java Lab	0	0	2	1	40	60
8	R22A6991	Industry Oriented Project	0	0	4	2	40	60
9	R22A0061	Public Policy and Governance*	2	0	0	0	40	60
		Total	**17**	**1**	**8**	**20**	**360**	**540**

*Mandatory course: Non-credit course, 50% of scoring is required for the award of the degree

III Year B. Tech - CSE (INTERNET OF THINGS) – I Semester

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0409	Microprocessors and Microcontrollers	3	0	0	3	40	60
2	R22A6601	Artificial Intelligence	3	0	0	3	40	60
3	R22A1207	Automata Theory and Compiler Design	3	0	0	3	40	60
4		**Open Elective-I**	3	0	0	3	40	60
5	R22A0512 R22A6201 R22A0566 R22A6615	**Professional Elective-I** 1. Computer Networks 2. Cyber Security Essentials 3. Web Programming 4. Human Computer Interaction	3	0	0	3	40	60
6	R22A0488	Microprocessors and Microcontrollers Lab	0	0	2	1	40	60
7	R22A6683	Artificial Intelligence Lab	0	0	2	1	40	60
8	R22A6992	Application Development –I	0	0	4	2	40	60
9	R22A0084	Professional Development Skills – I	0	0	2	1	40	60
		Total	**15**	**0**	**10**	**20**	**360**	**540**

III Year B. Tech - CSE (INTERNET OF THINGS) – II Semester

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A6703	Data Analytics	3	0	0	3	40	60
2	R22A6602	Machine Learning	3	0	0	3	40	60
3	R22A6903	IoT System Architecture	3	0	0	3	40	60
4		**Open Elective –II**	3	0	0	3	40	60
5	R22A1206 R22A0514 R22A6904 R22A6701	**Professional Elective-II** 1. Mobile Application Development 2. Distributed Systems 3. Industrial IoT 4. Data Science and It's Applications	3	0	0	3	40	60
6	R22A6783	Data Analytics Lab	0	0	2	1	40	60
7	R22A6681	Machine Learning Lab	0	0	2	1	40	60
8	R22A6993	Application Development –II	0	0	4	2	40	60
9	R22A0085	Professional Development Skills – II	0	0	2	1	40	60
		Total	**15**	**0**	**10**	**20**	**360**	**540**

IV Year B. Tech - CSE (INTERNET OF THINGS) – I Semester

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0513	Full Stack Development	3	0	0	3	40	60
2	R22A6208	IoT Security & Privacy	3	0	0	3	40	60
3	R22A0522	Cloud Computing	3	1	0	4	40	60
4	R22A6621 R22A6214 R22A6606 R22A6203	**Professional Elective-III:** 1. Generative AI 2. Database Security 3. Computer Vision 4. Ethical Hacking	3	0	0	3	40	60
5	R22A6907 R22A0527 R22A6905 R22A0521	**Professional Elective-IV:** 1. IoT Automation 2. Blockchain Technology 3. Architecting Smart IoT Devices 4. DevOps	3	0	0	3	40	60
6	R22A0589	Full Stack Development Lab	0	0	2	1	40	60
7	R22A6994	Project Development (Phase-I)	0	0	6	3	40	60
		Total	**15**	**1**	**8**	**20**	**280**	**420**

IV Year B. Tech - CSE (INTERNET OF THINGS) – II Semester

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0334	Innovation, Start-Up & Entrepreneurship	4	0	0	4	40	60
2	R22A6906 R22A0530 R22A6614 R22A0528	**Professional Elective-V:** 1. Programming Languages for IoT 2. Edge Computing 3. Expert Systems 4. Quantum Computing	3	0	0	3	40	60
3	R22A6908 R22A0517 R22A0567 R22A6909	**Professional Elective-VI:** 1. Smart Sensors Technologies 2. Augmented Reality & Virtual Reality 3. Wireless Networks 4. 5G and IoT Technologies	3	0	0	3	40	60
4	R22A6995	Project Development (Phase-II)	0	0	20	10	80	120
		Total	**10**	**0**	**20**	**20**	**200**	**300**

List of Open Electives:

OPEN ELECTIVE – I		
S.No	**Subject Code**	**SUBJECT NAME**
1	R22A1251	WEB DEVELOPMENT
2	R22A2151	INTELLECTUAL PROPERTY RIGHTS
3	R22A0551	JAVA PROGRAMMING
4	R22A0351	ROBOTICS AND AUTOMATION
5	R22A0451	ELECTRONICS FOR HEALTH CARE
6	R22A0251	RENEWABLE ENERGY SOURCES
7	R22A6751	PRINCIPLES OF DATA SCIENCE
8	R22A6752	BUSINESS ANALYTICS

OPEN ELECTIVE – II		
S.No	**Subject Code**	**SUBJECT NAME**
1	R22A0553	DATABASE SYSTEMS
2	R22A6753	BIG DATA ARCHITECTURE
3	R22A0352	DESIGN THINKING
4	R22A0552	PRINCIPLES OF CLOUD COMPUTING
5	R22A6951	IOT & IT'S APPLICATIONS
6	R22A2152	NANO MATERIALS
7	R22A0252	ELECTRICAL AND HYBRID VEHICLES
8	R22A6251	CYBER GOVERNANCE

BACHELOR OF TECHNOLOGY (B.Tech)

CSE(INTERNET OF THINGS - IOT)
I Year B.Tech (R22)
I Sem & II Sem

S Y L L A B U S

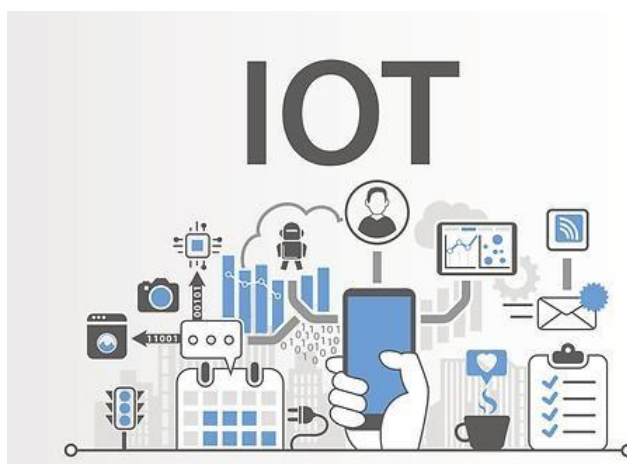**(Batches admitted from the academic year 2022 - 2023)**

BACHELOR OF TECHNOLOGY (B.Tech)

Internet of Things (IoT)

II Year B.Tech (R22)

S Y L L A B U S

(Batches admitted from the academic year 2022 - 2023)

II Year – I Semester (R22) CSE (Internet of Things)

Course Structure of II Year - I Sem CSE(IoT) - R22 Regulation

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0503	Data Structures	3	0	0	3	40	60
2	R22A0504	Database Management Systems	3	0	0	3	40	60
3	R22A1261	Computer Organization & Architecture	3	1	0	4	40	60
4	R22A0509	Operating Systems	3	0	0	3	40	60
5	R22A0026	Probability, Statistics and Queueing Theory	3	1	0	4	40	60
6	R22A0583	Data Structures Lab	0	0	2	1	40	60
7	R22A0584	Database Management Systems Lab	0	0	2	1	40	60
8	R22A0587	Operating Systems Lab	0	0	2	1	40	60
9	*R22A0005	Foreign Language: French	2	0	0	0	100	-
		Total	**17**	**2**	**6**	**20**	**420**	**480**

II Year B.Tech CSE(IoT) – I Sem (R22)   **L/T/P/C**

                                                    3/-/-/-3

(R22A0503) DATA STRUCTURES

COURSE OBJECTIVES:

This course will enable students to

1. Implement Object Oriented Programming concepts in Python.
2. Understand Lists, Dictionaries and Regular expressions in Python.
3. Understanding how searching and sorting is performed in Python.
4. Understanding how linear and non-linear data structures works.
5. To learn the fundamentals of writing Python scripts.

UNIT - I
Oops Concepts - class, object, constructors, types of variables, types of methods. **Inheritance:** single, multiple, multi-level, hierarchical, hybrid, **Polymorphism:** with functions and objects, with class methods, with inheritance, **Abstraction:** abstract classes.

UNIT - II
Data Structures - Definition, Linear Data Structures, Non-Linear Data Structures, Python Specific Data Structures, List, Tuples, Set, Dictionaries, Comprehensions and its Types, Strings, slicing.

UNIT - III
Arrays - Overview, Types of Arrays, Operations on Arrays, Arrays vs List.
Searching - Linear Search and Binary Search.
Sorting - Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort.

UNIT - IV
Linked Lists – Implementation of Singly Linked Lists, Doubly Linked Lists, Circular Linked Lists.
Stacks - Overview of Stack, Implementation of Stack (List & Linked list), Applications of Stack
Queues: Overview of Queue, Implementation of Queue(List & Linked list), Applications of Queues, Priority Queues.
UNIT -V
Graphs - Introduction, Directed vs Undirected Graphs, Weighted vs Unweighted Graphs, Representations, Breadth First Search, Depth First Search.
Trees - Overview of Trees, Tree Terminology, Binary Trees: Introduction, Implementation, Applications. Tree Traversals, Binary Search Trees: Introduction, Implementation, AVL Trees: Introduction, Rotations, Implementation.

TEXTBOOKS:

1. Data structures and algorithms in python by Michael T. Goodrich
2. Data Structures and Algorithmic Thinking with Python by Narasimha Karumanchi

REFERENCE BOOKS:

1. Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition by Dr. Basant Agarwal, Benjamin Baka.
2. Data Structures and Algorithms with Python by Kent D. Lee and Steve Hubbard.
3. Problem Solving with Algorithms and Data Structures Using Python by Bradley N Miller and David L. Ranum.
4. Core Python Programming -Second Edition,R. Nageswara Rao, Dreamtech Press

COURSE OUTCOMES:

The students should be able to:

1. Examine Python syntax and semantics and apply Python flow control and functions.
2. Create, run and manipulate Python Programs using core data structures like Lists,
3. Apply Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Master object-oriented programming to create an entire python project using objects and classes

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II Year B.Tech CSE(IoT) - I Sem (R22)   **L/T/P/C**

3/-/-/-3

| (R22A0504) DATABASE MANAGEMENT SYSTEMS |

COURSE OBJECTIVES:

1. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
2. To understand and use data manipulation language to query, update, and manage a database
3. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server(Database Server),Data Warehousing.
4. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
5. Familiar with basic database storage structures and access techniques: file and page organizations

UNIT I:

Database System Applications, Purpose of Database Systems, View of Data–Data Abstraction –Instances and Schemas–Database Languages–database Access for applications Programs–Database Users and Administrator–Transaction Management–Database Architecture–Storage Manager–the Query Processor.

Data Models: Introduction to the Relational Model– Structure – Database Schema, Keys – Schema Diagrams. Database design– Other Models, ER diagrams – ER Model -Entities, Attributes and Entity sets – Relationships and Relationship sets – ER Design Issues – Concept Design – Conceptual Design with relevant Examples. Relational Query Languages, Relational Operations.

UNIT II:

Relational Algebra-Selection and projection set operations–renaming–Joins–Division Examples of Algebra overviews – Relational calculus – Tuple Relational Calculus (TRC) –Domain relational calculus(DRC).

Overview of the SQL Query Language – Basic Structure of SQL Queries, Set Operations, Aggregate Functions–GROUPBY–HAVING, Nested Subqueries, Views, Triggers, Procedures.

UNIT III:

Normalization – Introduction, Non loss decomposition and functional dependencies, First, Second, and third normal forms – dependency preservation, Boyce/Codd normal form.Higher Normal Forms - Introduction, Multi-valued dependencies and Fourth normal form, Join dependencies and Fifth normal form

UNIT IV:

Transaction Concept- Transaction State- Implementation of Atomicity and Durability –Concurrent Executions – Serializability- Recoverability – Implementation of Isolation –Testingforserializability-Lock–BasedProtocols–TimestampBasedProtocols-Validation-BasedProtocols–MultipleGranularity.

UNIT V:

Recovery and Atomicity– Log– Based Recovery – Recovery with Concurrent Transactions – Check Points – Buffer Management–Failure with loss of non-volatile storage.

TEXTBOOKS:

1. DatabaseSystemConcepts,Silberschatz,Korth,McGrawhill,SixthEdition. (All units except IIIrd)
2. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition.

REFERENCEBOOKS:

1. Fundamentals of Database Systems, Elmasri Navathe Pearson Education.
2. An Introduction to Database systems, C.J. Date, A.Kannan, S.Swami Nadhan, Pearson, Eight Edition for UNITIII.

COURSE OUTCOMES:

At the end of this course, students will be able to:
1. Demonstrate the basic elements of a relational database management system
2. Ability to identify the data models for relevant problems
3. Ability to design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries.
4. Apply normalization for the given database
5. Understand the various Recovery Mechanisms

M R C E T CAMPUS | AUTONOMOUS INSTITUTION - UGC, GOVT. OF INDIA

II Year B.Tech CSE(IoT) - I Sem (R22)   **L/T/P/C**

3/1/-/-4

| (R22A1261) COMPUTER ORGANIZATION AND ARCHITECTURE |

OBJECTIVES:

The students will be able to:

1. To understand the working of a Computer System and its basic principles.
2. To learn the architecture and design of 8086 processor.
3. To know the concepts of Memory and corresponding technologies.
4. To understand the functional aspects of various peripheral devices.
5. To acquire knowledge about parallel processors.

UNIT - I:

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Computer Organization and Architecture - Von Neumann

Data representation: signed number representation, fixed and floating point Representations, Character representation. Computer arithmetic – integer addition and Subtraction, Ripple carry adder, carry look-ahead adder, etc. Multiplication – shift-and add, Booth multiplier, Carry save multiplier, etc. Division restoring and non-restoring techniques, Floating point arithmetic.

UNIT - II:

Introduction to x86 architecture.

Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL Interpretation of instructions, addressing modes, instruction set. **CPU Control unit design**: Hardwired and micro-programmed design approaches.

UNIT - III:

Memory system design: Semiconductor memory technologies, memory organization. **Memory organization:** Memory interleaving, concept of hierarchical memory organization, Cache memory, cache size vs. block size, mapping functions, Replacement algorithms, write policies.

UNIT - IV:

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB

UNIT - V:

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

TEXT BOOKS:

1. **"**Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

REFERENCE BOOKS:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw- Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course Outcomes :

At the end of the course, Students will be able to:

1. Illustrate the functional block diagram of a single bus architecture of a computer.
2. Analyze the various instruction sets and addressing modes.
3. Design a memory module and analyze its operation by interfacing with the CPU for a specific architecture.
4. Compare and contrast the peripherals and the related I/O transfers
5. Assess the performance, and apply design techniques to enhance performance using pipelining & parallelism.

II Year B.Tech CSE(IoT) - I Sem (R22) **L/T/P/C**

3/-/-/-3

| **(R22A0509) OPERATING SYSTEMS** |

COURSE OBJECTIVES:
1. To understand the fundamental concepts and techniques of Operating Systems.
2. To study the concepts of LINUX OS and process scheduling.
3. To understand the concepts in deadlocks and process management.
4. To understand the techniques in memory managements and IPC mechanism.
5. To study file system concepts and sockets.

UNIT - I
Operating System-Introduction, Structures-Simple Batch, Multi-programmed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services.
Introduction to Linux operating system, Linux file system, Linux Utilities

UNIT - II
Linux: Introduction to shell, Types of Shell's, example shell programs.
Process and CPU Scheduling - Process concepts and scheduling, Operations on processes, Cooperating Processes, Threads, Scheduling Criteria, Scheduling Algorithms, Multiple -Processor Scheduling.

UNIT - III
Deadlocks - System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock
Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors.

UNIT - IV
Inter process Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory implementation in Linux. Corresponding system calls.
Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

UNIT - V

File System Interface and Operations -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, kernel support for files, system calls for file I/O operations open, create, read, write, close, lseek, stat, ioctl

Disk Management: Disk Scheduling Algorithms-FCFS, SSTF, SCAN, C-SCAN

TEXT BOOKS:

1. Beginning Linux Programming –Neil Mathew, Richard Stones 4th Edition, Wiley
2. Operating System Principles- Abraham Silberschatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
3. Unix System Programming using C++, T. Chan, PHI.
4. Unix Concepts and Applications, 4th Edition, SumitabhaDas,TMH,2006.
5. Advanced programming in the UNIX environment, W.R. Stevens, Pearson education.

REFERENCE BOOKS:

1. Operating Systems – Internals and Design Principles Stallings, Fifth Edition–2005, Pearson Education/PHI
2. Operating System A Design Approach- Crowley, TMH.
3. Modern Operating Systems, Andrew S. Tanenbaum 2nd edition, Pearson/PHI
4. UNIX programming environment, Kernighan and Pike, PHI/ Pearson Education
5. UNIX Internals -The New Frontiers, U. Vahalia, Pearson Education.

COURSE OUTCOMES:

At the end of the course students should have:

1. Ability to apply concepts of operating system.
2. Ability to write shell programs and simulate process scheduling algorithms.
3. Skills to analyze memory management and deadlocks situations.
4. An ability to develop programs using system calls and utilities.
5. Capability to compare various file systems.

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II Year B.Tech CSE(IoT) - I Sem (R22)   **L/T/P/C**

                                                                 3/1/-/-4

(R22A0026) PROBABILITY, STATISTICS AND QUEUEING THEORY

Course Objectives:
- To understand a random variable that describes randomness or an uncertainty in certain realistic situation. It can be either discrete or continuous type.
- To learn important probability distributions like: in the discrete case, study of the Binomial and the Poisson Distributions and in the continuous case the Normal Distributions.
- To Understand linear relationship between two variables and also to predict how a dependent variable changes based on adjustments to an independent variable.
- To learn the types of sampling, sampling distribution of means and variance, Estimations of statistical parameters.
- Use of probability theory to make inferences about a population from large and small samples.
- To understand different queuing models.

UNIT - I: Basic Probability and Random Variables

Basic Probability: Definition,The axioms of probability and basic problems.
Single Random Variables:Discrete and Continuous. Probability distribution function,Probability mass and density functions, mathematical expectation.
Multiple Random variables: Discrete and Continuous, Joint probability distributions-Joint probability mass and density functions, Marginal probability mass and density functions.

UNIT-II: Probability Distributions

Binomial distribution – properties, mean, variance and recurrence formula for Binomial distribution, Poisson distribution – Poisson distribution as Limiting case of Binomial distribution, properties, mean variance and recurrence formula for Poisson distribution,Normal distribution – mean, variance, median,mode and characteristics of Normal distribution.

UNIT -III:Correlation and Regression

Correlation -Coefficient of correlation, Rank correlation, Regression- Regression coefficients, Lines of regression.
Multiple correlation and regression- Coefficient of multiple Correlation, multiple regression, Multiple linear regression equations.

UNIT -IV: Testing of Hypothesis

Sampling: Definitions ,Standard error . Estimation - Point estimation and Interval estimation.

Testing of hypothesis: Null and Alternative hypothesis - Type I and Type II errors, Critical region - confidence interval - Level of significance, One tailed and Two tailed test.

Large sample Tests: Test of significance - Large sample test for single mean, difference of means, single proportion, difference of proportions.

Small samples: Test for single mean, difference of means, paired t-test, test for ratio of variances (F-test) ,Chi- square test for goodness of fit and independence of attributes.

UNIT V: Queuing Theory

Queuing theory –Structure of a queuing system and its characteristics- Arrival pattern and service pattern- Pure birth and Death process.

Terminology of Queuing systems-queuing models and its types - M/M/1 Model of infinite queue(without proofs) and M/M/1 Model of finite queue(without proofs).

Suggested Text Books:
   i)   Fundamental of Statistics by S.C. Gupta,7thEdition,2016.
   ii)   Fundamentals of Mathematical Statistics by SC Gupta and V.K.Kapoor
   iii) Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers, 35th Edition,2000.
   iv) R. A. Johnson, Miller and Freund's "Probability and Statistics for Engineers", Pearson Publishers, 9th Edition, 2017.

References :
   i)   Introduction to Probability and Statistics for Engineers and Scientists by SheldonM.Ross.
   ii)   Probability and Statistics for Engineers by Dr. J. Ravichandran.

Course Outcomes: After learning the contents of this paper the student must be able to
1. Describe randomness in certain realistic situation which can be either discrete or continuous type and compute statistical constants of these random variables.
2. Provide very good insight which is essential for industrial applications by learning probability distributions.
3. Make objective, data-driven decisions by using correlation and regression.
4. *Draw statistical inference* using samples of a given size which is taken from a population.
5. To design balanced systems that serve customers quickly and efficiently but it is not cost effective.

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II Year B.Tech CSE(IoT) - I Sem (R22)   **L/T/P/C**

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(R22A0583) DATA STRUCTURES LAB

COURSE OBJECTIVES:
1. To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
2. To know how linear data structures work
3. To implement non-linear data structures.
4. To simulate searching and sorting techniques.
5. To develop programs for performing operations on Trees and Graphs .

WEEK 1: Write a Python program for class, Flower, that has three instance variables of type str, int, and float, that respectively represent the name of the flower, its number of petals, and its price. Your class must include a constructor method that initializes each variable to an appropriate value, and your class should include methods for setting the value of each type, and retrieving the value of each type.

WEEK 2: Develop an inheritance hierarchy based upon a Polygon class that has abstract methods area( ) and perimeter( ). Implement classes Triangle, Quadrilateral, Pentagon, that extend this base class, with the obvious meanings for the area( ) and perimeter( ) methods. Write a simple program that allows users to create polygons of the various types and input their geometric dimensions, and the program then outputs their area and perimeter.

WEEK 3: Write a python program to implement method overloading and method overriding.

WEEK 4: Write a Python program to illustrate the following comprehensions:
a)   List Comprehensions   b) Dictionary Comprehensions
c)   Set Comprehensions   d) Generator Comprehensions

WEEK 5: Write a Python program to generate the combinations of n distinct objects taken from the elements of a given list. **Example:** Original list: [1, 2, 3, 4, 5, 6, 7, 8, 9] Combinations of 2 distinct objects: [1, 2] [1, 3] [1, 4] [1, 5] …. [7, 8] [7, 9] [8, 9].

WEEK 6: Write a program for Linear Search and Binary search

WEEK 7: Write a program to implement Bubble Sort and Selection Sort

WEEK 8: Write a program to implement Merge sort and Quick sort

WEEK 9: Write a program to implement Stacks and Queues

WEEK 10: Write a program to implement Singly Linked List
WEEK 11: Write a program to implement   Doubly Linked list
WEEK 12: Write a program to implement   Binary Search Tree

COURSE OUTCOMES:
The students should be able to:
1. Examine Python syntax and semantics and apply Python flow control and functions.
2. Create, run and manipulate Python Programs using core data structures like Lists
3. Apply Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Master   object-oriented   programming to create an entire python project using objects and classes

II Year B.Tech CSE(IoT) - I Sem (R22)   **L/T/P/C**

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(R22A0587)-OPERATING SYSTEMS LAB

OBJECTIVES:

1.   To provide an understanding of the design aspects of operating system concepts through simulation
2.   Introduce basic Linux   commands, system   call interface   for process management, inter-process communication and I/O in Unix.
3.   Student will learn various process and CPU scheduling Algorithms through simulation programs
4.   Student will have exposure to System calls and simulate them.
5.   Student will learn deadlocks   and   process management & Inter   Process communication and simulate

WEEK1:
Practice File handling utilities, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities.

WEEK2:
Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or directory and reports accordingly. Whenever the argument is a file it reports no of lines present in it.

WEEK3:
Simulate the following CPU scheduling algorithms. a) FCFS b) SJF c) Round Robin
d) Priority.

WEEK4:
Simulate Bankers Algorithm for Dead Lock Avoidance; Simulate Bankers Algorithm for Deadlock Prevention.

WEEK5:
a)   Write a C program to simulate the concept of Dining-philosophers problem.
b)   Write a C program to simulate producer-consumer problem using Semaphores

WEEK6:
a)   Write a C program to implement kill(),raise()and sleep()functions.
b)   Write a C program to implement alarm(),pause()and abort()functions
c)   Write a program that illustrate communication between two process using unnamed pipes

WEEK7:
a)   Write a program that illustrates communication between two process using named pipes or FIFO.
b)   Write a C program that receives a message from message queue and display them.

WEEK8:
Write a C program that illustrates two processes communicating using Shared memory.

WEEK9:
Simulate all page replacement algorithms a) FIFO b) LRU   c) OPTIMAL

WEEK10:
Write a C program that takes one or more file/directory names as command line input and reports following information A)File Type B)Number Of Links C)Time of last Access D)Read, write and execute permissions

WEEK11
a)   Implement In c language the following UNIX commands using system calls i)cat
ii)ls iii) Scanning Directories(Ex: open dir(), read dir(),etc.)
b)   Write a C program to create child process and allow parent process to display "parent" and the child to display "child" on the screen

WEEK12:
Write a C program to simulate disk scheduling algorithms. a) FCFS b) SCAN c) C-SCAN

TEXT BOOKS:

1.   Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
2.   Advanced programming in the Unix environment, W.R.Stevens, Pearson education.

REFERENCE BOOKS:

1.   Operating Systems – Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI
2.   Operating System - A Design Approach-Crowley, TMH.
3.   Modern Operating Systems, Andrew S Tanenbaum, 2nd edition, Pearson/PHI
4.   UNIX Programming Environment, Kernighan and Pike, PHI/Pearson Education
5.   UNIX Internals: The New Frontiers, U. Vahalia, Pearson Education

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(R22A0584) - DATABASE MANAGEMENT SYSTEMS LAB

COURSE OBJECTIVES:

1. Introduce ER data model, database design and normalization
2. Learn SQL basics for data definition and data manipulation
3. To enable students to use Non-Relational DBMS and understand the usage of document oriented and distributed databases.
4. To enable the students to use TCL and DCL Commands and perform all states of Transaction operations.
5. To familiarize issues of concurrency control and transaction management

List of Experiments:

1. Concept design with E-R Model

2. Relational Model

3. Normalization

4. Practicing DDL commands

5. Practicing DML commands

6. A. Querying (using ANY, ALL, UNION, INTERSECT, JOIN, Constraints etc.)

      B. Nested, Correlated subqueries

7. Queries using Aggregate functions, GROUP BY, HAVING and Creation and dropping of Views.

8. Triggers (Creation of insert trigger, delete trigger, update trigger)

9. Procedures

10. Usage of Cursors

11. Installation of MySQL / MongoDB and practicing DDL, commands

TEXT BOOKS:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill, 3 rd Edition
2. Database System Concepts, Silberschatz, Korth, McGraw Hill, V edition.

REFERENCE BOOKS:
1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate, Pearson Education
3. Introduction to Database Systems, C.J. Date, Pearson Education
4. Oracle for Professionals, The X Team, S. Shah and V. Shah, SPD.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.
6. Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition.

COURSE OUTCOMES:
1. Design database schema for a given application and apply normalization
2. Acquire skills in using SQL commands for data definition and data manipulation.
3. Develop solutions for database applications using procedures, cursors and triggers

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(R22A0005) - FOREIGN LANGUAGE-FRENCH

INTRODUCTION

In view of the growing importance of foreign languages as a communication tool in some countries of the world, French has been identified as one of the most popular languages after English. As a result, French program is introduced to develop the linguistic and communicative skills of engineering students and to familiarize them to the French communication skills. This course focuses on basic oral skills.

COURSE OBJECTIVES

1. To inculcate the basic knowledge of the French language
2. To hone the basic sentence constructions in day to day expressions for communication intheir vocation
3. To form simple sentences that aids in day-to-day communication
4. To prepare the students towards DELF A1
5. To develop in the student an interest towards learning languages.

UNIT - I:

Speaking: Introduction to the French language and culture – Salutations - French alphabet -Introducing people

Writing: Understand and fill out a form

Grammar: The verbs "to be ' and "to have '' in the present tense of the indicative

Vocabulary: The numbers from 1 to 20 - Professions- Nationalities

UNIT - II:

Speaking: Talk about one's family – description of a person - express his tastes and preferences - express possession - express negation

Writing: Write and understand a short message

Grammar: Nouns (gender and number) - Articles - The–erverbs in the present-Possessive adjectives - Qualifying adjectives

Vocabulary: The family – Clothes-Colors- The numbers from 1 to 100-The classroom

UNIT - III

Speaking: Talk about your daily activities - be in time - ask and indicate the date and time - talk about sports and recreation - express

the frequency
Writing: A letter to a friend
Grammar: The expression of time– The –ir verbs in the present- The verbs do, go, take, come,- Adverbs-Reflexive verbs
Vocabulary: The days and months of the year-   The sports-Hobbies

UNIT - IV

Speaking: Express the quantity - ask and give the price - express the need, the will and the capacity - compare (adjective) - speak at the restaurant / in the shops
Writing: A dialogue between a vendor and a customer at the market
Grammar: Verbs "to want", "to can"- Express capacity / possibility- Express will / desire – thefuture tense
Vocabulary: The food – Meals-Fruits and vegetables– The parts of the body

UNIT - V

Speaking: Express the prohibition and the obligation - describe an apartment - talk about theweather / ask the weather - ask the opinion - give your opinion - express your agreement or disagreement
Writing: Descriptions
Grammar: Demonstrative adjectives-   Prepositions- The verb 'must' to indicate obligation and necessity in the present
Vocabulary: Seasons – Holidays-The city– Furniture
NOTE: The students are exposed to simple listening and reading activities.

REFERENCE BOOKS

1. Apprenons le Français 1& 2, New Saraswati House, 2015
2. A propos, A1, Langers International, 2010
3. Easy French Step-by-step by Myrna Bell Rochester
4. Ultimate French Beginner-Intermediate (Coursebook) By Livid Language
5. Ã L'Aventure: An Introduction to French Language and Francophone Cultures by Evelyne Charvier-Berman, Anne C. Cummings.

COURSE OUTCOMES

1. The students will be able to communicate in French at A1 level.
2. The student will have an advantage in the competitive job market.
3. This course benefits the graduates when pursuing   study *opportunities* in the countries where French is the official language

II Year – II Semester (R22) CSE (Internet of Things)

Course Structure of II Year - II Sem CSE(IoT) - R22 Regulation

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0507	Object Oriented Programming through Java	3	0	0	3	40	60
2	R22A0505	Software Engineering	3	0	0	3	40	60
3	R22A0512	Computer Networks	3	0	0	3	40	60
4	R22A0506	Design and Analysis of Algorithms	3	1	0	4	40	60
5	R22A6901	Sensors and Devices	3	0	0	3	40	60
6	R22A6981	Computer Networks & Sensors and Devices Lab	0	0	2	1	40	60
7	R22A0586	Object Oriented Programming through Java Lab	0	0	2	1	40	60
8	R22A6291	Industry Oriented Project	0	0	4	2	40	60
9	R22A0061	Public Policy and Governance	2	0	0	0	40	60
		Total	**17**	**1**	**8**	**20**	**360**	**540**

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II Year B.Tech CSE(IoT) - II Sem (R22)   **L/T/P/C**

                                                   3/-/-/-3

(R22A0507)- OBJECT ORIENTED PROGRAMMING THROUGH JAVA

COURSE OBJECTIVES:

1. To understand objectoriented principles like abstraction, encapsulation, inheritance,polymorphism and apply them in solving problems.
2. To understand the implementation of packages and interfaces.
3. To understand the concepts of exception handling, multithreading and collection classes.
4. To understand how to connect to the database using JDBC.
5. To understand the design of Graphical User Interface using applets and swing controls.

UNIT-I

Java Programming- History of Java, comments, Java Buzz words, Data types, Variables, Constants, Scope and Lifetime of variables, Operators, Type conversion and casting, Enumerated types, Control flow- block scope, conditional statements, loops, break and continue statements, arrays, simple java stand alone programs, class, object, and its methods constructors, methods, static fields and methods, access control, this reference, overloading constructors, recursion, exploring string class, garbage collection.

UNIT - II

Inheritance - Inheritance types, super keyword, preventing inheritance, final classes andmethods.
Polymorphism - method overloading and method overriding, abstract classes and methods**. Interfaces-** Interfaces Vs Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface, inner class.
Packages- Defining, creating and accessing a package, importing packages.

UNIT-III

Exception handling-Benefits of exception handling, the classification of exceptions - exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception subclasses.
Multithreading - Differences between multiple processes and multiple threads, thread life cycle, creating threads, interrupting threads, thread

priorities, synchronizing threads, inter-thread communication, producer consumer problem.

UNIT-IV

Collection Framework in Java – Introduction to java collections, Overview of java collection framework, Commonly used collection classes- Array List, Vector, Hash table, Stack, Lambda Expressions.

Files- Streams- Byte streams, Character streams, Text input/output, Binary input/output, File management using File class.

Connecting to Database - JDBC Type 1 to 4 drivers, Connecting to a database, querying a database and processing the results, updating data with JDBC,Data Access Object (DAO).

UNIT-V

GUI Programming with Swing - The AWT class hierarchy, Introduction to Swing, Swing Vs AWT, Hierarchy for Swing components, Overview of some Swing components – Jbutton, JLabel, JTextField, JTextArea, simple Swing applications, Layout management – Layout manager types – border, grid and flow.

Event Handling- Events, Event sources, Event classes, Event Listeners, Delegation event model, Examples: Handling Mouse and Key events, Adapter classes.

TEXT BOOK:

1. Java Fundamentals–A Comprehensive Introduction, Herbert Schildt and Dale Skrien,TMH.
2. Core Java: An Integrated Approach – Dr R Nageswara Rao

REFERENCE BOOKS:

1. Java for Programmers, P.J.Deitel and H.M.Deitel, PEA (or) Java: How to Program ,P.J.Deitel and H.M.Deitel,PHI
2. ObjectOrientedProgrammingthroughJava,P.RadhaKrishna,Universities Press.
3. Thinking in Java, Bruce Eckel,PE
4. Programming in Java, S. Malhotra and S. Choudhary, Oxford Universities Press.
5. Design Patterns Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides.

COURSE OUTCOMES:

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

1. Understand the use of OOP's Concepts.
2. Implement Packages and interfaces in java
3. Develop and Understand exception handling ,multithreaded applications with synchronization
4. Understand the use of Collection Framework
5. Design GUI based applications using AWT and Swings

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(R22A0505) - SOFTWARE ENGINEERING

COURSE OBJECTIVES
1. The aim of the course is to provide an understanding of the working knowledge of the techniques to understand Software development as a process.
2. Various software process models and system models.
3. Various software designs, Architectural, object oriented, user interface etc.
4. Software testing methodologies overview: various testing techniques including white box testing black box testing regression testing etc.
5. Software quality: metrics, risk management quality assurance etc.

UNIT -I

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths.
A Generic view of process: Software engineering-a layered technology, a process framework, the capability maturity model integration(CMMI).
Process models: The waterfall model, Spiral model and Agile methodology

UNIT -II

Software Requirements: Functional and non- functional requirements, user requirements, system requirements, interface specification, the software requirements document.

Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

UNIT-III

Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, usecase diagrams, component diagrams.

UNIT-IV

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
Metrics for Process and Products: Software measurement, metrics for software quality.

UNIT-V

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM.

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000qualitystandards.

TEXTBOOKS:

1. SoftwareEngineering, Apractitioner's Approach-Roger S.Pressman, 6th Edition, McGraw Hill International Edition.
2. SoftwareEngineering-Sommerville,7thedition,PearsonEducation.

Course Outcomes

1. Understand software development life cycle Ability to translate end-user requirements into system and software requirements.
2. Structure the requirements in a Software Requirements Document and Analyze Apply various process models for a project, Prepare SRS document for a project
3. Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.
4. Understand requirement and Design engineering process for a project and Identify different principles to create an user interface
5. Identify different testing methods and metrics in a software engineering project and Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

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3/-/-/-3

(R22A0512) - COMPUTER NETWORKS

COURSE OBJECTIVES:

1. To know the fundamentals of computer networks, TCP/IP & OSI model.
2. To know Data link layer Issues, Protocols.
3. To know Network layer Protocols, IP addressing.
4. To know end to end communication & various things in Transport layer.
5. To know various user services in a network

UNIT - I:

Introduction: Network, Uses of Networks, Types of Networks, Reference Models: TCP/IP Model, The OSI Model, Comparison of the OSI and TCP/IP reference model.
Physical Layer: Guided transmission media, Wireless transmission media, Switching

UNIT - II:

Data Link Layer - Design issues, Error Detection & Correction, Elementary Data Link Layer Protocols, Sliding window protocols
Multiple Access Protocols - ALOHA, CSMA, CSMA/CD, CSMA/CA, Collision free protocols, Ethernet- Physical Layer, Ethernet MAC Sub layer.

UNIT - III:

Network Layer: Network Layer Design issues, store and forward packet switching connection less and connection oriented networks, routing algorithms: optimality principle, shortest path, flooding, Distance Vector Routing, Count to Infinity Problem, Link State Routing, Path Vector Routing, Hierarchical Routing; Congestion control algorithms,
IP addresses, CIDR, Sub netting, Super Netting, IPv4, Packet Fragmentation, IPv6 Protocol, Transition from IPv4 to IPv6, ARP, RARP.

UNIT - IV:

Transport Layer: Services provided to the upper layers elements of transport protocol, addressing, connection establishment, Connection release, Error Control & Flow Control, Crash Recovery. The Internet Transport Protocols: UDP, Introduction to TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Sliding Window, The TCP Congestion Control Algorithm.

UNIT - V:

Application Layer- Introduction, providing services, Applications layer paradigms: Client server model, HTTP, E-mail, WWW, TELNET, DNS.

TEXT BOOKS:

1.   Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
2.   Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.

REFERENCES BOOKS:

1.   An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Education.
2.   Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.
3.   Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

COURSE OUTCOMES:

The students will be able to:
1.   Explore the basics of Computer Networks and Various Protocols.
2.   Recall the World Wide Web concepts.
3.   Interpret the working of TCP layer functionalities.
4.   Describe the functionalities of application layer services.
5.   Administrate a network and flow of information further.

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	3/1/-/-3

(R22A0506) - DESIGN AND ANALYSIS OF ALGORITHMIS

COURSEOBJECTIVES:

1. To analyze performance of algorithms.
2. To choose the appropriate data structure and algorithm design method for a specified application.
3. To understand how the choice of data structures and algorithm design methods impacts the performance of programs.
4. To solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking and branch and bound.
5. To understand the differences between tractable and intractable problems and to introduce P and NP classes.

UNIT-I
Introduction: Algorithms, Pseudocode for expressing algorithms, performance analysis-Space complexity, Time Complexity, Asymptotic notation- Big oh notation, omega notation, theta notation and little oh notation.
Divide and Conquer: General method. Applications- Binary search, Quick sort, merge sort, Strassen's matrix multiplication.

UNIT-II
Disjoint set operations, Union and Find algorithms, AND/OR graphs, Connected components, Bi-connected components.
Greedy method: General method, applications-Job sequencing with deadlines, Knapsack problem, Spanning trees, Minimum cost spanning trees, Single source shortest path problem.

UNIT-III
Dynamic Programming: General method, applications-Matrix chained multiplication, Optimal binary search trees,0/1 Knapsack problem, All pairs shortest path problem, Traveling sales person problem.

UNIT-IV
Backtracking: General method Applications-n-queues problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

UNIT-V

Branch and Bound: General method, applications- Travelling sales person problem,0/I k Knapsack problem LC branch and Bound solution, FIFO branch and bound solution.

NP-Hard and NP-Complete Problems: Basic concepts, Non deterministic algorithms, NP-Hard and NP-Complete classes, NP-Hard problems,Cook'stheorem.

TEXTBOOKS:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharan, Universities press
2. Design and Analysis of Algorithms, P.h.Dave, 2nd Edition, Pearson Education.

REFERENCES:

1. Introduction to the Design And Analysis of Algorithms ALevitin Pearson Education
2. Algorithm Design foundations Analysis and Internet examples, M.T.Goodrich and R Tomassia John Wiley and sons
3. Design and Analysis of Algorithms, S.Sridhar, Oxford Univ.Press
4. Design and Analysis of Algorithms, Aho,Ulman and Hopcraft, Pearson Education.
5. Foundations of Algorithms,R.NeapolitanandK.Naimipour,4thedition

COURSE OUTCOMES:

1. Ability to analyze the performance of algorithms.
2. Ability to choose appropriate algorithm design techniques for solving problems.
3. Ability to understand how the choice of data structures and the algorithm design methods to impact the performance of programs.
4. Describe the dynamic programming paradigm and explain when an algorithmic design situation calls for it. Synthesize dynamic programming algorithms and analyze them.
5. Describes NP hard and NP complete classes and also about the importance of Cook's theorem.

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II Year B.Tech CSE(IoT) - II Sem (R22)   **L/T/P/C**

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(R22A6901) - SENSORS AND DEVICES

Course Objectives:

- To introduce the terminology, technology and its applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web-based services on IoT devices

UNIT-I:
Introduction to Signals and systems - Brief introduction

Introduction to Internet of Things- Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT-II:
IoT and M2M- Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT-III:
IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C)

Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors

UNIT-IV:

Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor

UNIT-V:

IoT Physical Servers and Cloud Offerings– Introduction to Cloud Storage models and communication APIs Web Server – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

REFERENCE BOOKS:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan

2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014

3. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

Course Outcomes:

1. Understand IoT value chain structure (device, data cloud), application areas and technologies involved.

2. Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules

3. Market forecast for IoT devices with a focus on sensors

4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

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II Year B.Tech CSE(IoT) - II Sem (R22)   **L/T/P/C**

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(R22A6981) - COMPUTER NETWORKS & SENSORS AND DEVICES LAB

COMPUTER NETWORKS LAB EXPERIMENTS

Course Outcomes:

1. Implement data link layer farming methods
2. Analyze error detection and error correction codes.
3. Implement and analyze routing and congestion issues in network design.
4. Implement Encoding and Decoding techniques used in presentation layer
5. To be able to work with different network tools

List of Experiments

1. Implement the data link layer framing methods such as character, character-stuffing and bit stuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP
3. Develop a simple data link layer that performs the flow control using the sliding window protocol,
and loss recovery using the Go-Back-N mechanism.
4. Implement Dijsktra's algorithm to compute the shortest path through a network
5. Take an example subnet of hosts and obtain a broadcast tree for the subnet.
6. Implement distance vector routing algorithm for obtaining routing tables at each node.
7. Implement data encryption and data decryption
8. Write a program for congestion control using Leaky bucket algorithm.

SENSOR DEVICES EXPERIMENTS

List of Experiments

1: Connect an LED to GPIO pin 25 and control it through command line.
2: Connect an LED to GPIO pin 24 and a Switch to GPIO 25 and control the LED with the switch.
3: The state of LED should toggle with every press of the switch Use DHT11 temperature sensor and print the temperature and humidity of the room with an interval of 15 seconds
4: Use joystick and display the direction on the screen
5: Use Light Dependent Resistor (LDR) and control an LED that should switch-on/off depending on the light.
6: Create a traffic light signal with three colored lights (Red, Orange and Green) with a duty cycle of 5-2-10 seconds
7: Switch on and switch of a DC motor based on the position of a switch.

TEXT BOOKS:

1. Computer Networks, Andrew S Tanenbaum, David. j. Wetherall, 5th Edition.
Pearson Education/PHI

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks, S.Keshav, 2nd Edition, Pearson Education

2. Data Communications and Networking – Behrouz A. Forouzan. 3rd Edition, TMH.

3. Real Digital Forensics for Handheld Devices, E. P. Dorothy, Auerback Publications, 2013.

4. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics,J. Sammons, Syngress Publishing, 2012.

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

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 II Year B.Tech CSE(IoT) - II Sem (R22)   **L/T/P/C**

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(R22A0586) OBJECT ORIENTED PROGRAMMINGTHROUGH JAVA LAB

COURSE OBJECTIVES:

1. To prepare students to become familiar with the Standard Java technologies ofJ2SE
2. To provide Students with a solid foundation in OOP fundamentals required to solve programming problems and also to learn Advanced Java topics like J2ME, J2EE, JSP, JavaScript
3. To train Students with good OOP programming breadth so as to comprehend, analyze, design and create novel products and solutions for the real life problems.
4. To inculcate in students professional and ethical attitude, multidisciplinary approach and an ability to relate java programming issues to broader application context.
5. To provide student with an academic environment aware of excellence, written ethical codes and guidelines and lifelong learning needed for a successful professional career

Week 1:
   a) Write a java program to find the Fibonacci series using recursive and non-recursive functions
   b) Write a   program to multiply two given matrices.
   c) Write a   program for Method overloading and Constructor overloading

Week 2:
   a) Write a program to demonstrate execution of static blocks ,static variables & static methods.
   b) Write a program to display the employee details using Scanner class
   c) Write a program for sorting a given list of names in ascending order

Week 3:
        a) Write a program to implement single and Multi level inheritance
        b) Write a program to implement Hierarchical Inheritance.
        c) Write a program to implement method overriding.

Week 4:
   a) Write a   program to create an abstract class named Shape that contains two integers and an empty method named printArea (). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea () that prints the area of the given shape.
   b) Write a   program to implement Interface .

c) Write a program to implement multiple and Hybrid Inheritance

Week 5:
a) Write a program to create inner classes
b) Write a program to create user defined package and demonstrate various access modifiers.
c) Write a program to demonstrate the use of super and final keywords.

Week 6 :
a) Write a program if number is less than 10 and greater than 50 it generate the exception out of range. else it displays the square of number.
b) Write a program with multiple catch Statements.
c) write a program to implement nested try

Week 7:
a) Write a   Program to implement simple Thread by extending Thread class and implementing runnable interface.
b) Write a program that implements a multi-thread application that has three threads
c) write a program to set and print thread priorities

Week 8:
Write a program to implement following collections
a) array List   b) Vector   c) Hash table   d) Stack

Week 9:
a) Write a program to demonstrate lambda expressions.
 b) Write a   program for producer and consumer problem using Threads

Week 10:
 a) Write a program to list all the files in a directory including the files present in all its subdirectories.
b) Write a Program to Read the Content of a File Line by Line

Week 11:
a) Write a program that connects to a database using JDBC display all records in a table.
b) Write a program to connect to a database using JDBC and insert values into it.
c) Write a program to connect to a database using JDBC and delete values from it
Week 12:
Write a   program that works as a simple calculator. Use a Grid Layout to arrange Buttons for digits and for the + - * % operations. Add a text field to display the result.

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

1. Analyze the necessity for Object Oriented Programming paradigm and over structured programming and become familiar with the fundamental concepts in OOP.
2. Demonstrate an ability to design and develop Java programs, analyze, and interpret object oriented data and report results.
3. Analyze the distinguish between various types of inheritance.
4. Demonstrate an ability to design an object oriented system, AWT components or multithreaded process as per needs and specifications.
5. Demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks like console and windows applications for standalone programs.

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II Year B.Tech CSE(IoT) - II Sem (R22)　　　　　　　　　**L/T/P/C**

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(R22A0061)-PUBLIC POLICY & GOVERNANCE

Course objectives:

1. To make the students understand in-depth analysis of public policy and to solve its ills prevailing in the society.
2. To provide an opportunity for the students to learn the basic areas of public policy analysis, implementation and evaluation.
3. To make understand the process and various approaches in public policy making.
4. To understand the theories and issues of social coordination and the nature of all patterns of rule.
5. To make the students understand the techniques of governance and emerging trends in public and private governance its policy-making and implementation.

Unit-I
Introduction of Public Policy: Definition, Nature, Scope and Importance of Public Policy, Evolution of Public Policy and Policy Sciences, Public Policy and Public Administration. **Approaches to Public Policy Analysis:** The Process Approach, The Logical Positivist Approach, The Phenomenological Approach, The Participatory Approach and Normative Approach

Unit-II
Theories and Process of Public Policy Making: Theories and Models of Policy Making, Perspectives of Policy Making Process, Institutions of Policy Making.

Unit-III
Policy Implementation and Evaluation: Concept of Policy Implementation, Techniques of Policy Implementation, Concept of Policy Evaluation, Constraints of Public Policy Evaluation

Unit-IV
Introduction of Governance: Definitions, Issues and Controversies, Reinventing Government, Reforming Institutions: The State, Market and Public domain. **State and Governance:** Origin and types of State, Democratic State and Democratic Administration, Neo-Liberalism and Rolling Back State and Governance as Government.

Unit-V
Citizen and Techniques of Governance: Rule of Law and Human Rights, Accountability, Participation, Representation. **Techniques of Governance**: Openness and Transparency, Citizen Charter, Social Audit. **Emerging**

Trends in Public and Private Governance: An Overview, Market, Civil Society, Information and Communication Technology.

TEXT AND REFERENCE BOOKS:
1. Introduction to Public Policy- Charles Wheelan, Naked Economics 2010.
2. Birkland Thomas A., (2005), An Introduction to The Policy Process: Theories, Concepts, And Models of Public Policy Making, Armonk; M.E. Sharpe.
3. Anderson J.E., (2006) Public Policy-Making: An Introduction, Boston, Houghton
4. Bardach, Eugene (1977), The Implementation Game: What Happens After a Bill Becomes a Law, Cambridge, MA: MIT.
5. Bell, S., and Hind moor, A. (2009) Rethinking Governance: The Centrality of the State in Modern Society, Cambridge: Cambridge University Bell, Stephen and Andrew Hind moor.
6. Joyee M. Mitchell & William C. Mitchell, Political Analysis & Public Policy: An Introduction to Political Science, Thomson Press Limited, New Delhi, 1972.
7. R.K. Sapru, Public Policy, Art and Craft of policy Analysis, PHI learning private limited, New Delhi, 2011.
8. Brian W. Hogwood & Lewis A. Gunn, Policy Analysis for the Real world, Oxford University, Press, 1986.

COURSE OUTCOMES

After completion of the course, student will be able to

1. Understand public policy analysis and they will be able to understand policy evaluation and implementation.
2. Understand the public policy and governance on the largest gamut of its canvas.
3. Students will understand the what are emerging trends in public and private governance   and various theories in public policy making
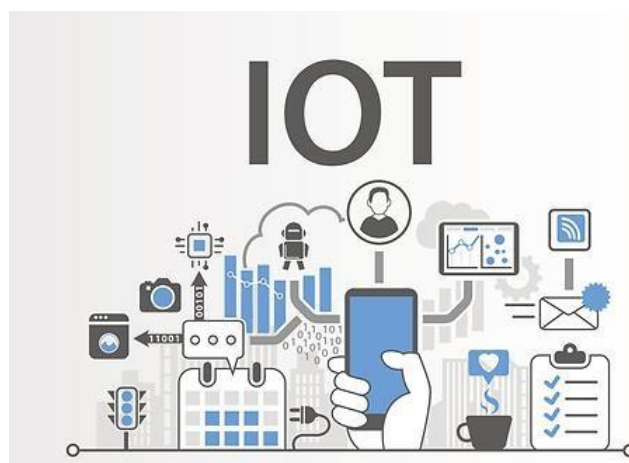
BACHELOR OF TECHNOLOGY (B.Tech)

Internet of Things (IoT)

III Year B.Tech (R22)

S Y L L A B U S

(Batches admitted from the academic year 2022 - 2023)

III Year – I Semester (R22) CSE (Internet of Things)

Course Structure of III Year B. Tech - CSE (Internet of Things) – I Semester- R22 Regulation

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A62xx	Microprocessors and Microcontrollers	3	0	0	3	40	60
2	R22A73xx	Artificial Intelligence	3	0	0	3	40	60
3	R22A12xx	Automata and Compiler Design	3	1	0	4	40	60
4		**Open Elective-I**	3	0	0	3	40	60
5	R22A05xx R22A62xx R22A05xx R22A66xx	**Professional Elective-I** 1. Discrete Mathematics 2. Cyber Security Essentials 3. Web Programming 4. Human Computer Interaction	3	0	0	3	40	60
6	R22A62xx	Microprocessors and Microcontrollers Lab	0	0	2	1	40	60
7	R22A73xx	Artificial Intelligence Lab	0	0	2	1	40	60
8	R22A62xx	Application Development -I	0	0	4	2	40	60
		Total	**15**	**1**	**8**	**20**	**320**	**480**

*** The Detailed Syllabus from III Year Onwards is subject to Internal Dept. AAC and BoS Approval**
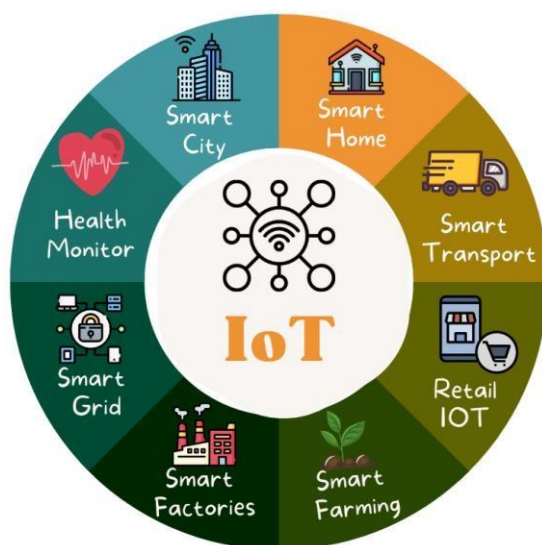
BACHELOR OF TECHNOLOGY (B.Tech)

Internet of Things (IoT)

III Year B.Tech (R22)
S Y L L A B U S

(Batches admitted from the academic year 2022 - 2023)

III Year – I Semester (R22) CSE(Internet of Things)

Course Structure of III Year B. Tech - CSE (IoT) – I Semester- R22 Regulation

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0409	Microprocessor and Microcontrollers	3	0	0	3	40	60
2	R22A6601	Artificial Intelligence	3	0	0	3	40	60
3	R22A1207	Automata Theory and Compiler Design	3	0	0	3	40	60
4		**Open Elective-I**	3	0	0	3	40	60
5	R22A6201 R22A0512 R22A0566 R22A6615	**Professional Elective-I** 1. Cyber Security Essentials 2. Computer Networks 3. Web Programming 4. Human Computer Interaction	3	0	0	3	40	60
6	R22A0488	Microprocessor and Microcontrollers Lab	0	0	2	1	40	60
7	R22A6683	Artificial Intelligence Lab	0	0	2	1	40	60
8	R22A6792	Application Development – I	0	0	4	2	40	60
9	R22A0084	Professional Development Skills – I	0	0	2	1	40	60
		Total	**15**	**0**	**10**	**20**	**360**	**540**

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III Year B.Tech CSE(IoT) - I Sem (R22)   **L/T/P/C**

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(R22A0409) MICROPROCESSORS AND MICROCONTROLLERS

COURSE OBJECTIVES:

1. To understand the basics of microprocessors and microcontrollers architectures and its functionalities.
2. To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques.
3. To design and develop Microprocessor/ microcontroller-based systems for real time applications using low level language like ALP.
4. To create an exposure to basic peripherals, its programming and interfacing techniques.
5. To understand the concepts of ARM Processor.

UNIT -I
8086 ARCHITECTURE: Architecture of 8086, Register Organization, Physical Memory Organization, Signal descriptions of 8086- Common Function Signals, Minimum and Maximum mode signals, Timing diagrams.

UNIT -II
INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086:

Addressing modes, Instruction Set, Assembler Directives, Procedures, Macros, Simple Programs involving Logical, Branch and Call Instructions, Sorting, Evaluating Arithmetic Expressions, String Manipulations.

UNIT -III
I/O INTERFACE: 8255 PPI, Various Modes of Operation and Interfacing to 8086, D/A and A/D Converter, Stepper motor, Interfacing of DMA controller 8257.Memory Interfacing to 8086, Interrupt Structure of 8086, Interrupt Vector Table.
COMMUNICATION INTERFACE: Serial Communication Standards, Serial Data Transfer Schemes, 8251 USART Architecture and Interfacing.

UNIT -IV
INTRODUCTION TO MICROCONTROLLERS: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051, Simple Programs.

UNIT -V
8051 REAL TIME CONTROL: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.
ARM PROCESSOR: Fundamentals, Registers, Current program status register, Pipeline

TEXT BOOKS:

1. D. V. Hall, Microprocessors and Interfacing, TMGH, 2nd Edition2006.
2. Kenneth. J. Ayala, The 8051 Microcontroller, 3rd Ed., CengageLearning.
3. ARM System Developer's Guide: Designing and Optimizing System Software-Andrew N. Sloss, Dominic Symes, Chris Wright, Elsevier Inc.,2007

REFERENCE BOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, TMH, 2nd Edition2006.
2. The 8051Microcontrollers, Architecture and Programming and Applications -K.Uma Rao, Andhe Pallavi, Pearson, 2009.
3. Micro Computer System 8086/8088 Family Architecture, Programming and Design – Liu and GA Gibson, PHI, 2ndEd.
4. Microcontrollers and Application – Ajay. V. Deshmukh, TMGH,2005.

COURSE OUTCOMES:

After going through this course, the student will

1. Learn the internal organization of popular 8086/8051microprocessors/microcontrollers.
2. Learn hardware and software interaction and integration.
3. Learn the Assembly level language programming
4. Learn the Memory andInterfacing of different external peripheral devices with microprocessors and micro controllers
5. Learn thedeveloping an assembly language program for specified application

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III Year B.Tech CSE(IoT) - I Sem (R22)   **L/T/P/C**

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(R22A6601) - ARTIFICIAL INTELLIGENCE

COURSE OBJECTIVES:

1. To train the students to understand different types of AI agents.
2. To understand various AI search algorithms.
3. Fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation.
4. Fundamentals of reasoning
5. Study of Markov Models enable the student ready to step into applied AI.

UNIT - I:

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT - II:

Advanced Search: Constructing Search Trees, Stochastic Search, AO* Search Implementation, Minimax Search, Alpha-Beta Pruning Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT - III:

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Nonmonotonic Reasoning, Other Knowledge Representation Schemes

Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

UNIT - IV:

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT - V:

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOKS:

1. *Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, PrenticeHall, 2010.*

REFERENCES:

1. *Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009. 2. George F. Luger,*

2. *Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.*

COURSE OUTCOMES:

1. Understand the informed and uninformed problem types and apply search strategies to solve them.
2. Apply difficult real life problems in a state space representation so as to solve those using AI techniques like searching and game playing.
3. Design and evaluate intelligent expert models for perception and prediction from intelligent environment.
4. Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.
5. Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area

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III Year B.Tech CSE(IoT) - I Sem (R22)   **L/T/P/C**

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(R22A1207) AUTOMATA THEORY AND COMPILER DESIGN

COURSE OBJECTIVES:
This course will enable the students :

1. To provide an understanding of automata, grammars, language translators.
2. To know the various techniques used in compiler construction.
3. To learn about language classes & grammars relationship among them with the help of Chomskyhierarchy.
4. To be aware of the process of semantic analysis.
5. To analyse the code optimization & code generation techniques.

UNIT - I
Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata - DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Context Free grammars and parsing, derivation, parse trees, Application of Finite Automata.

UNIT - II
Introduction To Compiler: Phases of Compilation, ambiguity LL(K) grammars and LL(1) parsing Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.
Semantics: Syntax directed translation, S-attributed and L-attributed grammars.

UNIT - III
Intermediate code: abstract syntax tree, translation of simple statements and control flow statements. Context Sensitive features -Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

UNIT - IV
Run time storage: Storage organization, storage allocation strategies scope access to now local names. Code optimization: Principal sources of optimization, optimization of basic blocks, peephole optimization.

UNIT - V
Code generation: Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.
TEXT BOOKS:
1. Introduction to Theory of computation Sipser, 2nd Edition, Thomson.
2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.

REFERENCE BOOKS:
1. Modern Compiler Implementation in C- Andrew N. Apple, Cambridge University Press.
2. Lex & yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dream tech.
3. Engineering a Compiler-Cooper & Linda, Elsevier.
4. Compiler Construction, Louden, Thomson.
5. Introduction to Automat a Theory Languages and Computation‖. Hopcroft H.E. and UllmanJ.D.Pearson Education.

COURSE OUTCOMES:
Upon completion of this course, the student should be able to:
1. Explain deterministic and non-deterministic machines.
2. Design a deterministic finite-state machine to accept a specified language.
3. Determine a language's location in the Chomsky hierarchy (regular sets, context-free, context-sensitive, and recursively enumerable languages).
4. Explain how a compiler can be constructed for a simple context free language.
5. Apply the code optimization & code generation techniques.

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III Year B.Tech CSE(IoT) - I Sem (R22)   L/T/P/C
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(R22A6201) – CYBER SECURITY ESSENTIALS (Professional Elective - I)

Course objectives:
1. To understand various types of cyber-attacks and cyber-crimes
2. To learn threats and risks within context of the cyber security
3. To have an overview of the cyber laws & concepts of cyber forensics
4. To study the defensive techniques against these attacks
5. To understand various cyber security privacy issues

UNIT - I
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT - II
Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.
Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

UNIT - III
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in Mobile Computing Era, Laptops.

UNIT- IV
Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations

UNIT - V
Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc

TEXT BOOKS:
1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B.B. Gupta, D.P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.
REFERENCE BOOKS:
1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

Course Outcomes:
1. Analyze and evaluate the cyber security needs of an organization.
2. Understand Cyber Security Regulations and Roles of International Law.
3. Design and develop a security architecture for an organization.
4. Understand fundamental concepts of data privacy attacks

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> ## (R22A0512) COMPUTER NETWORKS (Professional Elective - I)

COURSE OBJECTIVES:

1. To understand the fundamentals of computer networks, TCP/IP & OSI model.
2. To analyze Data link layer Issues, Protocols.
3. To explain Network layer Protocols, IP addressing.
4. To identify end to end communication & various things in Transport layer.
5. To describe various user services in a network.

UNIT - I:

Introduction: Network, Uses of Networks, Types of Networks, Reference Models: TCP/IP Model, The OSI Model, Comparison of the OSI and TCP/IP reference model. Physical Layer: Guided transmission media, Wireless transmission media.

UNIT - II:

Data Link Layer - Design issues, Error Detection & Correction, Elementary Data Link Layer Protocols, Sliding window protocols Multiple Access Protocols - ALOHA, CSMA,CSMA/CD, CSMA/CA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer.

UNIT - III:

Network Layer: Network Layer Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Count to Infinity Problem, Link State Routing, Path Vector Routing, Hierarchical Routing; Congestion control algorithms, IP addresses, CIDR, Subnetting, SuperNetting, IPv4, Packet Fragmentation, IPv6 Protocol, Transition from IPv4 to IPv6, ARP, RARP.

UNIT - IV:

Transport Layer: Services provided to the upper layers elements of transport protocol addressing connection establishment, Connection release, Error Control & Flow Control, Crash Recovery. The Internet Transport Protocols: UDP, Introduction to TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Sliding Window, The TCP Congestion Control Algorithm.

UNIT - V:

Application Layer- Introduction, providing services, Applications layer paradigms: Client server model, HTTP, E-mail, WWW, TELNET, DNS.

TEXT BOOKS:

1. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
2. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

COURSE OUTCOMES:

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

1. Understand basics of Computer Networks and Reference Models.
2. Understand the Data link Layer Concepts
3. Know allotment of IP addresses, best routing path calculations in network.
4. Analyze TCP,UDP working and know how to handle congestion
5. Get an idea of various things in Application Layer.

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(R22A0566) WEB PROGRAMMING (Professional Elective - I)

Course Objectives:
1. To understand the technologies used in Web Programming.
2. To know the importance of object-oriented aspects of Scripting.
3. To understand creating database connectivity using JDBC.
4. To learn about applet techniques
5. To learn the concepts of web-based application using sockets.

UNIT - I Client side Programming

HTML- Basic Tags- List, Tables, Images, Forms, Frames, CSS
JAVA Script -Web page Designing using HTML, Scripting basics- Client side and server side scripting. Java Script Object, names, literals, operators and expressions-statements and features- events - windows -documents - frames - data types - built-in functions- Browser object model - Verifying forms.-HTML5-CSS3- HTML 5 canvas - Web site creation using tools.

UNIT - II JAVA

Introduction to object-oriented programming-Features of Java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces – Exception Handling – Multithreaded Programming – Input/Output – Files – Utility Classes – String Handling.

UNIT - III JDBC

JDBC Overview – JDBC implementation – Connection class – Statements - Catching Database Results, handling database Queries. Networking– InetAddress class – URL class- TCP sockets – UDP sockets, Java Beans –RMI.

UNIT - IV APPLETS

Java applets- Life cycle of an applet – Adding images to an applet – Adding sound to an applet. Passing parameters to an applet. Event Handling. Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking. Introduction to JSP.

UNIT - V XML AND WEB SERVICES

Xml – Introduction-Form Navigation-XML Documents- XSL – XSLT- Web services-UDDI-WSDL-Java web services – Web resources.

TEXT BOOKS:

1. Harvey Deitel, Abbey Deitel, Internet and World Wide Web: How To Program 5th Edition.
2. Herbert Schildt, Java - The Complete Reference, 7th Edition. Tata McGraw- Hill Edition.
3. Michael Morrison XML Unleashed Tech media SAMS.

REFERENCE BOOKS:

1. John Pollock, Javascript - A Beginners Guide, 3rd Edition –- Tata McGraw-Hill Edition.

2. Keyur Shah, Gateway to Java Programmer Sun Certification, Tata McGraw Hill, 2002.

Course Outcomes:

1. Design web pages.
2. Use technologies of Web Programming.
3. Apply object-oriented aspects to Scripting.
4. Create databases with connectivity using JDBC.
5. Build web-based application using sockets.

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(R22A6615) HUMAN COMPUTER INTERACTION (Professional Elective - I)

Course Objectives:
1. To gain an overview of Human-Computer Interaction (HCI), with an understanding of user interface design
2. Able to apply models from cognitive psychology to predicting user performance in various human-computer interaction tasks and recognize the limits of human performance as they apply to computer operation;
3. To Familiar with a variety of both conventional and non-traditional user interface paradigms, the latter including virtual and augmented reality, mobile and wearable computing, and ubiquitous computing;
4. To understand the social implications of technology and their ethical responsibilities as engineers in the design of technological systems.
5. Finally, working in small groups on a product design from start to finish will provide you with invaluable team-work experience.

UNIT - I
Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design.
The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

UNIT - II
Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.
Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, orderingof screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT- III
Windows – New and Navigation schemes selection of window, selection of devices based and screen- based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

UNIT- IV
HCI in the software process, The software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI

patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction

UNIT- V
Cognitive models Goal and task hierarchies Design Focus: GOMS saves money Linguistic models The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities Ubiquitous computing applications research Design Focus: Ambient Wood – augmenting the physical Virtual and augmented reality Design Focus: Shared experience Design Focus: Applications of augmented reality Information and data visualization Design Focus: Getting the size right.

TEXT BOOKS:
1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dream Tech. Units 1, 2, 3
2. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg,Pearson Education Units 4,5

REFERENCE BOOKS:
1. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3. User Interface Design, Soren Lauesen , Pearson Education.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5. Human –Computer Interaction, Smith - Atakan, Cengage Learning.

Course Outcomes:
- Ability to apply HCI and principles to interaction design.
- Ability to design certain tools for blind or PH people.

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(R22A0488) MICROPROCESSOR AND MICROCONTROLLERS LAB

COURSE OBJECTIVES

1. To study programming based on 8086 microprocessor and 8051 microcontroller.
2. To study 8086 microprocessor-based ALP using arithmetic, logical and shift operations.
3. To study to interface 8086 with I/O and other devices.
4. To study parallel and serial communication using 8051 microcontroller.
5. Understand the operations of various study cards like 8257/37, stepper motor etc.

Note: - Minimum of 12 experiments has to be conducted

The Following programs/experiments are to be written for assembler and execute the same with 8086 and 8051 kits.

1. Programs for 16-bit arithmetic operations using 8086 (using Various Addressing Modes).
2. Program for sorting an array using 8086.
3. Program for searching a number or character in a string using 8086.

4. Program for string manipulations using 8086.
5. Program for digital clock design using 8086.
6. Interfacing ADC and DAC to 8086.
7. Parallel communication between two microprocessors using 8255.
8. Serial communication between two microprocessor kits using 8251.
9. Interfacing to 8086 and programming to control stepper motor.

10. Programming using arithmetic, logical and bit manipulation instructions of 8051.
11. Program and verify Timer/ Counter in 8051.
12. Program and verify Interrupt handling in 8051
13. UART Operation in 8051.
14. Communication between 8051 kit and PC.
15. Interfacing LCD to 8051.
16. Data Transfer from Peripheral to Memory through DMA controller 8237/8257.

COURSE OUTCOMES

1. Demonstrate ability to handle arithmetic operations using assembly language programming in MASM and training boards.
2. Work with standard microprocessor real time interfaces including serial ports, digital-to-analog converters and analog-to-digital converters.
3. Troubleshoot interactions between software and hardware.
4. Demonstrate ability to handle string instructions using assembly language programming in MASM.
5. Various applications of microcontrollers like LCD, Key Board are learned.

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(R22A6683) ARTIFICIAL INTELLIGENCE LAB

COURSE OBJECTIVES:
1. Familiarity with the Prolog and Python Programming environment.
2. Systematic introduction to Prolog programming constructs
3. Understanding list data structure in Prolog.
4. To provide student with an academic environment aware of various AI Algorithms.
5. To train Students with python programming as to comprehend, analyze, design and create AI platforms and solutions for the real life problems.

WRITE THE FOLLOWING PROGRAMS USING PYTHON/PROLOG

Week 1

a) Write a program to print the multiplication table for the given number.

b) Write a program to find factorial of a number.

c) Write a program to check whether the given number is prime or not.

Week 2

a) Write a program to implement Simple Calculator program.

b) Write a program to generate Calendar for the given month and year.

c) Write a program to Illustrate Different Set Operations.

Week 3

Write a program to implement simple Chat bot.

Week 4

a) Write a program to remove punctuations from the given string.

b) Write a program to sort the sentence in alphabetical order.

Week 5

Write a program to Implement of Towers of Hanoi Problem.

Week 6

Write a program to Implement Breadth First Search.

Week 7

Write a program to Implement Depth First Search.

Week 8

Write a program to implement Hill Climbing Algorithm.

Week 9

Write a program to implement A* Algorithm.

Week 10

Write a program to implement Tic-Tac-Toe game.

Week 11

Write a program to implement Water Jug Problem.

LAB OUTCOMES:

Upon completion of the course, students will be able to

1. Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction)

2. Understand the fundamentals of knowledge representation, inference.

3. Understand the fundamentals of theorem proving using AI tools.

4. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

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| **(R22A0084) PROFESSIONAL DEVELOPMENT SKILLS -I** |

OBJECTIVES:
1. To strengthen the students with the professional skill set.
2. To make the students recognize the role of technical English in their academic and professional fields.
3. To improve language proficiency and to develop the required professional ethics.
4. To equipstudents, organize, comprehend, write, and present, short and long forms of any technical work within the broad framework of the Scientific Method.
5. To facilitate communication about projects and ideas throughout the industry and also to the non-technical people.

SYLLABUS

UNIT- I:
- Communication Skills: Verbal & Non-verbal communication
- Body Language: Facial expressions, Gestures, Eye Contact, Shrugging, and Standing Postures
- Writing: Letter Writing: requisition, complaint, Enquiry and response
- Exploring Career Opportunities

UNIT-2:
- Self-Introduction
- Ice-Breaking
- Writing: E-Mail Writing, Email Etiquette
- Social and Cultural Etiquette

UNIT-3:
- Oral Presentation Skills: PPTs, Paper Presentation, Poster Presentation etc.,
- JAM Session
- Writing: Paragraph writing and Types of Paragraph Writing (descriptive, narrative, expository, and persuasive)
- Ethics and Integrity

UNIT-4:
- Describing People, Places, things etc.
- Telephonic Conversation: Telephonic Expressions, and Etiquette
- Writing: Essay writing and Types of Essay Writing
- Digital Literacy and Social Media

UNIT-5:

- Extempore
- Role play and Situational dialogues
- Writing: Memo Writing
- Digital Ethics and Cyber Security

OUTCOMES:

Students will be able to
1. Understand information which assists in completion of the assigned job tasks more successfully
2. Market them with the rich professional skills that they acquire.
3. Adhere to ethical norms of scientific communication
4. Strengthen their individual and collaborative work strategies
5. Successfully market them and sell themselves to the employer of their choice.

REFERENCE BOOKS:

1. Curriculum and Guide line for Life Skills, By UGC, August 2023
2. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
3. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
4. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
5. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
6. Meenakshi Raman, Prakash Singh, Business communication, Oxford Publication, New Delhi 2012.
7. Dale Jung k, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
8. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
9. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

III Year – II Semester (R22) CSE(Internet of Things)

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A6703	Data Analytics	3	0	0	3	40	60
2	R22A6602	Machine Learning	3	0	0	3 m,	40	60
3	R22A6903	IoT System Architecture	3	0	0	3	40	60
4		**Open Elective –II**	3	0	0	3	40	60
5	R22A1206 R22A0514 R22A6904 R22A6701	**Professional Elective-II** 1. Mobile Application Development 2. Distributed Systems 3. Industrial IoT 4. Data Science and It's Applications	3	0	0	3	40	60
6	R22A6982	Data Analytics Lab	0	0	2	1	40	60
7	R22A6681	Machine Learning Lab	0	0	2	1	40	60
8	R22A6993	Application Development –II	0	0	4	2	40	60
9	R22A0085	Professional Development Skills – II	0	0	2	1	40	60
		Total	**15**	**0**	**10**	**20**	**360**	**540**

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(R22A6703) DATA ANALYTICS

Course Objectives:
- To explore the fundamental concepts of data analytics.
- To learn the principles and methods of statistical analysis
- To gain the knowledge on Big Data Techniques like Hadoop
- To explore the MapReduce and YARN techniques for Big Data Analytics
- To understand the various search methods and visualization techniques

UNIT - I Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Processing & Processing.

UNIT - II Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Databases & Types of Data and Variables, Data Modelling Techniques, Missing Imputations etc. Need for Business Modelling.

UNIT – III
Big data technologies and Databases: Hadoop – Requirement of Hadoop Framework - Design principle of Hadoop –Comparison with other system SQL and RDBMS- Hadoop Components – Architecture -Hadoop 1 vs Hadoop 2.

UNIT – IV
MapReduce and YARN framework: Introduction to MapReduce , Processing data with Hadoop using MapReduce, Introduction to YARN, Architecture, Managing Resources and Applications with Hadoop YARN.
Big data technologies and Databases: NoSQL: Introduction to NoSQL - Features and Types- Advantages & Disadvantages -Application of NoSQL.

UNIT - V Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:
1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.

REFERENCE BOOKS:
1.Data Mining Analysis and Concepts, M. Zaki and W. Meira 3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Milliway Labs Jeffrey D Ullman Stanford Univ.
2. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley India Pvt. Ltd., 2016.
3. Mike Frampton, "Mastering Apache Spark", Packt Publishing, 2015.

Course Outcomes: After completion of this course students will be able to:
1. Understand the impact of data analytics for business decisions andstrategy
2. Carry out data analysis/statistical analysis
3. To carry out standard data visualization and formal inference procedures
4. Design Data Architecture; Understand various Data Sources

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III Year B.Tech CSE (IoT) - II Sem   **L/T/P/C**

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(R22A6602) MACHINE LEARNING

Course Objectives:
1. Recognize the basic terminology and fundamental concepts of machine learning.
2. Understand the concepts of Supervised Learning models with a focus on recent advancements.
 3. Relate the Concepts of Neural Networks Models of supervised Learning
4. Discover unsupervised learning paradigms of machine learning
5. Understand the concepts of Reinforcement learning and Ensemble methods.

UNIT - I
Introduction: Introduction to Machine learning, Supervised learning, Unsupervised learning, Reinforcement learning. Deep learning. Feature Selection: Filter, Wrapper , Embedded methods. Feature Normalization:- min-max normalization, z-score normalization, and constant factor normalization
Introduction to Dimensionality Reduction : Principal Component Analysis(PCA), Linear Discriminant Analysis(LDA)

UNIT-II
Supervised Learning – I (Regression/Classification)
Regression models: Simple Linear Regression, multiple linear Regression. Cost Function, Gradient Descent, Performance Metrics: Mean Absolute Error(MAE),Mean Squared Error(MSE) R-Squared error, Adjusted R Square.
Classification models: Decision Trees-ID3,CART, Naive Bayes, K-Nearest-Neighbours (KNN), Logistic Regression, Multinomial Logistic Regression Support Vector Machines (SVM) - Nonlinearity and Kernel Methods

UNIT - III
 Supervised Learning – II (Neural Networks) Neural Network Representation – Problems – Perceptrons , Activation Functions, Artificial Neural Networks (ANN) , Back Propagation Algorithm.
Classification Metrics: Confusion matrix, Precision, Recall, Accuracy, F-Score, ROC curves.

UNIT - IV
 Model Validation in Classification : Cross Validation - Holdout Method, K-Fold, Stratified K-Fold, Leave-One-Out Cross Validation. Bias-Variance tradeoff, Regularization , Overfitting, Underfitting.
Ensemble Methods: Boosting, Bagging, Random Forest.

UNIT - V

Unsupervised Learning : Clustering-K-means, K-Modes, K-Prototypes, Gaussian Mixture Models, Expectation-Maximization.

Reinforcement Learning: Exploration and exploitation trade-offs, non-associative learning, Markov decision processes, Q-learning

Text Book(s)

 1. Machine Learning – Tom M. Mitchell, -MGH

2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press,2012

3. R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press.1998

Reference Books

 1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer2009

 2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer,2007.

 3. Machine Learning Yearning, AndrewNg.

4. Data Mining–Concepts and Techniques -Jiawei Han and Micheline Kamber,Morgan Kaufmann

Expected Course Outcome:

 1. Explain the concepts and able to prepare the dataset for different Machine learning models.

2. Identify and Apply appropriate Supervised Learning models.

3. Design Neural Network models for the given data.

4. Perform Evaluation of Machine Learning algorithms and Model Selection.

5. Devise un-supervised and Reinforcement learning models

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III Year B.Tech CSE (IoT) - II Sem   **L/T/P/C**

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(R22A6903) IOT SYSTEM ARCHITECTURE

Course Objectives:
Knowledge on concepts of IoT applications and IoT architectures, Event driven analysis and security testing IoT systems

Course Outcomes:

1. Understand IoT applications and IoT Architectures.
2. Learn about IoT devices and event driven analysis
3. Understand and analyze IIoT.
4. Understand safety and security testing of IoT systems

UNIT - I:
The IoT Landscape: What Is IoT? Applications, Architectures, Wireless Networks, Devices, Security and Privacy, Event-Driven Systems. IoT System Architectures: Introduction, Protocols Concepts, IoT- Oriented Protocols, Databases, Time Bases, Security.

UNIT - II:
IoT Devices & Event-Driven System Analysis: The IoT Device Design Space, Cost of Ownership and Power Consumption, Cost per Transistor and Chip Size, Duty Cycle and Power Consumption, Platform Design. Event-Driven System Analysis: Introduction, Motivating Example, IoT Network Model, Events, Networks, Devices and Hubs, Single-Hub Networks, Multi-hub Networks, Network Models and Physical Networks, IoT Event Analysis, Event Populations, Stochastic Event Populations, Environmental Interaction Modeling, Event Transport and Migration.

UNIT - III:
Industrial Internet of Things: Introduction, Industry 4.0, Industrial Internet of Things (IIoT), IIoT Architecture, Basic Technologies, Applications and Challenges.

UNIT - IV:

Security and Safety: Introduction, Systems Security, Network Security, Generic Application Security, Application Process Security and Safety, Reliable-and-Secure-by-Design IoT Applications, Run-Time Monitoring, The ARMET Approach, Privacy and Dependability.

UNIT - V:

Security Testing IoT Systems: Introduction, Fuzz Testing for Security, White-Box Fuzzing, Black-Box Fuzzing, Fuzzing Industrial Control Network Systems, Fuzzing Modbus, The Modbus Protocol, Modbus/TCP Fuzzer.

TEXT BOOKS:

1. Dimitrios Serpanos, Marilyn Wol, Internet-of-Things (IoT) Systems Architectures, Algorithms, Methodologies, ISBN 978-3-319-69714-7.

REFERENCE BOOKS:

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
3. ―From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence‖, Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
4. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.

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PROFESSIONAL ELECTIVES - II
(R22A6904) - INDUSTRIAL IOT

Course Objectives: To provide students with a good depth of knowledge of Designing Industrial IOT Systems for various applications.

Course Outcomes: Upon completion of this course, the students will be able to:

1. Identify the Key opportunities and benefits in Industrial IoT.
2. Apply virtual network to demonstrate the use of Cloud in Industrial IoT.
3. Analyze industrial IoT Three tier topology and data management system.
4. Summarize Legacy Industrial and Modern Communication Protocols.
5. Describe Middleware Architecture, LoRaWAN- and Augmented reality.

UNIT - I:

Introduction to Industrial Internet and Use-Cases: Industrial Internet- Key IIoT Technologies- Innovation and the IIoT -Key Opportunities and Benefits - The Digital and Human Workforce - Logistics and the Industrial Internet- IOT Innovations in Retail.

UNIT - II:

The Technical and Business Innovators of The Industrial Internet: Cyber Physical Systems (CPS) – IP Mobility – Network Virtualization - SDN (Software Defined Networks)- The Cloud and Fog – Role of Big Data in IIOT - Role of Machine learning and AI in IIOT.

UNIT - III:

IIOT Reference Architecture: Industrial Internet Architecture Framework (IIAF) -Industrial Internet Viewpoints -. Architectural Topology: The Three-Tier Topology- Key System Characteristics- Data Management- Advanced data analytics.

UNIT - IV:

Protocols for Industrial Internet Systems: Legacy Industrial Protocols - Modern Communication Protocols-Proximity Network Communication Protocols- Wireless Communication Technologies- Gateways: industrial gateways - CoAP (Constrained Application Protocol) - NFC.

UNIT - V:

Middleware Software Patterns and IIOT Platforms: Publish/Subscribe Pattern: MQTT, XMPP, AMQP, DDS- Middleware Architecture- SigFox- LoRaWAN Augmented reality- Real-World Smart Factories

Application of IIOT: Case study: Health monitoring, Iot smart city, Smart irrigation, Robot surveillance

TEXT BOOKS:
1. Gilchrist, Alasdair, ―Industry 4.0 The Industrial Internet of Things‖, Apress, 2017.
2. Zaigham Mahmood, ―The Internet of Things in the Industrial Sector: Security and Device connectivity, smart environments and Industry 4.0 (Springer), 2019.

REFERENCE BOOKS
1. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat ―Industrial Internet of Things: Cyber manufacturing Systems‖ (Springer), 2017.
2. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)
3. Vijay Madisetti and Arshdeep Bahga, ―Internet of Things (A Hands-on-Approach)‖, 1st Edition, VPT, 2014
4. Michahelles, –Architecting the Internet of Things‖, ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer
5. Francis daCosta, ―Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, 1st Edition, Apress Publications, 20132 Cuno Pfister, Getting Started with the Internet of Things, O‟ Reilly Media, 2011, ISBN: 978-1-4493-9357-1

E-BOOK:
1. https://www.apress.com/gp/book/9781484220467

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PROFESSIONAL ELECTIVES - II
(R22A0514) – DISTRIBUTED SYSTEMS

COURSE OBJECTIVES:

1. To learn the principles, architectures, algorithms and programming models used in distributed systems.
2. To understand the algorithms of mutual exclusion, election & multicast communication.
3. To learn the different mechanisms for Inter process communication and remote invocations.
4. To acquire knowledge and implement sample distributed systems.
5. To learn transactions and concurrency control mechanisms in different distributed environments

UNIT-I Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. System Models: Introduction, Architectural Models, Fundamental Models.

UNIT-II Time and Global States: Introduction, Clocks Events and Process States, Synchronizing Physical Clocks, Logical Time and Logical Clocks, Global States, Distributed Debugging. Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication, Consensus and Related Problems.

UNIT-III Inter Process Communication: Introduction, The API for the Internet Protocols, External Data Representation and Marshalling, Client-Server Communication, Group Communication, Case Study: IPC in UNIX. Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects, Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI.

UNIT-IV Distributed File Systems: Introduction, File Service Architecture, Case Study 1: Sun Network File System, Case Study 2: The Andrew File System. Name Services: Introduction, Name Services and the Domain Name System, Directory Services, Case Study of the Global Name Services. Distributed Shared Memory: Introduction, Design and Implementation Issues, Sequential Consistency and IVY case study, Release Consistency, Munin Case Study, Other Consistency Models.

UNIT- V Transactions and Concurrency Control: Introduction, Transactions, Nested Transactions, Locks, Optimistic Concurrency Control, Timestamp Ordering, Comparison of Methods for Concurrency Control. Distributed Transactions: Introduction, Flat and Nested Distributed Transactions, Atomic Commit Protocols, Concurrency Control in Distributed Transactions, Distributed Deadlocks, Transaction Recovery.

TEXT BOOKS:
1. Distributed Systems, Concepts and Design, George Coulouris, **J** Dollimore and Tim Kindberg, Pearson Education, Edition. 2009. REFERENCE BOOKS

REFERENCES:
1. Distributed Systems, Principles and paradigms, Andrew S.Tanenbaum, Maarten Van Steen, Second Edition,PHI.
2. Distributed Systems,An Algorithm Approach, Sikumar Ghosh, Chapman & Hall/CRC Taylor & Fransis Group,2007.

COURSE OUTCOMES: 1. Able to compare different types of distributed systems and different models.
2. Able to analyze the algorithms of mutual exclusion, election & multicast communication.
3. Able to evaluate the different mechanisms for Inter-process communication and remote invocations.
4. Able to design and develop new distributed applications.
5. Able to apply transactions and concurrency control mechanisms in different distributed Environments.

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PROFESSIONAL ELECTIVES - II
(R22A6701) - DATA SCIENCE & ITS APPLICATIONS

I.   COURSE OVERVIEW:
The course is designed to introduce to the basics of data science and use R for statistical programming, data exploration, applications of data science and various tools available for the data science. The main objective of the course is to teach a range of topics and concepts related to the data science process. This course reaches to student by power point presentations, lecture notes, and lab which will give you the chance to apply knowledge of data science process.

II. COURSE OBJECTIVES:
The students will try to learn:
I. The fundamental knowledge on basics of data science.
II. The programs in R language for understanding and data manipulation using R
III. The fundamentals of how to obtain, store, explore, and model data efficiently.
IV. The knowledge on Data Science Application and its Tools.

Unit-I: Introduction to Data Science- Introduction- Definition - Data Science in various fields - Examples - Impact of Data Science - Data Analytics Life Cycle - Data Science Toolkit - Data Scientist - Data Science Team Understanding data: Introduction – Types of Data: Numeric – Categorical – Graphical – High Dimensional Data – Classification of digital Data: Structured, Semi-Structured and UnStructured - Example Applications. Sources of Data: Time Series – Transactional Data – Biological Data – Spatial Data – Social Network Data – Data Evolution.

Unit-II: R Programming: Introduction to R- Features of R - Environment - R Studio. Basics of R-Assignment - Modes - Operators - special numbers - Logical values - Basic Functions - R help functions - R Data Structures - Control Structures. Vectors: Definition- Declaration - Generating - Indexing - Naming - Adding & Removing elements - Operations on Vectors - Recycling - Special Operators - Vectorized if- then else-Vector Equality – Functions for vectors - Missing values - NULL values - Filtering & Subsetting.

Unit-III Exploratory Data Analysis and the Data Science Process - Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: Data collection process in real time applications.

Unit-IV Data Science Applications - Data Science and it's various applications – Data Science Applications in Uses Cases Applications of Data Science - In Search Engines, Social Media, Transportation, Banking, Financial Services and Insurance (BFSI), Business and E-Commerce & Retail Applications, Health Care Sector, Targeting Recommendation, Gaming Technology, Medicine and Drug Development and Telecom etc.Introduction-Collecting and Analyzing Twitter Data and YouTube Data.

Unit-V: Data Science Toolkit: Brief Introduction to data science tools: SaS, Apache Spark, BigML, Excel, R-Programming, TensorFlow, KNIME, Tableau, PowerBI etc with advantages and disadvantages.

III. TEXT BOOKS:
1. Sinan Ozdemir, ―Principles of Data Science‖, Packt.
2. Norman Matloff , ―The Art of R Programming‖, Cengage Learning.

IV. REFERENCE BOOKS:
1. Cathy O'Neil and Rachel Schutt, ―Doing Data Science, Straight Talk From The Frontline‖, O'Reilly, 2014.
2. Nina Zumel, John Mount, ―Practical Data Science with R‖, Manning Publications, 1st Edition, 2014.
3. 3. Cathy O'Neil and Rachel Schutt , ―Doing Data Science‖, O'Reilly, 2015.

V. WEB REFERENCES:
1. https://en.wikipedia.org/wiki/R_programming_language
2. http://www.r-bloggers.com/how-to-learn-r-2/#h.obx6jyuc9j7t.
3. http://www.tutorialspoint.com/r/

VI. E BOOKS
1. https://www.programmer-books.com/introducing-data-science-pdf/
2. https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf
3. https://innovacion-tecnologia.com/wp-content/uploads/2020/09/DATA-SCIENCE-FROM-SCRATCH.pdf
4. https://covid19.uthm.edu.my/wp-content/uploads/2020/04/Data-Science-from-Scratch-First-Principles-with-Python-by-Joel-Grus-z-lib.org_.epub_.pdf

VII. COURSE OUTCOMES:
1. Describe what Data Science is and the skill sets needed to be a data scientist
2. Ability to learn the R Programming
3. Explain the significance of exploratory data analysis (EDA) in data science.
4. Explore the Various Data Science Applications
5. Understand the various tools for Data Science and its Analysis

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PROFESSIONAL ELECTIVES - II

(R20A1207) MOBILE APPLICATION DEVELOPMENT

Course Objectives:

1. To understand the basics of Android Operating System
2. To know the essentials of mobile app development using Android Operating System.
3. To understand the core modules like designing, developing, testing, signing, packaging which helps in distributing high-quality mobile apps.
4. To learn mobile app development using Android as the development platform.
5. To acquire knowledge to deploy database to mobile devices using Android

UNIT-I
Introduction to Android Operating System: Android OS and Features – Android development framework;
Installing and running applications on Android Studio, Creating AVDs, Types of Android application; Creating Activities, Activity Life Cycle, Activity states, monitoring state changes;

UNIT - II
Android application components – Android Manifest file, Externalizing recourses like Simple Values, Drawables, Layouts, Menus, etc,
Building User Interfaces: Fundamental Android UI design, Layouts – Linear, Relative, Grid and Table Layouts. User Interface (UI) Components

UNIT-III
Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities,

UNIT-IV
Intents and Broadcasts: Using intents to launch Activities, Types of Intents, Passing data to Intents, Getting results from Activities, Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters;

UNIT-V
Database: Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data;

TEXT BOOKS:
1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

REFERENCES:
1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013
2. Android Application Development (with Kitkat Support), Black Book, Pradeep Kothari, 2014, Dreamtech Press publisher, Kogent Learning Inc.,2014
3. Android Programming: Pushing the Limits, Erik Hellman, 1st Edition,Wiley Publications, 2014

Course Outcomes:
   Students will be able to :
1. Install and configure Android studio
2. Analyze architecture of android and current trends in mobile operating systems.
3. Apply suitable software tools and APIs for the development of User Interface for a particular mobile application.
4. Apply in tents and broadcast receivers in android application.
5. Develop and design apps for mobile devices using SQLite Database.

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(R22A6783) DATA ANALYTICS LAB

COURSE OBJECTIVES:
1. To explore the fundamental concepts of Data Analytics
2. To Learn the principles and methods of statistical analysis
3. To Discover interesting patterns, analyse supervised and unsupervised models and estimate the accuracy of the data
4. To understand and generate the various data models and analysis of data through visualization techniques

List of Programs

#Week-1 & 2 (Using Python):
1. Working on all data types of python (i.e., LIST, TUPLE, SET, String, Numbers, Dictionary)
2. Program to fetch a element or value using index
3. Program to append a value in python
4. Program to insert new value based on index
5. Program to extend the elements in a given list
6. List with sum, count, length, pop, delete, remove operations
7. Program to calculate minimum, maximum and sorted

#Week-3: Using Python: (i) Working on python conditional statements
1. IF
2. IF-Else
3. IF-Else-if
    (ii) loops (for, while)
1. Using BREAK
2. Using Continue
3. Using RANGE

#Week-4:Using Python: Working on numpy, pandas
1. Python Program to create an array consists of values
    Working on Dataframes and Dataset
2. Python Program to create dataframes
3. Python Program to Import CSV File (Dataset)
4. Python Program to Import Excel File (Dataset)
5. Python Program to fetch the columns and rows (single and multiple)
6. Working on group-by using pandas

#Week-5 & 6: Using Python: Handling Missing Values
1. Display the Missing Values
2. Display the Missing Values using ISNULL
3. Display the Missing Values using NOTNULL
4. Filling a null values using fillna()
5. Fill the Value for NaN with common value
6. Fill the Values for NaN using PAD Method
7. Fill the Values for NaN using BFILL
8. Fill the values using FFILL
9. Fill the values using FFILL with limit
10. Fill the values for a particular NaN using LOC

11. Working with DROPNA
12. Working with DROPNA with HOW & ALL
13. Display the values using AXIS Method
14. Interpolate of missing values
15. Fill the value using "replace" function

#Week 7: Data Visualization - Plotting the Data

Working with Matplotlib Functionality in Python
#The entire plots are classified in 3 different categories
#Basic Plots using "Matplotlib"

    a) AreaPlots   (plt.stackplot)
    b) BarPlots   (plt.bar)
    c) Histograms   (plt.hist)

#Specialized Visualization Tools using Matplotlib

    i)   PieCharts   (plt.pie)
    ii)   BoxPlot   (plt.boxplot)
    iii)   ScatterPlots (plt.scatter)
    iv)   BubblePlots (plt.scatter))

#Week 8 & 9: Data Visualization using Seaborn & Folium

1) Program to generate world map using folium library
2) Program to generate specific area or country using folium and zoom function.
3) Using seaborn library generate various visualization reports for a "tips" datasets.
a) Barplot using Seaborn
b) Linear Plot
c) pairplot
d) Violin plot
e) Use "Kind" Operation

#Week 10 & 11: Hadoop and MapReduce Programs
Install Apache Hadoop
1. Develop a MapReduce program to calculate the frequency of a given word in a given file.
2. Develop a MapReduce program to find the maximum temperature in each year.
3. Develop a MapReduce program to find the grades of student's.
4. Develop a MapReduce program to implement Matrix Multiplication.

#Week 12: Working on KNIME
Working on various node operations in KNIME

Lab Outcomes:
   Upon successful completion of this course, the students will be able to:

- Understand the concepts of various data analytical and how to deal with the various categories of data.
- Apply the various data analytical tools like python, knime etc, students will study and perform the outliers, missing values and generate insights from the data.
- Understand and applying the Hadoop Mapping and Reducing concepts for the bigdata and generate insights.
- Understand the data and generate the analysis using KNIME.

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(R22A6681) – MACHINE LEARNING LAB

Lab Objectives:

- To introduce the basic concepts and techniques of Machine Learning and the need of Machine Learning techniques in real-world problems.
- To provide understanding of various Machine Learning algorithms and the way to evaluate performance of the Machine Learning algorithms.
- To apply Machine Learning to learn, predict and classify the real-world problems in the Supervised Learning paradigms as well as discover the Unsupervised Learning paradigms of Machine Learning.
- To inculcate in students professional and ethical attitude, multidisciplinary approach and an ability to relate real-world issues and provide a cost effective solution to it by developing ML applications.

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Week-1: Implementation of Python Basic Libraries such as Statistics, Math, Numpy and Scipy
a) Usage of methods such as floor(), ceil(), sqrt(), isqrt(), gcd() etc.
b) Usage of attributes of array such as ndim, shape, size, methods such as sum(), mean(), sort(), sin() etc.
c) Usage of methods such as det(), eig() etc.
d) Consider a list datatype (1D) then reshape it into2D, 3Dmatrix using numpy
e) Generater and ommatrices using numpy
f) Find the determinant of a matrix using scipy
g) Find eigen value and eigen vector of a matrix using scipy

Week 2: Implementation of Python Libraries for ML application such as Pandas and Matplotlib.
a) Create a Series using pandas and display
b) Access the index and the values of our Series
c) Compare an array using Numpy with a series using pandas
d) Define Series objects with individual indices
e) Access single value of a series
f) Load datasets in a Dataframe variable using pandas
g) Usage of different methods in Matplotlib.

Week 3:
a) Creation and Loading different types of datasets in Python using the required libraries.
i. Creation using pandas
ii. Loading CSV dataset files using Pandas
iii. Loading datasets using sklearn

b) Write a python program to compute Mean, Median, Mode, Variance, Standard Deviation using Datasets
c) Demonstrate various data pre-processing techniques for a given dataset. Write a python program to compute

i. Reshaping the data,
ii. Filtering the data,
iii. Merging the data
iv. Handling the missing values in datasets
v. Feature Normalization: Min-max normalization

Week4: Implement Dimensionality reduction using Principle Component Analysis (PCA) method on a dataset (For example Iris).

Week 5: Write a program to demonstrate the working of the decision tree based ID3 algorithm by considering a dataset.

Week 6: Consider a dataset, use Random Forest to predict the output class. Vary the number of trees as follows and compare the results:
       i. 20
       ii. 50
       iii. 100
       iv. 200
       v. 500

Week 7: Write a Python program to implement Simple Linear Regression and plot the graph.
Week 8: Write a Python program to implement Logistic Regression for iris using sklearn and plot confusion matrix
Week 9: Build KNN Classification model for a given dataset. Vary the number of k values as follows and compare the results:
       i. 1
       ii. 3
       iii. 5
       iv. 7
       v. 11
Week 10: Implement Support Vector Machine for a dataset and compare the accuracy by applying the following kernel functions:
       i. Linear
       ii. Polynomial
       iii. RBF
Week 11: Write a python program to implement K-Means clustering Algorithm. Vary the number of k values as follows and compare the results:
       i. 1
       ii. 3
       iii. 5
Lab Outcomes:
Upon successful completion of this course, the students will be able to:

- Understand the basic concepts and techniques of Machine Learning and the need of Machine Learning techniques in real-world problems.

- Understand various Machine Learning algorithms and the way to evaluate performance of the Machine Learning algorithms

- Apply Machine Learning to learn, predict t and classify the real-world problems in the Supervised Learning paradigms as well as discover the Unsupervised Learning paradigms of Machine Learning.

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(R22A0085) - PROFESSIONAL DEVELOPMENT SKILLS - II

OBJECTIVES:

1. To strengthen the students with the professional skill set.
2. To make the students recognize the role of technical English in their academic and professional fields.
3. To improve language proficiency and to develop the required professional ethics.
4. To equip students, organize, comprehend, write, and present, short and long forms of any technical work within the broad framework of the Scientific Method.
5. To facilitate communication about projects and ideas throughout the industry and also to the non-technical people.

UNIT- I:
*   Inter-personal & Intra-Personal Communication
*   Sub Skill of Reading: Skimming
*   Writing: Resume Writing: Functional, Chronological, Targeted
*   Innovative Leadership and Design Thinking

UNIT-2:
*   Group Discussion: Factual, Opinion-Based, Abstract
*   Sub Skill of Reading: Scanning
*   Writing: Cover Letter
*   Trust and Collaboration

UNIT-3:
*   Debate
*   Sub Skill of Reading: Intensive Reading
*   Writing: Report Writing: Research Report, Analytical and Projects
*   Managing Personal Finance

UNIT-4:
*   Interview skills
*   Sub Skill of Reading: Extensive reading
*   Writing: PrécisWriting
*   Leadership and Managerial Skills

UNIT-5:
*   Mock Interviews
*   Reading: Cloze-Test
*   Writing: Mini Projects
*   Entrepreneurial Skills

TEXT BOOKS & REFERENCE BOOKS:

1. Curriculum and Guide line for Life Skills, By UGC, August 2023
2. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
3. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
4. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
5. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
6. Meenakshi Raman, Prakash Singh, Business communication, Oxford Publication, New Delhi 2012.
7. Dale Jung k, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
8. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
9. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

OUTCOMES:
Students will be able to

1. Understand information which assists in completion of the assigned job tasks more successfully
2. Market them with the rich professional skills that they acquire
3. Adhere to ethical norms of scientific communication
4. Strengthen their individual and collaborative work strategies
5. Successfully market them and sell themselves to the employer of their choice.

III Year – II Semester (R22) CSE (IoT)
OPEN ELECTIVES – II
SYLLABUS

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OPEN ELECTIVE - II
(R22A0553) – DATABASE SYSTEMS

COURSE OBJECTIVES:

1. The purpose of the course is to enrich the previous knowledge of database systems and exposing the need for distributed database technology to confront with the deficiencies of the centralized database systems.

2. Introduce basic principles and implementation techniques of distributed database systems.

3. Equip students with principles and knowledge of parallel and object-oriented databases.

4. Topics include distributed DBMS architecture and design; query processing and optimization; distributed transaction management and reliability; parallel and object database management systems.

UNIT - I

Introduction: Distributed Data Processing, Distributed Database System, Promises of DDBSs,Problem areas.

Distributed DBMS Architecture: Architectural Models for Distributed DBMS, DDMBS Architecture. **Distributed Database Design:** Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.

UNIT - II

Query processing and decomposition: Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data.

Distributed query Optimization: Query optimization, centralized query optimization, distributed queryoptimization algorithms.

UNIT - III

Transaction Management: Definition, properties of transaction, types of transactions, distributed concurrency control: serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.

UNIT - IV

Distributed DBMS Reliability: Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning.

Parallel Database Systems: Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.

UNIT - V

Distributed object Database Management Systems: Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, objectquery Processing.

Object Oriented Data Model: Inheritance, object identity, persistent programming languages,persistence of objects, comparison OODBMS and ORDBMS

TEXT BOOKS:
1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.
2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.

REFERENCE BOOK:
1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: –Database Systems: The Complete Book‖, Second Edition, Pearson International Edition

COURSE OUTCOMES:
1. Understand theoretical and practical aspects of distributed database systems.
2. Study and identify various issues related to the development of distributed database system.
3. Understand the design aspects of object-oriented database system and relateddevelopment.

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OPEN ELECTIVE - II
(R22A6753) - BIG DATA ARCHITECTURE

COURSE OBJECTIVES:
1. The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
2. This course is also designed to give an exposure of the frontiers of Big data Analytics
3. To Understand the knowledge of Hadoop, HDFC and MapReduce Techniques
4. To gain the acknowledge on Hadoop Architecture.
5. To learn the machine learning approaches using R

UNIT - I:
Introduction to Big Data: Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

UNIT - II:
Big Data Technologies: Hadoop's Parallel World – Data discovery – Open-source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data

UNIT - III:
Introduction Hadoop: Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization

UNIT - IV:
Hadoop Architecture: Hadoop: RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node, HDFS Architecture, Hadoop Configuration, Map Reduce Framework, Role of HBase in Big Data processing, HIVE, PIG.

UNIT - V:
Data Analytics with R Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Social Media Analytics, Mobile Analytics, Big Data Analytics with BigR.

TEXT BOOKS:
1. Big Data Analytics, Seema Acharya, Subhasini Chellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O"Reilly Media, 2012.

REFERENCE BOOKS:
1. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013).
2. Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071, 2015.
3. Understanding Big data, Chris Eaton, Dirk deroos et al. McGraw Hill, 2012.

COURSE OUTCOMES:

1. Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools
2. Ability to program using HADOOP and Map reduce, NOSQL
3. Ability to understand the importance of Big Data in social media and Mining.

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OPEN ELECTIVE - II
(R22A6753) - BIG DATA ARCHITECTURE

COURSE OBJECTIVES:

1. To understand the engineering design process and identification of customer need.
2. To understand innovative problem-solving concepts.
3. To understand the principles of Design for Manufacturing and FMEA.
4. To know about the design for assembly principles.
5. To know about the concepts of design for environment and design for recycling.

UNIT-I
Introduction: Innovations in Design, Engineering Design Process, Prescriptive and integrativemodels of design, Design Review and societal considerations.
Identification of Customer Need: Evaluating Customer requirements   and survey on customer needs, Conversion of customer needs into technical Specifications, Information sources.

UNIT-II
Theory of Inventive Problem solving (TRIZ), Creativity and Problem solving, Functional Decomposition of the problem for innovative concept development, Introduction to Axiomatic Design, Concept evaluation and decision making.

UNIT-III
Design for Manufacturing: Technical estimating, design of experiments, design for manufacturability, statistical process control, Introduction to FMEA (failure modes and effects analysis), and Case study of design for manufacturing: Manufacturing System Design Based on Axiomatic Design: Case of Assembly Line

UNIT-IV
Design for Assembly: Assembly Principles, Process, Worksheet, Assumptions. Case study of design for Assembly: Manufacturing System Design Based on Axiomatic Design: Case of Assembly Line

UNIT-V
Design for Environment: Design for recycling; Design for disassembly, Design for energy Efficiency, Design for remanufacture, Design for disposability, Hazardous material minimization. Case study of design for Environment.

TEXT BOOKS:

1. Nigel Cross, Engineering Design Methods, John Wiley, 2009.
2. George E. Dieter, Engineering Design, McGraw-Hill, 2009.
3. GenrichAltshuller, The Innovation Algorithm, Technical Innovation Centre, 2011.

REFERENCE BOOKS

1. The Art of Innovation, by Tom Kelley.
2. Design Thinking, by Nigel Cross.
3. The Design of Business: by Roger Martin.

COURSE OUTCOMES:

1. The importance of design in innovation.
2. Design tools and processes can generate innovative new ideas.
3. Design and design thinking to innovative in areas such as engineering, software development and business operations.
4. Strengthen students' individual and collaborative capabilities to identify customer needs, create sound concept hypotheses, collect appropriate data, and develop a prototype that allows for meaningful feedback in a real-world environment.
5. To describe the various case studies for design for environment

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OPEN ELECTIVE - II
(R22A0522) - PRINCIPLES OF CLOUD COMPUTING

COURSE OBJECTIVES:
1. To understand the various distributed system models and evolving computing paradigm
2. To gain knowledge in virtualization of computer resources
3. To realize the reasons for migrating into cloud
4. To introduce the various levels of services that can be achieved by a cloud.
5. To describe the security aspects in cloud and the services offered by a cloud

UNIT - I
Cloud Computing Fundamentals: Definition of Cloud computing, Roots of Cloud Computing , Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers. **Computing Paradigms**: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing.

UNIT- II
Migrating into a Cloud: Introduction, Broad Approaches to Migrating into the Cloud, the Seven-Step Model of Migration into a Cloud.
Virtualization: Virtual Machines and Virtualization of Clusters and data centers-Implementation Levels of Virtualization -Virtualization Structures/Tools and Mechanisms- Virtualization of CPU, Memory, and I/O Devices-Virtual Clusters and Data Centers

UNIT- III
Infrastructure as a Service (IAAS) & Platform (PAAS): Virtual machines provisioning and Migration services, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action. On the Management of Virtual machines for Cloud Infrastructures- Aneka— Integration of Private and Public Clouds.

UNIT- IV
Software as a Service (SAAS) &Data Security in the Cloud: Software as a Service SAAS), Google App Engine – Centralizing Email Communications- Collaborating via Web- Based Communication Tools-An Introduction to the idea of Data Security.

UNIT- V
SLA Management in cloud computing: Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud.

TEXT BOOKS:
1. Cloud Computing Principles and Paradigms, by Rajkumar Buyya
2. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014
3. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Workand Collaborate Online, Que Publishing, August 2008.

REFERENCE BOOKS:

1. Cloud Computing : A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill,rp2011.
2. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press,2010.
3. Cloud Computing: Implementation, Management and Security, John W.Rittinghouse,James F.Ransome, CRC Press,rp2012.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud,George Reese, O_reilly, SPD,rp2011.
5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, TimMather, Subra Kumaraswamy, Shahed Latif, O_Reilly, SPD, rp2011.

COURSEOUTCOMES:
1. Ability to analyze various service delivery models of cloud computing
2. Ability to interpret the ways in which the cloud can be programmed and deployed.
3. Ability to comprehend the virtualization and cloud computing concepts
4. Assess the comparative advantages and disadvantages of Virtualization technology
5. Analyze security issues in cloud computing

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III Year B.Tech CSE (IoT) - II Sem (R22)   L/T/P/C
                                                            3/0/0/3

OPEN ELECTIVE - II
(R22A6951) – INTERNET OF THINGS & ITS APPLICATIONS

COURSE OBJECTIVES:

1.   To study IoT Networking Core
2.   To study IoT related network fundamentals
3.   To study IoT Architecture.
4.   To study IoT Application Development procedure
5.   To study various case studies and IoT applications.

UNIT I: FUNDAMENTALS OF IoT- Evolution of Internet of Things, Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II: IoT PROTOCOLS- IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks,6LoWPAN, Application Transport Methods: SCADA, Application Layer Protocols: CoAP and MQTT.

UNIT III: DESIGN AND DEVELOPMENT- Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details

UNIT IV: DATA ANALYTICS AND SUPPORTING SERVICES: Data Analytics:
Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M, Supporting Services: Computing Using a Cloud Platform for IoT/M2M Applications/Services, Everything as a service and Cloud ServiceModels.

UNIT V: CASE STUDIES/INDUSTRIAL APPLICATIONS: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment, Industry 4.0 concepts

TEXT BOOKS:

1.   6LoWPAN:TheWirelessEmbeddedInternet,ZachShelby,CarstenBormann,Wiley
2.   Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems,Dr.Ovidiu Vermesan, Dr.Peter Friess, RiverPublishers
3.   Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann

REFERENCE BOOKS:

1. The Internet of Things: From RFID to the Next-Generation Pervasive NetworkedLuYan, Yan Zhang,Laurence T.Yang, Huansheng Ning
2. Internet of Things (A Hands-on-Approach), Vijay Madisetti, Arshdeep Bahga
3. Designing the Internet of Things, Adrian McEwen (Author),Hakim Cassimally
4. Asoke K Talukder and Roopa R Yavagal, "MobileComputing,"Tata Mc Graw Hill, 2010.
5. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition,VPT, 2014
6. Computer Networks; By: Tanenbaum, AndrewS; Pearson Education Pte.Ltd., Delhi,4thEdition
7. Data and Computer Communications; By: Stallings, William; Pearson Education Pte.Ltd., Delhi, 6thEdition

COURSE OUTCOMES:

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

1) Understand IoT Networking Core
2) Understand IoT related network fundamentals
3) Understand IoT Architecture.
4) Understand IoT Application Development procedure
5) Understand various case studies and IoT applications.

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III Year B.Tech CSE (IoT) - II Sem (R22)   **L/T/P/C**

3/0/0/3

OPEN ELECTIVE - II
(R22A2152) - NANO TECHNOLOGY

Course objectives

1. To provide a comprehensive overview of synthesis and characterization of nanoparticles, Nano composites and hierarchical materials with Nano scale features.
2. To provide the engineering students with necessary background for understanding various nanomaterial's characterization techniques
3. To develop an understanding of the basis of the choice of material for device applications
4. To give an insight into complete systems where nanotechnology can be used to improve our everyday life.

UNIT I: Introduction to Nanomaterials

Nanotechnology, Frontier of future - an overview, Length Scales, Variation of physical properties from bulk to thin films to nanomaterials, Confinement of electron in 0D, 1D, 2D and 3D systems, Synthesis of Nanomaterials: Bottom-Up approach: Chemical Routes for Synthesis of nanomaterials-Sol-gel, Precipitation, Solution Combustion synthesis, Hydrothermal, Top-Down approach- Ball milling technique, Sputtering, Laser Ablation.

UNIT II: Characterization of Nanomaterials

Basic principles and instrumentations of Electron Microscopy –Transmission Electron Microscope, Scanning Electron Microscope, Scanning Probes- Scanning Tunneling microscope, Atomic Force Microscope –different imaging modes, comparison of SEM and TEM, AFM and STM, AFM and SEM.

UNIT III: Carbon Based Materials

Introduction, Synthesis, Properties (electrical, Electronic and Mechanical), and Applications of Graphene, SWCNT, MWCNT, Fullerenes and other Carbon Materials: Carbon nanocomposites, nanofibers, nano discs, nanodiamonds.

UNIT IV: Nanotechnology in Energy storage and conversion

Solar cells: First generation, Second generation and third generation solar cells: Construction and working of Dye sensitized and Quantum dot sensitized solar cells.
Batteries: Nanotechnology in Lithium ion battery- working, Requirements of anodic and cathodic materials.
Fuel Cells: Introduction, construction, working of fuel cells and nanotechnology in hydrogen storage and proton exchange membranes

UNIT V: Applications of Nanotechnology

Nanotech Applications and Recent Breakthroughs: Introduction, Significant Impact of Nanotechnology and Nanomaterial, Electronic Applications (Nano electronics), Computing Applications (Nano computers), Chemical Applications (Nano chemistry), Optical Applications (Nano photonics*).*

TEXT BOOKS:

1. Nano Materials – A.K. Bandyopadhyay/ New Age Publishers
2. Nanocrystals: Synthesis, Properties and Applications – C.N.R. Rao, P. John Thomas and G. U. Kulkarni, Springer Series in Materials Science
3. Nano Essentials- T. Pradeep/TMH

REFERENCES:

1. Introduction to Nanotechnology, C. P. Poole and F. J. Owens, Wiley, 2003
2. Understanding Nanotechnology, Scientific American 2002
3. Nanotechnology, M. Ratner and D. Ratner, Prentice Hall 2003

OUTCOMES:

1. Demonstrate the synthesis of nanoparticles by various techniques.

2. Explain working of basic instruments used in characterization of nanoparticles.

3. Discuss the application of nanotechnology to mechanical and civil domains

4. Classify the nanomaterials based on the dimensions.

5. Assess the suitability of nanomaterials for various device applications.

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III Year B.Tech CSE (IoT) - II Sem (R22)   **L/T/P/C**
                                                      3/0/0/3

OPEN ELECTIVE - II

(R22A0252) – ELECTRICAL AND HYBRID VEHICLES

Course objectives

- To understand the fundamentals of Electric Vehicles (EVs), especially in Indian Context.
- To examine technology associated with each element of EV drive-train;
- To get in to the economics of EVs in India v is-à-v is petrol vehicles.

UNIT-I:

Introduction Overview of Electric Vehicles in India, India's EV program, Charging and Swapping Infrastructure, brief introduction of batteries, Lithium for batteries, EV Subsystems.

UNIT-II:

Vehicle Dynamics: Forces acting when a vehicle move, Aerodynamic drag, Rolling Resistance and Uphill Resistance, Power and Torque to accelerate.

Drive Cycle: Concept of Drive Cycle, Drive Cycles and Energy used per km.

UNIT-III:

EV Power train: Design of EV Drive Train, Introduction to Battery Parameters, Why Lithium Ion Battery? Batteries in Future, Li-Ion Battery Cells, SoH and SoC estimation and Self Discharge, Battery Pack Development, Computation of Effective cost of battery, Charging Batteries.

Fundamentals of EV Battery Pack design: Mechanical, Thermal and Electrical Design, BMS Design of Electric Vehicle.

UNIT-IV:

EV Motors and Controllers: Fundamentals and Design, Understanding Flow of Electricity, Magnetism and Heat, Power and Efficiency, Torque Production, Speed and Back EMF, the d-q Equivalent circuit, Field-oriented Control, Understanding Three phase AC and DC to AC conversion systems, Understanding the thermal design of the motors, Engineering Considerations, Future Frontiers.

UNIT-V:

EV Charging: Introduction, Slow or Fast EV Chargers, Battery Swapping, Standardization and On board Chargers, Public Chargers, Bulk Chargers/Swap Stations, Economics of Public Chargers in context, Analytics and Tools for EV systems.

TEXT BOOKS:

1. Electric Power train- Energy Systems, Power electronics and drives for Hybrid, electric and fuel cell vehicles by John G. Hayes and A. Goodarzi, Wiley Publication

2. MehrdadEhsani,YimiGao,SebastianE.Gay,AliEmadi,ModernElectric,Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004

3. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRCPress,2003

REFERENCE BOOKS:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley,2003

2. Chris Mi, M.Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles:Principles and Applications with Practical Perspectives, John Wiley & Sons Ltd., 2011

3. Fundamentals of Electric Vehicles: technology and economics https://onlinecourses.nptel.ac.in/noc20_ee99/previewhttps://archi ve.nptel.ac.in/courses/10 8/106/108106170/

COURSE OUTCOMES:

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

1. Understand the fundamentals of Electric Vehicles.
2. Design of batteries, EV motors and Power electronic controllers for EV systems.Analyze the economics of EV market and E data using Analytical tools.

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III Year B.Tech CSE (IoT) - II Sem (R22)   **L/T/P/C**
3/0/0/3

OPEN ELECTIVE - II
(R22A6251) - CYBER GOVERANCE

Prerequisite: CYBER SECURITY

Course Objectives:
1. To learn Principles of Cyber Security.
2. To learn various types of attacks and the precautions.
3. To gain the knowledge of security and governance measurements
4. To learn the analyticals and various security compliance in Cyber Security through governance.
5. To gain the knowledge of various countries Cyber Security Principles and Governance.

UNIT - I:
Principles of cyber-security governance, Assessment of cyber security maturity**,** Theories of governance – introduction, Governance – definitions and typologies, Tools, methods and processes,

UNIT - II:
Vulnerability management, Threat management, Endpoint management , Intrusion detection and prevention system (IDPS), Security incident management, Security operations center (SOC) and related concepts.

UNIT - III:
Measurement of governance: Metrics – concepts, Application security metrics, Network security metrics, Security incident metrics, Vulnerability metrics, Service level objectives / agreement (SLO / SLA), NIST metrics

UNIT - IV:
Basics of security analytics, Threat intelligence and governance, Data driven security governance, Impact of cognitive security on security governance, Industry specific security compliance

UNIT - V:
Cyber security governance India and Other countries, NIST mandates for compliance, Security reporting basics, CISO – role and organization structure

TEXT BOOKS:
1. Hayden, Lance. IT Security Metrics: A Practical Framework for Measuring Security & Protecting Data. McGraw-Hill Education Group, 2010.
2. Jacobs, Jay, and Bob Rudis. Data-driven security: analysis, visualization and dashboards. John Wiley & Sons, 2014
3. Collins, Michael. Network Security Through Data Analysis: From Data to Action. ‖ O'Reilly Media, Inc.‖, 2017.
4. Jaquith, Andrew. Security metrics: replacing fear, uncertainty, and doubt. Pearson Education, 2007.

REFERENCE BOOKS:

1. Cybersecurity, Critical Infrastructure. –Framework for Improving Critical Infrastructure Cybersecurity.‖ Framework 1 (2014): 11.

Course Outcomes:

1. Students will be able to understand the basis of cyber-security.
2. Students will be able to know various governance principles
3. Students will learn about various types of attacks and threats in Security
4. Students will gain the knowledge of other countries standards, methods in governance.

IV Year – I Semester (R22) CSE (Internet Of Things)

IV Year B. Tech - CSE (Internet Of Things) – I Semester

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0513	Full Stack Development	3	0	0	3	40	60
2	R22A6208	IoT Security & Privacy	3	0	0	3	40	60
3	R22A0522	Cloud Computing	3	1	0	4	40	60
4	R22A6621 R22A6214 R22A6606 R22A6203	**Professional Elective-III:** 1. Generative AI 2. Database Security 3. Computer Vision 4. Ethical Hacking	3	0	0	3	40	60
5	R22A6907 R22A0527 R22A6905 R22A0521	**Professional Elective-IV:** 1. IoT Automation 2. Blockchain Technology 3. Architecting Smart IoT Devices 4. DevOps	3	0	0	3	40	60
6	R22A0589	Full Stack Development Lab	0	0	2	1	40	60
7	R22A6994	Project Development (Phase-I)	0	0	6	3	40	60
		Total	**15**	**1**	**8**	**20**	**280**	**420**

IV Year B.Tech CSE (IoT) - I Sem (R22)   **L-T-P-C**
                                                                    3-0-0-3

(R22A0513) – FULL STACK DEVELOPMENT

COURSE OBJECTIVES:
1. To become knowledgeable about the most recent web development technologies.
2. Idea for creating two tier and three tier architectural web applications.
3. Students will become familiar to implement fast, efficient, interactive and scalable web applications using run time environment provided by the full stack components
4. Design and Analyze real time web applications and Constructing suitable client and server side applications.
5. To learn core concept of both front end and back end programming.

UNIT - I
Web Development Basics: Understanding the Basic Web Development Framework- User, Browser, Webserver, Backend Services, **HTML Basics:** Headings, Paragraphs, Links, Images, Lists, Tables, Div Element, Forms, **Cascading Style Sheets**: Syntax, Types, Selectors, Background, Border, Font, Text, Table**,** box model, **Version Control:** Getting Started with Git, Git Basics, Git Branching and Merging, working with remote repositories.

UNIT - II
JavaScript and jQuery: JavaScript basics, Functions, form validation, OOPS Aspects of JavaScript, JQuery Framework, jQuery events, AJAX for data exchange with server, JSON data format.

UNIT - III
Angular: importance of Angular, Understanding Angular, creating a Basic Angular Application, Angular Components, Expressions, Data Binding, Built-in Directives, Custom Directives, Implementing AngularServices in Web Applications.
React:
Need of React, Simple React Structure, The Virtual DOM, React Components, Introducing React Components, Creating Components in React, Data and Data Flow in React, Rendering and Life Cycle Methods in React, Working with forms in React, integrating third party libraries, Routing in React.

UNIT – IV
Node js: Getting Started with Node.js, Using Events, Listeners, Timers, and Callbacks in Node.js, Handling Data I/O in Node.js, Accessing the File System from Node.js, Implementing Socket Services in Node.js.
UNIT - V
MongoDB:
Understanding NoSQL and MongoDB**,** Getting Started with MongoDB**,** Getting Started with MongoDB and Node.js**,** Manipulating MongoDB Documents from Node.js**,** Accessing MongoDB from Node.js**,** Using Mongoose for Structured Schema and Validation**,** Advanced MongoDB Concepts.

TEXT BOOKS:
   1. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett Professional JavaScript for Web Developers Book by Nicholas C. Zakas. **(Unit-I, II).**
   2. ProGit, 2nd Edition, Apress publication by Scott Chacon and Straub. **(Unit I).**
   3. Mark Tielens Thomas, React in Action, 1st Edition, Manning Publications. **(Unit-III).**
   4. Brad Dayley, Brendan Dayley, Caleb Dayley., Node.js, MongoDB and Angular Web Development, 2nd Edition, Addison-Wesley, 2019. **(Unit-III, Unit-IV, Unit-V)**.

REFERENCE BOOKS:
   1. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Edition, Apress, 2019.
   2. Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', 1st edition, Apress, 2018.
   3. Kirupa Chinnathambi, Learning React: A Hands-On Guide to Building Web Applications Using React and Redux, 2nd edition, Addison-Wesley Professional, 2018.

COURSE OUTCOMES:
   1. UnderstandFullstack components for developing web application.
   2. Students are able to develop a dynamic webpage by the use of java script and jQuery.
   3. Design faster and effective single page applications using Angular and Create interactive user interfaces with react components
   4. Apply packages of NodeJS to work with Data, Files, Http Requests and Responses.
   5. Use MongoDB data base for storing and processing huge data and connects with NodeJS application.

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IV Year B.Tech. CSE(IoT)-I Sem   **L-T-P-C**
                                                                                        3-0-0-3

(R22A6208) IOT SECURITY AND PRIVACY

Course Objectives:
1. Understand the fundamentals, various attacks and importance of Security aspects in IoT.
2. Understand the techniques, protocols and some idea on security towards Gaming models.
3. Understand the operations of Bitcoin blockchain, crypto-currency as application of blockchain technology.
4. Understand the essential components of IoT.
5. Understand security and privacy challenges of IoT.

Course Outcomes:
1. Incorporate the best practices learnt to identify the attacks and mitigate the same.
2. Adopt the right security techniques and protocols during the design of IoT products.
3. Assimilate and apply the skills learnt on ciphers and block chains when appropriate.
4. Describe the essential components of IoT.
5. Find appropriate security/privacy solutions for IoT.

UNIT - I
Fundamentals of IoT and Security and its need, Prevent Unauthorized Access to Sensor Data, Block ciphers, Introduction to Blockchain, Introduction of IoT devices, IoT Security Requirements, M2M Security, Message integrity, Modeling faults and adversaries, Difference among IoT devices, computers, and embedded devices.

UNIT - II
IoT and cyber-physical systems RFID Security, Authenticated encryption Byzantine Generals problem sensors and actuators in IoT. IoT security (vulnerabilities, attacks, and countermeasures), Cyber Physical Object Security, Hash functions, Consensus algorithms and their scalability problems, Accelerometer, photoresistor, buttons.

UNIT - III
Security engineering for IoT development Hardware Security, Merkle trees and Elliptic curves digital signatures, verifiable random functions, Zero-knowledge systems motor, LED, vibrator. IoT security lifecycle, Front-end System Privacy Protection, Management, Secure IoT Databases, Public-key crypto (PKI), blockchain, the challenges, and solutions, analog signal vs. digital signal.

UNIT - IV
Data Privacy Networking Function Security Trees signature algorithms proof of work, Proof of stake, Networking in IoT, Device/User Authentication in IoT IoT Networking Protocols, Crypto-currencies, alternatives to Bitcoin consensus, Bitcoin scripting language and their use Real-time communication.

UNIT - V

Introduction to Authentication Techniques Secure IoT Lower Layers, Bitcoin P2P network, Ethereum and Smart Contracts, Bandwidth efficiency, Data Trustworthiness in IoT Secure IoT Higher Layers, Distributed consensus, Smart Contract Languages and verification challenges data analytics in IoT - simple data analyzing methods.

TEXT BOOKS:
1. B. Russell and D. Van Duren, —Practical Internet of Things Security,‖ Packt Publishing, 2016.
2. FeiHU, —Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations‖, CRC Press, 2016.
3. Narayanan et al., —Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction,‖ Princeton University Press, 2016.

REFERENCE BOOKS:
1. A. Antonopoulos, —Mastering Bitcoin: Unlocking Digital Cryptocurrencies,‖ O'Reilly, 2014.
2. T. Alpcan and T. Basar, —Network Security: A Decision and Game-theoretic Approach,‖Cambridge University Press, 2011.
3. Security and the IoT ecosystem, KPMG International, 2015.
4. Internet of Things: IoT Governance, Privacy and Security Issues‖ by European ResearchCluster.
5. Ollie Whitehouse, —Security of Things: An Implementers' Guide to Cyber-Security for Internetof Things Devices and Beyond‖, NCC Group, 2014
6. Josh Thompson, ‗Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

IV Year B.Tech CSE (IoT) - I Sem (R22)   L-T-P-C
                                                            3-0-0-3

(R22A0522) – CLOUD COMPUTING

COURSEOBJECTIVES
1. To understand the cloud computing fundamentals and evolving computing paradigms
2. To realize the reasons for migrating into cloud
3. To gain knowledge in virtualization of computer resources
4. To introduce the various levels of services that can be achieved by a cloud.
5. To describe the security aspects in cloud and the services offered by a cloud.

UNIT- I Cloud Computing Fundamentals: Definition of Cloud computing, Roots of Cloud Computing , Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers.

Computing Paradigms: Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Quantum Computing.

UNIT- II Migrating into a Cloud: Introduction, Broad Approaches to Migrating into the Cloud, the Seven-Step Model of Migration into a Cloud.

Virtualization: Virtual Machines and Virtualization of Clusters and data centers- Implementation Levels of Virtualization -Virtualization Structures/Tools and Mechanisms- Virtualization of CPU, Memory, and I/O Devices-Virtual Clusters and Data Centers

UNIT- III Infrastructure as a Service (IAAS) & Platform (PAAS): Virtual machines provisioning and Migration services - Virtual Machines Provisioning and Manageability - Virtual machine Migration Services - VM Provisioning and Migration in Action.

On the Management of Virtual machines for Cloud Infrastructures. Aneka—Integration of Private and Public Clouds.

UNIT- IV Software as a Service (SAAS) & Data Security in the Cloud: Software as a Service SAAS), Google App Engine – Centralizing Email Communications- Collaborating via Web-Based Communication Tools-An Introduction to the idea of Data Security. The Current State of Data Security in the Cloud - Cloud Computing and Data Security Risk -Cloud Computing and Identity.

UNIT- V SLA Management in cloud computing: Traditional Approaches to SLO Management,Types of SLA, Life Cycle of SLA, SLA Management in Cloud.

TEXT BOOKS:
1. CloudComputing Principles andParadigms, by Rajkumar Buyya
2. Essentials of cloudComputing: K. Chandrasekhran, CRC press, 2014
3. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
4. Cloud Computing,A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH

REFERENCE BOOKS:

1. Cloud Computing : A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill,rp2011.
2. EnterpriseCloud Computing,Gautam Shroff,Cambridge University Press,2010.
3. Cloud Computing: Implementation, Management and Security, John W.Rittinghouse, James F.Ransome, CRC Press,rp2012.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O'reilly, SPD,rp2011.
5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

COURSE OUTCOMES:

- Ability to analyze various service delivery models of cloud computing
- Ability to interpret the ways in which the cloud can be programmed and deployed.
- Ability to comprehend the virtualization and cloud computing concepts
- Assess the comparative advantages and disadvantages of Virtualization technology
- Analyze security issues in cloud computing

IV Year B.Tech CSE (IoT) - I Sem (R22)   **L-T-P-C**
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(R22A6611) Generative AI
(PROFESSIONAL ELECTIVE-III)

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1. To familiarize students on the concept of Generative Modelling
2. To understand the encoding & decoding mechanisms in Variational Autoencoders.
3. To gain knowledge on Generative Adversarial Networks.
4. To learn the fundamentals of Autoregressive models & Transformers.
5. To assess the emerging market of Generative Artificial Intelligence.

UNIT I Generative Modeling

Generative Modeling, Generative Versus Discriminative Modeling, The rise of Generative Modeling, Generative Modeling and AI, Building a Generative Model, Core Probability Theory, Generative Model Taxonomy, **Case Study**: The Generative Deep Learning Codebase, Cloning the Repository, Using Docker, Running on a GPU.

UNIT II Variational Autoencoders (VAE)

Introduction, **Autoencoders**: Architecture, The Encoder, The Decoder, Joining the Encoder to the Decoder, Training & Analysis of the Auto Encoder, Case Study – The Variational Art Exhibition, **VAE:** Building a VAE, Analysis of the VAE, Case Study – Using VAE to generate faces.

UNIT III Generative Adversarial Networks (GAN)

Introduction, **Deep Convolutional GAN (DC-GAN)**: Discriminator, Generator, Training & Analysis of DCGAN, Case Study - Wasserstein GAN with Gradient Penalty (WGAN - GP): Wasserstein Loss, The Lipschitz Constraint, Weight Clipping, The Gradient Penalty (GP) Loss, Training & Analysis of the WGAN - GP.

UNIT IV Autoregressive Models & Transformers

Introduction, **Long Short-Term Memory Network (LSTM)**: The Recipes Dataset, Working with Text Data, Tokenization, Creating the Training Set, The LSTM Architecture, The Embedding Layer, The LSTM Layer, The LSTM Cell, Training & Analysis of the LSTM, **Transformers –** Introduction, GPT: The Wine Reviews, Dataset, Attention, Queries, Keys, and Values, Multihead Attention, Causal Masking, The Transformer Block, Positional Encoding, Training & Analysis of GPT.

UNIT V Timeline & Future Scope of Generative AI

2014–2017: The VAE and GAN Era, 2018–2019: The Transformer Era, 2020–2022: The Big Model Era, **The Current State of Generative AI**: Large Language Models (LLM's), Text-to-Code Models, Text-to-Image Models, Other Applications, **The Future of Generative AI**: Generative AI in Everyday Life, Generative AI in the Workplace, Generative AI in Education, Generative AI Ethics and Challenges.

TEXT BOOK

1. GENERATIVE DEEP LEARNING Teaching Machines to Paint, Write, Compose and Play - David Foster - O'Reilly - 2nd Edition

REFERENCE BOOKS

1. Generative AI in Practice – Bernard Marr - Wiley

IV Year B.Tech CSE (IoT) - I Sem (R22)   L-T-P-C
                                                            3-0-0-3

(R22A6214) DATABASE SECURITY **(PROFESSIONAL ELECTIVE-III)**

Course Objectives:
1. To understand the concepts of web security and cryptographic system.
2. To learn privacy protection techniques and web server security concepts.
3. To understand access control models in XML, web server security and security in data warehouses.
4. To learn the techniques and concepts of re-engineering security for databases.
5. To expose to trends in database publishing and mobile environment securities.

UNIT – I: The Web Security, the Web Security Problem, Risk Analysis and Best Practices Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification

UNIT – II: The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications

UNIT – III: Database Security: Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems

UNIT – IV: Security Re-engineering for Databases: Concepts and Techniques, Database Watermarking for Copyright Protection, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities and

UNIT – V: Future Trends Privacy in Database Publishing: A Bayesian Perspective, Privacyenhanced Location-based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment.

TEXTBOOKS:
1. Web Security, Privacy and Commerce Simson GArfinkel, Gene Spafford, O'Reilly.
2. Handbook on Database security applications and trends Michael Gertz, Sushil Jajodia

COURSE OUTCOMES:
Students should be able to
1.   Understand the Web architecture and applications
2.   Understand client side and service side programming
3.   Understand how common mistakes can be bypassed and exploit the application
4.   Identify common application vulnerabilities

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(R22A6203) ETHICAL HACKING
(PROFESSIONAL ELECTIVE-III)

Course Objectives:
1. To understand and analyses Information security threats & countermeasures.
2. To perform security auditing & testing.
3. To understand issues relating to ethical hacking.
4. To study & employ network defense measures.
5. To understand penetration and security testing issues in wireless networks.

UNIT - I
ETHICAL HACKING OVERVIEW & VULNERABILITIES
Understanding the importance of security, Concept of ethical hacking and essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit, Phases involved in hacking

UNIT - II
FOOTPRINTING & PORT SCANNING
Footprinting - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase. Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS

UNIT - III
SYSTEM HACKING
Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

UNIT - IV
HACKING WEB SERVICES & SESSION HIJACKING
Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools

UNIT - V
HACKING WIRELESS NETWORKS
Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.

REFERENCES:
1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010
3. Rajat Khare, "Network Seuciryt and Ethical Hacking", Luniver Press, 2006
4. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing, 2011
5. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

Course Outcomes:
1. Students will be able to understand and analyses Information security threats & countermeasures.
2. Students will be able to perform security auditing & testing.
3. Students will be able to understand issues relating to ethical hacking.
4. Students will be able to study & employ network defense measures.
5. Students will be able to understand penetration and security testing issues in wireless networks

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(R22A6606) COMPUTER VISION
(PROFESSIONAL ELECTIVE-III)

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COURSE OBJECTIVES

1. To introduce various components of image processing techniques for computer vision.
2. To understand filters and computing Image Gradient.
3. To understand segmentation, model fitting and tracking
4. To impart knowledge about object registration and object matching
5. To implement various techniques available for object recognition.

UNIT-I

IMAGE FORMATION: Geometric Camera Models, Intrinsic and Extrinsic Parameters, Geometric Camera Calibration – Linear and Non – linear approach, Light and Shading - Inference from, Modeling Inter reflection, Human Color Perception.

UNIT-II

EARLY VISION: Linear Filters - Convolution, Fourier Transforms, Sampling and Aliasing, Filters as Templates, Correlation, Local Image Features - Computing the Image Gradient, Gradient-Based Edge Detectors, Orientations, Texture - Local Texture Representations Using Filters, Shape from Texture.

UNIT-III

MID-LEVEL VISION: Segmentation by Clustering - Basic Clustering Methods, The Watershed Algorithm, Segmentation Using K-means, Grouping and Model Fitting - Fitting Lines with the Hough Transform, Fitting Curved Structures, Tracking - Tracking by Detection, Tracking Translations by Matching, Tracking Linear Dynamical Models with Kalman Filters.

UNIT-IV

HIGH-LEVEL VISION: Registration, Registering Rigid and Deformable Objects, Smooth Surfaces and Their Outlines - Contour Geometry, Koenderink's Theorem, The Bitangent Ray Manifold, Object Matching using Interpretation Trees and Spin Images, Classification, Error, and Loss.

UNIT-V

OBJECT DETECTION AND RECOGNITION: Detecting Objects in Images - The Sliding Window Method, Face Detection, Detecting Humans, Boundaries and Deformable Objects, Object Recognition – Categorization, Selection, Applications – Tracking People, Activity Recognition.

TEXT BOOKS:

1. Forsyth, Jean Ponce David A. "Computer Vision: A Modern Approach", Second Edition, Pearson Education Limited 2015.
2. Szeliski, Richard, "Computer vision: algorithms and applications", Springer Science & Business Media, 2010.

REFERENCE BOOKS:

1. Hau, Chen Chi, "Handbook of pattern recognition and computer vision", World Scientific, FifthEdition, 2015.
2. Muhammad Sarfraz, "Computer Vision and Image Processing in Intelligent Systems and Multimedia Technologies", IGI Global, 2014.
3. Theo Gevers, ArjanGijsenij, Joost van de Weijer, Jan-Mark Geusebroek "Color in Computer Vision:Fundamentals and Applications", Wiley, 2012.
4. Kale, K. V, Mehrotra S.C, Manza. R.R., "Advances in Computer Vision and Information Technology",IK International Pvt Ltd, 2013.

COURSE OUTCOMES:

1. Understand various image formation models.
2. Extract shape, texture and edge based features.
3. Detect region of interest using image segmentation and object localization techniques.
4. Identify and recognize objects using image registration and classification. Explore various case studies on vision based applications.

(R22A0527) BLOCKCHAIN TECHNOLOGY
(PROFESSIONAL ELECTIVE-IV)

COURSE OBJECTIVES:

This course will enable the students:

1. To enable the student to understand and appreciate, the importance of fundamentals of blockchain technology
2. To enable the student to understand and appreciate, the importance of fundamentals of blockchain technology application of cryptography in blockchain
3. To gain the awareness about the concepts of various implementations of blockchain technology such as bitcoin, Ethereum, and Hyper ledger.
4. To gain the awareness about the concepts of various implementations of cryptography blockchain .
5. Students will enable the concepts of Smart Contract and Hyper ledger.

UNIT-I

Introduction to Blockchain Technology – Distributed systems – The history of blockchain – Introduction to blockchain – CAP theorem and blockchain – Benefits and limitations of blockchain – Decentralization using blockchain - Methods of decentralization – Routes to decentralization

UNIT-II

Cryptography in Blockchain: Introduction – cryptographic primitives – Assymetric cryptography – public and private keys -line interface – Bitcoin improvement proposals (BIPs) – Consensus Algorithms.

UNIT-III

BitCoin Introduction – Transactions – Structure - Transactions types – The structure of a block– The genesis block – The bitcoin network– Wallets and its types– Bitcoin payments– Bitcoin investment and buying and selling bitcoins – Bitcoin installation – Bitcoin programming and the command-line interface – Bitcoin improvement proposals (BIPs).

UNIT-IV

Ethereum - Ethereum blockchain- Elements of the Ethereum blockchain– Precompiled contracts – Accounts and its types – Block header- Ether – Messages – Mining - Clients and wallets – Trading and investment – The yellow paper - The Ethereum network - Applications developed on Ethereum - Scalability and security issues, SideChain, GHOST.

UNIT-V

Smart Contract and Hyper ledger – History of Smart Contract – Ricardian contracts - The DAO. Hyper ledger projects – Hyperledger as a protocol – Fabric - Hyperledger Fabric - Sawtooth lake – Corda Architecture.

TEXT BOOKS:

1. Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd Revised edition edition. Birmingham: Packt Publishing, 2018.

REFERENCE BOOKS:

1. A. M. Antonopoulos, Mastering bitcoin, First edition. Sebastopol CA: O'Reilly,2015.

2. Z. Zheng, S. Xie, H. Dai, X. Chen, andH. Wang, ―An Overviewof Blockchain Technology: Architecture, Consensus, and Future Trends,‖ in 2017 IEEE International Congress on Big Data (BigData Congress), 2017, pp.557–564.

Course Outcomes:

1. Student will be able to to understand the fundamentals of blockchain technology.
2. Apply knowledge of implementations of Bitcoin, Ethereum and Hyperledger to develop solutions in the appropriate domains.
3. Students will be able to implement cryptography.
4. Students will be able to implement Smart Contract and Hyper ledger.
5. Students will be able to implement bitcoin using blockchain technology.

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IV Year B.Tech. CSE(IoT)- I Sem – R22 Regulation

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(R22A6907) IOT AUTOMATION
PROFESSIONAL ELECTIVE - IV

Course Objectives:
- While the promise of the Industrial Internet of Things (IIoT) brings many new business prospects, it also presents significant challenges ranging from technology architectural choices to security concerns.
- Students acquire the upcoming Industrial IoT: Roadmap to the Connected World Course offers important insights on overcoming the challenges and thrive in this exciting space.

Course Outcomes:
- Discover key IIoT concepts including identification, sensors, localization, wireless protocols, data storage and security.
- Explore IoT technologies, architectures, standards, and regulation.
- Realize the value created by collecting, communicating, coordinating, and leveraging the data from connected devices.
- Examine technological developments that will likely shape the industrial landscape in the future.
- Understand how to develop and implement own IoT technologies, solutions, and applications.

UNIT - I
Introduction & Architecture: Introduction of IIoT and the connected, The difference between IoT and IIoT, Architecture IIoT, IOT node, Challenges of IIOT, Fundamentals of Control System, introductions, components, closed loop & open loop system.

UNIT - II
IIOT Components: Introduction to Sensors, Types of sensors, working principle of basic Sensors - Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11). Digital switch, Electro Mechanical switches.

UNIT - III
Communication Technologies of IIoT: Communication Protocols: IEEE 802.15.4, ZigBee, Z Wave, Bluetooth, BLE, NFC, RFID Industry standards communication technology (LoRAWAN, OPC UA, MQTT), connecting into existing Modbus and Profibus technology, wireless network communication.

UNIT - IV
Visualization and Data Types of IIoT: Front-end EDGE devices, Enterprise data for IIoT, Emerging descriptive data standards for IIoT, Cloud database, Cloud computing, Fog or Edge computing.
Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.

UNIT - V
Retrieving Data: Extraction from Web: Grabbing the content from a web page, Sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M).
Control & Supervisory Level of Automation: Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA). HMI in an automation process, ERP & MES.

TEXT BOOKS:
1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
2. Industrial Internet of Things: Cyber manufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication).
3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor).

REFERENCE BOOK:
1. Jerker Delsing, IoT Automation: Arrowhead Framework, CRC Press.

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(R22A0521) DEV OPS
(PROFESSIONAL ELECTIVE-IV)

Course Objectives:

The main objectives of this course are to:

1. Describe the agile relationship between development and IT operations.
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
3. Implement automated system update and DevOps lifecycle.
4. Describe about the Agile development model.
5. Describe about the Project management.

UNIT - I

Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT - II

Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing. DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

UNIT - III

Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

UNIT - IV

Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

TEXT BOOKS:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2ndedition (2018). ISBN10: 1788392574

2. Deepak Gaikwad,Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

REFERENCE BOOK:

1. Len Bass,Ingo Weber, Liming Zhu. DevOps:A Software Architect's Perspective. Addison Wesley; ISBN-10.

CourseOutcomes:On successful completion ofthis course,students will be able to:

1. Identify components of Devops environment.
2. Describe Software developmentmodels andarchitectures of DevOps.
3. Apply different project management,integration,testing and code deployment tool.
4. Investigate different DevOps Software development models.
5. Assessvarious Devops practices.

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(R22A6905) ARCHITECTING SMART IOT DEVICES
(Professional Elective – IV)

Prerequisite: Embedded hardware design.

Course Objectives:
1. To understand the architectural overview of the Internet of Things (IoT).
2. To acquire skills on data acquisition and communication in IoT.
3. To understand the threats of IoT.

Course Outcome:
1. Understand how the IoT is different from traditional systems.
2. Demonstrate the revolution of internet in mobile and cloud.
3. Examine the architecture and operation of IoT.
4. Explore various tools and programming paradigms for IoT applications.
5. Develop an IoT prototype for real time scenario.
6. Understand the building blocks of IoT and security aspects.

UNIT - I
Design Principles of IoT: Design principles of connected devices, data acquiring organizing and analytics in IoT, system architecture of IoT.
UNIT - II
Prototyping the Embedded Devices for IoT: System hardware and prototyping, sensors and actuators for IoT, Radio module and wireless sensor network, gateways internet and web, software components.
UNIT - III
Embedded Programming for IoT: Programming connected devices, C and python for IoT, Case study: Temperature controller, Smart irrigation system.
UNIT - IV
Embedded RTOS: Program structure and real time, multitasking and scheduling, RTOS services, signals, semaphores, Nucleus SE, application timers, interrupts in nucleus ES, Nucleus SE initialization and starn1p.
UNIT - V
Tools for IoT: Introduction, chef puppet, NETCONF - YANG case studies.
IoT physical Devices: Basic building blocks of an IoT device and endpoints, family of ploT devices, pcDuino, Beagle bone black, cubie board, domain specific IoTs.

TEXT BOOKS:
1. Raj Kamal, Internet of Things, Architecture and Design Principles, lst edition, McGraw Hill Education, May 2017.
2. Arsheep Baga and Vijay Madisetti, Internet of Things: A Hands-On Approach, 1st Edition, Universities press, 2015.

REFERENCE BOOKS:
1. David Etter, IoT (Internet of Things Programming: A simple and fast way of Learning IoT, Kindle edition 2016.
2. Fei HU, Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, 1st Edition, CRC Press, 2016.
3. Colin Walls, Embedded RTOS Design Insights and Implementation. 1st edition. Elsevier. December 2020.

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(R22A0589) FULL STACK DEVELOPMENT LAB

COURSE OBJECTIVES:

This course will enable the students:
1. Usage of various front and back end Tools
2. They can understand and create applications on their own
3. Demonstrate and Designing of Websites can be carried out.
4. Develop web based application using suitable client side and server side code.
5. Implement web based application using effective database access.

PROGRAMS:

Week-1. Designing following static WebPages required for an Online Book Store website.

Week-2. Designing a webpage using CSS Which includes different styles.

Week-3. Write a JavaScript to implement the following various events.

Week-4. Write a program to create and Build a Password Strength Check using JQuery.

Week-5. Write a program to create and Build a star rating system using JQuery.

Week-6. Write a program for sending request to a server by using AJAX.

Week-7. Develop an Angular JS application that displays a list of shopping items. Allow users to add and remove items from the list using directives and controllers. Note: The default values of items may be included in the program.

Week-8. Write a program to create a simple calculator Application using React JS.

Week-9. Write a program to create a voting application using React JS.

Week-10. Write a serverside program for Accessing MongoDB from Node.js.

Week-11. Write a serverside program for Manipulating MongoDB from Node.js.

COURSE OUTCOMES:

Students will be able to understand
1. Usage of various front and back end Tools
2. They can understand and create applications on their own
3. Demonstrate and Designing of Websites can be carried out.
4. Develop web based application using suitable client side and serverside code.
5. Implement web based application using effective database access.

IV Year – II- Semester (R22) CSE (Internet of Things)

S.No	Subject Code	SUBJECT	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0334	Innovation, Start-Up & Entrepreneurship	4	0	0	4	40	60
2	R22A6906 R22A0530 R22A6614 R22A0528	**Professional Elective-V:** 1. Programming Languages for IoT 2. Edge Computing 3. Expert Systems 4. Quantum Computing	3	0	0	3	40	60
3	R22A6908 R22A0517 R22A0567 R22A6909	**Professional Elective-VI:** 1. Smart Sensors Technologies 2. Augmented Reality & Virtual Reality 3. Wireless Networks 4. 5G and IoT Technologies	3	0	0	3	40	60
4	R22A6995	Project Development (Phase-II)	0	0	20	10	80	120
		Total	**10**	**0**	**20**	**20**	**200**	**300**