



# SARDAR PATEL UNIVERSITY, BALAGHAT

## School of Engineering and Technology

### Syllabus

**Course: B.Tech**

**Semester: VI**

**Branch: Computer Science and Engineering**

**w.e.f. Academic Session: 2024-25**

### CSE601 Cryptography

#### Course Objectives:

1. To impart knowledge of the basic principles and concepts of modern cryptography.
2. To provide students with a solid foundation in the principles and concepts of cryptography and its role in Cyber Security.
3. To enable students to understand and implement various cryptographic algorithms and protocols, both symmetric and asymmetric.

#### Unit I: Introduction:

Modern cryptography, Historical ciphers and their cryptanalysis, The heuristic versus the rigorous approach; adversarial models and principles of defining security, Perfectly-Secret Encryption: Definitions, the one-time pad; proven limitations. Private-Key (Symmetric) Encryption: Computational security, Defining secure, encryption, Constructing secure encryption; pseudo randomness, Stronger security notions, Constructing CPA-secure encryption, Modes of operation; CBC vs. CTR, Security of CTR with  $n - k$  bit counter for messages to size  $2k$  blocks with proof directly to the LR definition, CCA attacks.

#### Unit II: Message Authentication Codes:

Message Authentication Codes: Message integrity, Definition of security, Constructions from pseudorandom functions, CBC-MAC, Authenticated Encryption.

#### Unit III: Collision-Resistant Hash Functions:

Definitions, The Merkle-Damgard transform, HMAC, Birthday attacks, The Random oracle model, Password hashing, Constructions of Pseudorandom Permutations (Block Ciphers) in Practice, Substitution-permutation and Feistel networks, DES and attacks on reduced-round versions, double-DES and triple-DES, AES, Hash functions from block ciphers.

#### Unit IV: Number Theory:

Preliminaries and basic group theory, Primes, factoring and RSA, Cryptographic assumptions in cyclic groups, Collision resistant hash functions from discrete log.

#### Unit V: Public-Key (Asymmetric) Cryptography:

Introduction to Public Key Cryptography, Diffie-Hellman Key Exchange,

Public-Key (Asymmetric) Encryption: The model and definitions, Hybrid encryption and KEM/DEM, El Gamal, RSA: textbook encryption, attacks on textbook RSA, padded RSA; CCA-secure RSA KEM.

Digital Signatures: Definition and applications, Hash and sign, RSA signatures: textbook RSA, hashed



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RSA, security with ROM, Certificates and public-key infrastructures.

#### **Reference Books:**

1. Jonathan Katz and Yehuda Lindell, Introduction to Modern Cryptography, second edition 2014, CRC Press.
2. Cryptography: Theory and Practice by Douglas Stinson, Third edition, CRC Press.
3. Handbook of Applied Cryptography by Alfred Menezes, Paul Oorschot and Scott Vanstone. Available Online.
4. Foundations of Cryptography by Oded Goldreich. Available Online.
5. Cryptography, an Introduction by Nigel Smart. Available Online

#### **Course Outcome:**

At the end of the course, students should be able to:

1. Explain fundamental concepts of cryptography, including encryption, decryption, keys, and cryptographic protocols.
2. Demonstrate proficiency in implementing symmetric and asymmetric encryption algorithms (e.g., AES, RSA) and cryptographic hash functions (e.g., SHA-256).
3. Apply cryptographic principles to real-world scenarios, including secure data transmission, digital signatures, and authentication mechanisms.



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### **CSE602 Principles of Programming Languages**

#### **Course Objectives:**

1. To provide students with a comprehensive understanding of the fundamental concepts and principles that underpin programming languages.
2. To explore various programming paradigms (procedural, object-oriented, functional, logic, etc.) and their applications in Software Development.
3. To foster critical thinking by enabling students to compare and evaluate different programming languages based on their features, strengths and weaknesses.

#### **Unit I: Introduction to PPL:**

Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms – Imperative, Object Oriented, functional Programming, Logic Programming. Programming Language Implementation – Compilation and Virtual machines, programming environments.

#### **Unit II: Data Type & Loops:**

Data types: Introduction, primitive, character, user defined, array, associative, record, union, Pointer and reference types, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization. Sequence control with Expressions, Conditional Statements, Loops.

#### **Unit III: Sub Programs & Blocks:**

Subprograms and Blocks: Fundamentals of sub-programs, Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, design- issues for functions overloaded operators, co routines.

#### **Unit IV: Abstract Data Types & Threads:**

Abstract Data types: Abstractions and encapsulation, introductions to data abstraction, Static and Stack-Based Storage management. heap based storage management. Garbage Collection. object oriented programming in small talk, C++, Java, C#, PHP, Perl .

#### **Unit V: Logic Programming language:**

Functional Programming Languages: Introduction, fundamentals. Introduction to 4GL, Exception Handling, Exceptions, Exception Propagation, Exception Handler in C++ and Java programming. Logic Programming Language: Introduction and overview of logic programming, basic elements of prolog, application of logic programming.



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#### Reference Books:

1. Tucker, "Programming Languages: Principles and paradigms", Tata McGraw –Hill.
2. Cavlo Ghezzi & Mehdi Jazayeri " Programming Languages Concepts", Willey India.
3. Sebesta,"Concept of programming Language", Pearson Edu
4. Terrance W Pratt, "Programming Languages: Design and Implementation" Pearson Edu.
5. Louden, "Programming Languages: Principles & Practices", Cengage Learning.
6. E Horowitz, "Programming Languages", 2nd Edition, Addison Wesley.

#### List of Experiments:

1. Design of lexical Analyzer using lex/flex.
2. Case study of working of virtual machine.
3. Memory Implementation of 2D and 3D Array.
4. Design a web page in PHP.
5. Implementation of pointers in C++.
6. Write a program in Java to implement exception handling.
7. Write a program in C++ to implement different parameter passing Methods.
8. Write a program in Java to implement concurrent execution of a job using threads.
9. Implement different types of functions used in Prolog.
10. Implement Inheritance, Encapsulation & Polymorphism in C#.

#### Course Outcome:

At the end of the course, students should be able to:

1. Articulate the core concepts and principles that define programming languages, including syntax, semantics, and pragmatics.
2. Analyze and compare the features of different programming languages across various paradigms (e.g., procedural, functional, object-oriented).
3. Implement basic constructs of different programming languages and demonstrate proficiency in using them effectively.



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### CSE603 Theory of Computation

#### Course Objectives:

1. To provide students with a solid foundation in the theoretical aspects of computation, including models of computation, formal languages, and automata theory.
2. To explore various types of formal languages and grammars, including regular, context-free, and context-sensitive languages.
3. To introduce students to different types of automata (finite automata, pushdown automata, and Turing machines) and their roles in language recognition and computation.

#### Unit I: Introduction to Languages:

Introduction: L, G, & AT, Review of Sets, Graphs, Trees, Proof Techniques, Languages and Grammars – Fundamental Concepts Principal of Maths. Inche, proof by contradiction, etc.

#### Unit II: Finite Automata:

Finite Automata- DFAs, NFAs, Regular Expressions, Regular Grammars and Languages, Properties of Regular Languages, Pumping Lemma for Regular Languages Applications of Regular Expressions .

#### Unit III: Context Free Grammar:

Pushdown Automata- Context Free Grammar, Parsing, Ambiguity, Nondeterministic PDAs, Normal form of CFGs, CFG to NPDA, NPDA to CFGs. Deterministic PDA, Pumping Lemma for CFGs, Application of CFGs.

#### Unit IV: Turing Machine:

Turing Machines: Turing Machine as acceptor, Recognizing a Language, Universal TMs, Linear Bounded Automata, Context Sensitive Languages, Recursively Enumerable Languages, Unrestricted Grammars.

#### Unit V: Complexity Theory:

Chomsky Hierarchy, Concept of Solvability and Unsolvability, Church's Thesis, Complexity Theory: P and NP problems, Introduction to Petri Nets.

#### Reference Books:

1. Lewis and Papadimitriou, "Elements of Theory of Computation", Second Edition, Pearson Education, 2015.
2. Mandrioli D. and Gezzi C., "Theoretical Foundations of Computer Science", Krieger Publishing Co., Inc., USA, 1993.
3. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", Third Edition, Prentice Hall, 2006.



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4. John C. Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition, Mc Graw Hill, 2010.

#### **Course Outcome:**

At the end of the course, students should be able to:

1. Construct finite automata, pushdown automata, and Turing machines for specific languages and analyze their behavior.
2. Articulate the fundamental concepts of computation, including formal languages, automata, and the Church-Turing thesis.
3. Differentiate between various classes of formal languages (regular, context-free, etc.) and their associated automata.
4. Apply formal grammar to generate languages and understand the relationship between syntax and semantics.



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### CSE604 Computer Networking

#### Course Objectives:

1. To provide students with a comprehensive understanding of Computer Networking concepts, architectures and protocols.
2. To familiarize students with key networking protocols at different layers of the OSI and TCP/IP models.
3. To equip students with the skills to design, implement, and manage computer networks, including both wired and wireless technologies.

#### Unit I: Introduction to Computer Network:

Computer Network: Definitions, goals, components, Architecture, Classifications & Types. Layered Architecture: Protocol Hierarchy, Design Issues, Interfaces and Services, Connection Oriented & Connectionless Services, Service Primitives, Design issues & its functionalities, ISO- OSI Reference Model: Principle, Model, Descriptions of various layers and its comparison with TCP/IP.

#### Unit II: Data Link Layer:

Data Link Layer: Need, Services Provided, Framing , Flow Control, Error control. Data Link Layer Protocol: Elementary & Sliding Window protocol: 1-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Bit oriented protocols: SDLC, HDLC, BISYNC, LAP and LAPB.

#### Unit III: Mac Sublayer:

MAC Sublayer: MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes/Contention Schemes: for Data Services (ALOHA and Slotted- ALOHA), for Local-Area Networks (CSMA, CSMA/CD, CSMA/CA), Collision Free Protocols: Basic Bit Map, BRAP, Binary Count Down, MLMA Limited Contention Protocols: Adaptive Tree Walk, URN Protocol, High Speed LAN: Fast Ethernet, Gigabit Ethernet, FDDI, Performance Measuring Metrics. IEEE Standards 802 Series & their Variant.

#### Unit IV: Network Layer:

Network Layer: Need, Services Provided , Design issues, Routing algorithms: Least Cost Routing algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multicast Routing, Congestion Control Algorithms: General Principles of Congestion control, Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram subnets. IP Protocol, IP Addresses, Comparative Study of IPv4 & IPv6, Mobile IP.

#### Unit V: Transport Layer:

Transport Layer: Design Issues, UDP: Header Format, Per-Segment Checksum, Carrying Unicast/Multicast Real-Time Traffic, TCP: Connection Management, Reliability of Data Transfers,



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TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP Timer Management. Session layer: Authentication, Authorization, Session layer protocol (PAP, SCP, H.245). Presentation layer: Data conversion, Character code translation, Compression, Encryption and Decryption, Presentation layer protocol (LPP, Telnet, X.25 packet Assembler/Dis-assembler). Application Layer: WWW and HTTP, FTP, SSH, Email (SMTP, MIME, IMAP), DNS, Network Management (SNMP).

#### Reference Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks" Pearson Education.
2. Dimitri Bertsekas, Robert Gallager, "Data Networks", PHI Publication, Second Edition.
3. Kaveh Pahlavan, Prashant Krishnamurthy, "Networking Fundamentals", Wiley Publication.
4. Uyles Black, "Computer Networks", PHI Publication, Second Edition.
5. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source approach", McGraw Hill

#### List of Experiments:

1. Study of Different Type of LAN & Network Equipments.
2. Study and Verification of standard Network topologies i.e. Star, Bus, Ring etc.
3. LAN installations and Configurations.
4. Write a program to implement various types of error correcting techniques.
5. Write a program to implement various types of framing methods.
6. Study of Tool Command Language (TCL).
7. Study and Installation of Standard Network Simulator: N.S-2, N.S-3.OpNet,QualNet etc .
8. Study & Installation of ONE (Opportunistic Network Environment) Simulator for High Mobility Networks
9. Configure 802.11 WLAN.
10. Implement & simulate various types of routing algorithm.
11. Study & Simulation of MAC Protocols like Aloha, CSMA, CSMA/CD and CSMA/CA using Standard Network Simulators.
12. Study of Application layer protocols- DNS, HTTP, HTTPS, FTP and TelNet.

#### Course Outcome:

At the end of the course, students should be able to:

1. Describe fundamental networking concepts, including the OSI and TCP/IP models, and their respective layers.
2. Analyze and explain the operation of various network protocols, such as IP, TCP, UDP, HTTP, and DNS.
3. Design and implement basic network configurations using routers, switches and wireless access points.



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### **Elective-II CSE6051 Internet of Things**

#### **Course Objectives:**

1. To provide a comprehensive understanding of the fundamental concepts, architecture, and components of the Internet of Things.
2. To explore the integration of various sensors and devices into IoT ecosystems and how they communicate with each other.
3. To address security and privacy challenges associated with IoT devices and networks.
4. To enable students to develop and deploy Real-world IoT applications using various platforms and tools.

#### **Unit I: Introduction to IOT:**

Introduction: Definition, Characteristics of IOT, IOT Conceptual framework, IOT Architectural view, Physical design of IOT, Logical design of IOT, Application of IOT

#### **Unit II: IOT Communication:**

Machine-to-machine (M2M), SDN (software defined networking) and NFV(network function virtualization) for IOT, data storage in IOT, IOT Cloud Based Services.

#### **Unit III: IOT Protocols:**

Design Principles for Web Connectivity: Web Communication Protocols for connected devices, Message Communication Protocols for connected devices, SOAP, REST, HTTP Restful and Web Sockets. Internet Connectivity Principles: Internet Connectivity, Internet based communication, IP addressing in IOT, Media Access control.

#### **Unit IV: Sensor Technology:**

Sensor Technology , Participatory Sensing, Industrial IOT and Automotive IOT , Actuator, Sensor data Communication Protocols ,Radio Frequency Identification Technology, Wireless Sensor Network Technology.

#### **Unit V: Design Methodology:**

IOT Design methodology: Specification -Requirement, process, model, service, functional & operational view.IOT Privacy and security solutions, Raspberry Pi & arduino devices. IOT Case studies: smart city streetlights control & monitoring.

#### **Reference Books:**

1. Rajkamal, "Internet of Things", Tata McGraw Hill publication.
2. Vijay Madiseti and Arshdeep Bahga, "Internet of things(A-Hand-on-Approach)" 1st Edition, Universal Press



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3. Hakima Chaouchi “The Internet of Things: Connecting Objects”, Wiley publication.
4. Charles Bell “MySQL for the Internet of things”, Apress publications.
5. Francis dacosta “Rethinking the Internet of things:A scalable Approach to connecting everything”, 1st edition, Apress publications 2013.
6. Donald Norris “The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black”, McGraw Hill publication.

#### **Course Outcome:**

At the end of the course, students should be able to:

1. Demonstrate an understanding of IoT architecture, components, and key technologies.
2. Design and implement IoT systems, including hardware selection and software programming.
3. Apply appropriate networking protocols for communication between IoT devices and cloud services.
4. Identify potential security threats and implement basic security measures in IoT applications.



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### **Elective-II CSE6052 Mobile Application Development**

#### **Course Objectives:**

1. To provide an overview of mobile application development frameworks, platforms, and operating systems (iOS, Android).
2. To equip students with programming skills in languages and frameworks commonly used in mobile app development, such as Java, Kotlin, Swift, or Flutter.
3. To explore methods for integrating local and remote databases into mobile applications for data storage and retrieval.
4. To introduce techniques for testing, debugging, and optimizing mobile applications for performance and usability.

#### **Unit I: Mobile Communication Fundamentals:**

Introduction, issues in mobile communications, Wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, handoffs, channel allocation in cellular systems, CDMA, GPRS, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, Mobile IP, WAP: Architecture, protocol stack, applications.

#### **Unit II: Mobile Applications Development Frameworks and Tools:**

Introduction of Mobile Applications, Types and Benefits of a Mobile App, Mobile Platforms, deployment on Apple iOS with versions, Android, Windows phone application using development platforms: worklight, kendo, Appcon, Xcode, Xpage, Architecture of Mobile Software Applications, N-Tier Client–Server Frameworks and Tools, Java, BREW, Windows CE, WAP, Symbian EPOC, Publishing Frameworks, Mobile User Interface Design, Building Generic User Interfaces, mobile apps in the cloud.

#### **Unit III: Mobile Agents and Peer-to-Peer Architectures for Mobile Applications:**

Mobile Agents for Mobile Computing, Applications of Mobile Agents to Mobile Applications and Implementation Tools, Techniques for Agent-Based Software, Peer-to-Peer Applications for Mobile Computing, security and fault tolerance.

#### **Unit-IV Synchronization and Replication of Mobile Data:**

Taxonomy of Replication and Synchronization, Data Replication and Synchronization for Mobile Applications, SyncML, WebDAV, Mobile Agents, Replication, and Synchronization, Location Information Modeling, Problems with Building Location-Based Applications, Utilizing Location-Based Services with Mobile Applications, UML-Based Development Cycle for Mobile Applications, Architectural Patterns for Mobile Applications.



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#### **Unit-V Testing Mobile Applications:**

Validating the Mobile Use Cases before Development, The Effect of the Dimensions of Mobility on Software Testing, Stress Testing and Scalability Issues, Testing Location-Based Functionality, Android as your mobile platform, installation, Configuring of Eclipse and the Android SDK, Additional SDK Components, application layout and Android app development, Android user interface elements, Android Virtual Device, Connection to Google play.

#### **Reference Books:**

1. Reza b'far, Mobile computing Principles Designing and developing Mobile applications with Uml and xml, Cambridge University press.
2. Jeff Mcwherter, Scott Gowell, Professional Mobile application development, Wrox, John Wiley & Sons, Inc..
3. Richard Rodger, Beginning mobile application Development in the cloud, John Wiley & Sons, Inc.
4. J. Schiller, Mobile Communication, Addison Wesley.

#### **Course Outcome:**

At the end of the course, students should be able to:

1. Design user-friendly and visually appealing mobile applications following best practices in UI/UX design.
2. Write, test, and debug code for mobile applications using appropriate programming languages and frameworks.
3. Apply various testing methodologies to ensure mobile applications are robust, secure, and free of bugs.



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### **Elective-II CSE6053 Intellectual Property Rights**

#### **Course Objectives:**

1. To provide a comprehensive overview of intellectual property rights, including types, importance, and legal frameworks.
2. To explore the implications of IPR in the field of computer science and technology, including Software, Algorithms, and Digital Content.
3. To familiarize students with the national and international legal frameworks governing intellectual property, including copyright, patents, trademarks, and trade secrets.
4. To discuss ethical issues surrounding intellectual property, including plagiarism, fair use, and open-source licensing.

#### **Unit I: Overview of IPR:**

Introduction and Justifications of IPR, Nature of IP, Major forms of IP- Copyright, Patent, Trade Marks Designs, Geographic indication, layout design of Semi conductors, Plant varieties, Concept & Meaning of Intellectual Property. Major international documents relating to the protection of IP - Berne Convention, Paris Convention, TRIPS. The World Intellectual Property Organization (WIPO).

#### **Unit II: Copyright:**

Meaning and historical development of copyright , Subject matter , Ownership of copyright, Term of copyright, Rights of owner, Economic Rights, Moral Rights. Assignment and licence of rights, Infringement of copyright, Exceptions of infringement, Remedies, Civil, Criminal, Administrative, Registration Procedure.

#### **Unit III: Patents:**

Meaning and historical development,. Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Compulsory license, Revocation, Infringement of patents, Exceptions to infringement, Remedies, Patent office and Appellate Board.

#### **Unit IV: Trade Marks, Designs & GI:**

Trade Marks: Functions of marks, Procedure for registration, Rights of holder, Assignment and licensing of marks, Infringement, Trade Marks Registry and Appellate Board.

Designs: Meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

Geographical Indication: Meaning and evolution of GI, Difference between GI and Trade Marks, Registration, Rights, Authorized user.

#### **Unit V: Contemporary Issues & Enforcement of IPR:**

IPR & sustainable development, The Impact of Internet on IPR. IPR Issues in biotechnology, E-



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Commerce and IPR issues, Licensing and enforcing IPR, Case studies in IPR.

#### **Reference Books:**

1. P. Narayanan, Intellectual Property Law, Eastern Law House.
2. Neeraj Pandey and Khushdeep[ Dharni, Intellectual Property Rights, PHI, 2014
3. N.S Gopalakrishnan and T.G. Agitha, Principles of Intellectual Property, Eastern Book Co. Lucknow, 2009.
4. Anand Padmanabhan, Enforcement of Intellectual Property, Lexis Nexis Butterworths, Nagpur, 2012.
5. Managing Intellectual Property The Strategic Imperative, Vinod V. Sople, PHI.
6. Prabuddha Ganguli, “ Intellectual Property Rights” Mcgraw Hill Education, 2016.

#### **Course Outcome:**

At the end of the course, students should be able to:

1. Clearly explain key concepts and types of intellectual property rights and their significance in technology.
2. Analyze and apply national and international IPR laws relevant to software and technology.
3. Demonstrate the ability to apply knowledge of intellectual property rights in real-world scenarios, including filing for patents or trademarks.
4. Discuss the role of intellectual property in fostering innovation and creativity in Technology Development.



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### CSE607P Creativity and Entrepreneurship Development

#### Course Objectives:

1. Understand and use tools for generating entrepreneurial ideas and problem solving.
2. Understand and use tools for the selection of ideas.
3. Understand and gain the skills that are needed to implement ideas in today's society
4. Understand Entrepreneurship's part in process that includes idea generation and implementation.
5. Understand the concept of Entrepreneurship and its place in today's society.

#### Contents:

- The concept of Entrepreneurship, its history and its place in society.
- The concept of Entrepreneurship and its relation to concept of innovation.
- Creative processes for idea generation and problem solving.
- Business plan.
- Role of creativity, innovation and business research.
- Entrepreneurship opportunities in contemporary business environment.

#### Reference Books:

1. Dollinger M.J. "Entrepreneurship strategies and resources", 3rd edition Pearson Education New Delhi.
2. Panda, Shiba Charan "Entrepreneurship development", Anmol publication New Delhi.
3. Richard Blundel & Nigel locket, "Exploring Entrepreneurship: practices & perspectives" Oxford.
4. Charles E. Banford & Garry D. Bruton, "Entrepreneurship: A small business Approach, Mcgrawhill Education.
5. P. Narayana Reddy, "Entrepreneurship: Text and Cases", Cengage Learning
6. Rajeev Roy, "Entrepreneurship" Oxford.

#### Course Outcome:

At the end of the course, students should be able to:

1. Recognize an opportunity for a user group and frame an appropriate design challenge that addresses the need for the user.
2. Practice observation, interview and empathy skills to evolve a thorough understanding of the needs of the user.
3. Share and integrate team leanings.
4. Generate, develop and describe creative ideas that address the design challenge.



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#### CSE609P DotNET Lab

#### Course Objectives:

1. To gain foundational knowledge of the .NET architecture and components.
2. To develop proficiency in C# programming and object-oriented principles.
3. To learn to create Windows and web applications using .NET technologies.
4. To explore data access techniques using ADO.NET and Entity Framework.
5. To understand how to create and consume web services and APIs.

#### Unit I: Introduction to .NET Framework:

- Overview of .NET components and architecture
- CLR, FCL, and BCL
- Differences between .NET Framework, .NET Core, and .NET 5/6
- Setting up the development environment

#### Unit II: Programming with C#:

- Basics of C#: Data types, variables, operators
- Object-oriented programming concepts
- Exception handling and debugging techniques
- Collections and generics

#### Unit III: Windows Application Development:

- Introduction to Windows Forms
- Designing UIs and handling events
- Overview of WPF and XAML
- Multi-threading concepts

#### Unit IV: Web Application Development with ASP.NET:

- ASP.NET architecture overview
- Web Forms: Page lifecycle, controls, and state management
- ASP.NET MVC: Routing, controllers, and views
- Introduction to ASP.NET Core

#### Unit V: Data Access Technologies:

- ADO.NET: Database connections and commands
- Entity Framework: Code First and Database First approaches
- Performing CRUD operations and using LINQ
- **Web Services and APIs:**



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- ❖ Introduction to web services: SOAP vs. REST
- ❖ Building RESTful APIs with ASP.NET Core
- ❖ Implementing authentication and authorization

#### Reference Books:

1. "C# 9.0 in a Nutshell" by Joseph Albahari and Ben Albahari, A comprehensive guide to C# programming.
2. "Pro ASP.NET Core MVC 5" by Adam Freeman, A detailed resource on building web applications using ASP.NET Core.
3. "Entity Framework Core in Action" by Jon P Smith, An in-depth look at data access with Entity Framework Core.
4. "CLR via C#" by Jeffrey Richter, A deeper understanding of the .NET CLR and its workings.
5. "ASP.NET Core 5 for Beginners" by Chris Sainty, A beginner-friendly guide to ASP.NET Core development.

#### Course Outcome:

At the end of the course, students should be able to:

1. Develop and run .NET applications using C#.
2. Design and implement user interfaces in Windows Forms and WPF.
3. Create web applications using ASP.NET and ASP.NET Core.
4. Access and manipulate data using ADO.NET and Entity Framework.
5. Build and secure RESTful APIs.
6. Deploy applications effectively and understand security considerations.