



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

Honors

HONORS COURSES

TRACK1: WEB FRAMEWORK

2-2 Angular JS Framework

3-1 Django Framework

3-2 Dot Net Core

(3-2 Any Course from SWAYAM NPTEL Suggested by BoS in this track.)

4-1 Java Enterprise Framework

TRACK2: NETWORKS

2-2. Introduction to Networks (ITN)

3-1. Switching, Routing, and Wireless Essentials

3-2. Enterprise Networking, Security, and Automation

(3-2 Any Course from SWAYAM NPTEL Suggested by BoS in this track.)

4-1. Wireless Sensor Networks.

TRACK3: SECURITY

1) 2-2. Cyber Security

2) 3-1. Secure Coding

3) 3-2. Vulnerability Assessment & Penetration Testing

4) Privacy and Security in Online Social Media (THROUGH MOOCS)

5) 4-1. Malware Analysis

TRACK4: ARTIFICIAL INTELLIGENCE

1) 2-2. AI for Problem Solving.

2) 3-1. Social Network Analysis

3) 3-2 .Deep Learning for Computer Vision

4) Bio Informatics/ GPU Architecture and Programming (Through MOOCs)

5) 4-1. AI in Health Care



Subject Code	Subject Name	L	T	P	C
	Angular JS Framework	3	0	0	3

Course Objectives:

- To understand model view framework for building applications.
- To create modules for binding the application.
- To understand dependency injection for implementing services.
- To create and establish routes redirects and navigation.
- To validate forms for the submission of data.

Course Outcomes:

1. Understand the fundamentals of Angular JS and its architecture.
2. Apply data binding objects for implementing modules.
3. Implement service and retrieve rest call data.
4. Understand routes and their configuration in angular.
5. Implement form handling with event driven apps.

Unit 1 (8 Hours)

Angular JS – Introduction to Angular JS, Java Script vs Angular, MVC Framework, Component Based Model, **Setting Up the Environment**, Installation of Node and NPM, Angular CLI, Creating and Running Project, **Add Dependencies**, **The Anatomy of an AngularJS app**, **First Application**. **What is a Component, Create and Start Component**.

Learning Outcomes: Student will be able to

- Understand MVC framework for building applications. (L2)
- Understand the installations of Node, NPM and angular. (L2)
- Implement Components using angular dependencies. (L3)

Unit 2 (10 Hours)

Data Binding: Introduction to Data Binding, Types of Binding, Binding Data from Component, Async, Template Interpolation, Looping with ngFor, Condition with ngIf, Passing inputs and variables to Components, ngModel for 2-way binding, ngOnInit, Styling with components, Creating multiple modules. **Combine Forms with Data binding**.

Learning Outcomes: Student will be able to

- Understand data binding for components. (L2)
- Implement looping and decision making for components. (L3)
- Implement components and modules for binding data from the applications. (L3)



Unit 3 (10 Hours)

Dependency Injection: Understanding Dependency Injection(DI), Services, Creating a Service, Service Injection Context, Rest Calls with HttpClient, Building Angular Project.

Learning Outcomes: Student will be able to

- Understand the dependency injection and its types. (L2)
- Implement rest based calls from client using HttpClient. (L3)
- Implement Angular project by building angular services. (L3)

Unit 4 (12 Hours)

Routing & Wrap Up: Introduction to Routing, Angular Project with routing, Creating routes, Route redirects and wild cards, **Route Configuration, Static Data in Route, Nested Routing, Navigation Controlling.**

Learning Outcomes: Student will be able to

- Understand routing with angular. (L2)
- Implement and redirect routes for navigation. (L3)
- Implement wild cards and wrap up for building angular project. (L3)

Unit 5 (8 Hours)

Form Handling : Introduction to Form Handling, **Template Driven**, Form Validation, ng-minlength, ngmaxlength, ng-pattern, ng-required, Submitting Forms, Event Handling with Forms.

Learning Outcomes: Student will be able to

- Understand the working of forms and its validations. (L2)
- Implement event handling methods for form submissions. (L3)

CONTEMPORARY TOPICS:

- **Pipes**
- **HTTP Requests**
- **Authentication**
- **Angular Modules**
- **Animations**

APPLICATIONS:

- Online Web Applications
- Financial, Banking Applications and Gateways etc
- Online and Social Media Applications



TEXT BOOKS:

1. Angular 6 by Example: Get up and running with Angular by building modern realworld web apps, 3rd Edition, by Chandermani Arora.
2. Pro Angular 6, Apress, by Adam Freeman

REFERENCE BOOKS:

1. Angular JS by Green, Orielly
2. Professional AngularJS (WROX), by Valeri Karpov

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	3	2	2	1	3				1		1	1	2	3	3
	3	2	2	1	3				1		1	1	2	3	3
	3	3	3	2	3				1		1	2	3	3	3
	3	3	3	2	3				1		1	2	3	3	3
	2	2	2	2	2				1		1	1	2	2	2
	3	2	2	2	3				1		1	1	2	3	3



Honors

Subject Code	Subject Name	L	T	P	C
	Django Framework	3	0	0	3

Course Objectives:

- Understand the fundamentals of Django Framework.
- Implement Basic Templates for Client-side web pages.
- Implement Django model objects for generating data processing.
- Implement Django Forms for input processing and signals for profiles.
- Implement Serializers and Models using Rest APIs.

Course Outcomes:

1. Understand the environment of Django Web Server Framework. (L2)
2. Implement URL Mappings and Views using Templates. (L3)
3. Implement Django models for processing data from templates. (L3)
4. Implement Django Forms and Signals. (L3)
5. Implement Restfull APIs using Django Rest Framework. (L3)

Unit 1 (10 Hours)

Django Framework: Introduction to Django, Features of Django, Application areas of Django, Flask vs Django, Django Components, Install and Configure Django Components. **The Basics of Dynamic Web Pages.**

List of Programs:

1. Implement Django environment setup and installation in Windows/Linux. (L3)
2. Implement Django Project and app structure with django-admin commands. (L3)
3. Deployment of a Project in the Server. (L2)

Learning Outcomes: Student will be able to

1. Understand the features and applications of Django. (L2)
2. Install Django environment using pip installer. (L3)
3. Understand Components and its structure. (L2)

Unit 2 (8 Hours)

Django Templates: **MVT Development Pattern**, URLs, Views, Static Files, Images, Forms, Application development using Templates, Template Objects, **Template** Tags & Filters, Loops, **Template Loading** and **Template** Inheritance.

List of Programs:

1. Implement template in Django Project to process User Interface. (L3)
2. Implement multiple routes for using Django URLs. (L3)



Honors

3. Implement template inheritance with views and images. (L3)

Learning Outcomes: Student will be able to

1. Understand Django Template objects. (L2)
2. Implement URLs and Views of Django applications. (L3)
3. Implement loops and inheritance in templates. (L3)

Unit 3 (12 Hours)

Django Models: Introduction to Django Models, Admin Panel, **Configuring the Database**, **Interacting with a Database**, Database Relationships: One-One, One-Many, Many-Many, Model Queries, Rendering Data to Templates, Dynamic URLs and Routing, CRUD operations.

List of Programs:

1. Implement database configuration in Django admin with Sqlite3. (L3)
2. Implement CRUD operations using Django models. (L3)
3. Implement database relationships using django models. (L3)
4. Implement data rendering with templates and dynamic routing. (L3)

Learning Outcomes: Student will be able to

1. Understand the Django Models and Admin Panels (L2)
2. Apply relationships between multiple model objects. (L3)
3. Implement routing for navigating URLs. (L3)

Unit 4 (10 Hours)

Dynamic Forms & Signals: **Form Processing**, Inline Form sets, Search Forms, User Registration and **User Authentication**, User Roles & Permissions, User Profiles, Image Upload, Django Signals, Creating Customer Profiles with Django.

List of Programs:

1. Implement user registration and login authentication using django forms. (L3)
2. Implement the roles and permissions for user profile. (L3)
3. Implement Django signal for user profiles. (L3)

Learning Outcomes: Student will be able to

1. Implement dynamic web pages using FormSets (L3)
2. Implement registration and authentication for user profiles (L3)
3. Implement Django signals for creating customer profiles. (L3)

Unit 5 (8 Hours)

Django Rest Framework: Introduction to Django Rest Framework, Features of Rest APIs, Installation of Django Rest Framework, API_view, Response, JsonResponse, Models and Serializers, PATH and urlpatterns, HTTP methods GET, POST, PUT and DELETE methods



List of Programs:

1. Install and configure Django Rest framework package. (L3)
2. Implement django rest end points using API_view and JsonResponse. (L3)
3. Implement Django rest end points using Serializers and Models. (L3)
4. Implement HTTP rest end points with all CRUD operations. (L3)

Learning Outcomes: Student will be able to

1. Understand Django Rest framework and its packages. (L2)
2. Implement Models and Serializers for rest api. (L3)
3. Implement GET, POST, PUT and DELETE calls using rest framework package. (L3)

CONTEMPORARY TOPICS:

- Building a Pages Application.
- Building a Message Board Application.
- Building a Blog Application.
- Building a Password Change and Reset.

APPLICATIONS:

- Building enterprise level applications.
- Building Financial, banking applications, gateways etc.
- Online and Social media applications.

TEXT BOOKS:

- Django RESTful Web Services: The easiest way to build Python RESTful APIs by Gaston C Hillar, Packt
- Building Website with Django, 1 Edition, by Awanish Ranjan

REFERENCE BOOKS:

- Light Weight Django by O'Reilly Media, by Julia Elman and Mark Lavin
- Python Web Development with Django, by O'Reilly – Paul Bissex and Jeff Forcier

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	2	1	1	1	2				1		1	1	2	3	3
	1	3	2	1	3				1		1	1	2	3	3
	2	3	2	1	3				1		2	2	2	3	3
	2	3	2	1	3				1		2	2	2	3	3
	2	3	3	1	3				1		2	2	2	3	3
	2	3	2	1	3				1		1	1	2	3	3



Subject Code	Subject Name	L	T	P	C
	.NET Core	3	0	0	3

Course Objectives:

1. Understand Visual Studio Code and .NET Core development tools for an efficient coding environment.
2. Apply OOPS principles effectively within .NET Core applications.
3. Gain practical expertise in manipulating data using collections, LINQ, and generics.
4. Design and deploy secure and responsive web applications using ASP.NET Core and front-end frameworks.
5. Implement secure and efficient web applications with effective state management and persistence strategies in .NET Core.

Course Outcomes:

- Master the basics of C# syntax and structure within the .NET Core framework, ensuring organized and standard-compliant code.
- Apply object-oriented principles and asynchronous programming in .NET Core, focusing on efficient and scalable solutions.
- Utilize collections, LINQ, and generics for data manipulation in .NET Core, adopting a systematic approach to coding and debugging.
- Design dynamic, responsive web applications using ASP.NET Core and front-end frameworks, prioritizing secure and user-friendly interfaces.
- Build secure web applications with effective state management and database integration, committing to high-quality coding practices.

.NET Core Syllabus

Unit I: The .NET Core Technology & Introduction to C#: Fundamentals of the .NET Core framework and its architecture, Overview of .NET Core vs .NET Framework, Common Type System (CTS), Common Language Specification (CLS), Base Class Library (BCL) and Common Language Runtime (CLR), C# features and basics: Program structure, data types, operators, decision-making statements, loops, arrays, and strings

Learning Outcomes:

- Understand .NET Core program structure (L2)
- Understand decision-making and iterations in C# (L2)

Unit II: OOP Concepts and Asynchronous Programming: Class, object, inheritance, abstract classes, interfaces, polymorphism, exception handling, Collections in C# and LINQ,

Learning Outcomes:

- Understand object-oriented concepts with real-time applications (L2)



Honors

- Implement error and exception handling strategies (L3)
- Utilize asynchronous programming for better performance (L3)

Unit III: ASP.NET Core Web Development: Overview of ASP.NET Core framework, ASP.NET Core page lifecycle, Razor Pages, MVC pattern. Introduction to Tag Helpers, HTML Helpers, Validation, Integrating modern front-end frameworks (React or Angular or Vue) with ASP.NET Core

Learning Outcomes:

- Implement the Model-View-Controller architecture for creating web applications (L4)
- Develop responsive web applications using modern front-end frameworks (L3)
- Implement ASP.NET Core lifecycle through tag helpers and navigation (L4)

Unit IV: ASP.NET Core Session and State Management: Overview of session state, its importance, and the challenges of maintaining user state in web applications, Client-side and server-side session management

Learning Outcomes:

- Understand and identify the challenges associated with maintaining user state (L2)
- Compare client-side and server-side session management techniques in ASP.NET Core (L4)
- Implement both client-side and server-side techniques (L3)

Unit V: Working with Databases in .NET Core (Entity Framework Core): Overview of Entity Framework Core, Connected and Disconnected Architecture, Database connectivity, Integration with cloud databases and services (e.g., Azure SQL, AWS RDS)

Learning Outcomes:

- Describe the components and architecture of Entity Framework Core, including connected and disconnected models (L2)
- Demonstrate database connectivity in Entity Framework Core applications (L3)
- Analyze connected and disconnected architectures in Entity Framework Core and their impact on application performance (L4)
- Integrate .NET Core applications with cloud databases and services (L3)

Text Books

1. Pro ASP.NET Core 3, by Adam Freeman, Apress, 2019, 1st Edition



Honors

2. C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development, by Mark J. Price, Packt Publishing, 2019, 4th Edition
3. Entity Framework Core in Action, by Jon P Smith, Manning Publications, 2018, 1st Edition

Reference Books

1. ASP.NET Core in Action by Andrew Lock, Manning Publications, 2018, 1st Edition
2. Programming ASP.NET Core, by Dino Esposito, Microsoft Press, 2018, 1st Edition
3. Pro C# 8 with .NET Core: Foundational Principles and Practices in Programming, by Andrew Troelsen, Philip Japikse, Apress, 2019, 9th Edition

COURSE OUTCOMES VS POs MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P O1 0	PO 11	PO 12	PS O1	PS O2	PS O3
	3	3	2	1	2				2	2		1	3	1	2
	3	3	2	1	2				2	2		1	3	1	2
	3	3	2	2	2				2	2		1	3	1	2
	3	3	2	2	2				2	2		1	3	1	2
	3	3	2	2	2				2	2		1	3	1	2
	3	3	2	2	2				2	2		1	3	1	2



Honors

Subject Code	Subject Name	L	T	P	C
	Java Enterprise Framework	3	0	0	3

Course Objectives:

- Implement CRUD operations using Java APIs
- Understand servers id environment using Servlets.
- Creates riverside web pages using Java Server Pages.
- Understand Object relational mappingusingHibernate.
- Write business logics using Spring MVC and AO Programming.

CourseOutcomes:

1. Implement database operations from front end javaAPIs.
2. WriteserversideprogramsforcontrollingHTTPrequests.
3. CreatedynamicserversidewebpagesusingJSPTags.
4. CreateHibernateobjectsformappingobjectsanddatabaserelations.
5. Createmodelbasedjavaobjectsforcontrollingserverbasedapplications.

Unit I:

Java Database Connectivity - JDBC Overview & Architecture, JDBC Driver Types, Types of Result Set, Statement, Prepared Statement, Callable Statement, Executing DDL and DML Commands.

Learning Outcomes: Student will be ableto

- Understand JDBC driversforconnecting Database.(L2)
- Writecomplexqueries forretrievingdatafromdatabase.(L4)
- Createcallablestatementsforexecutingdatabaseprocedures.(L4)

Unit-II:

Servlets: Web Server, Container, Servlet Overview, Life cycle of Servlet, Handling WebForm Data in Servlets., Dynamically including Content in Servlets, Handling Exceptions inWeb Applications, Reading and Setting Cookies, Session Tracking, Servlet Filters, AccessingDatabases.

Learning Outcomes:Studentwill beableto

- UnderstandWebcontainerforstoringserversideprograms(L2).
- ImplementRequestand responsehandlersusingHttplibraries.(L4).
- CreateServletforretrievingdata fromdatabases.(L4)

UnitIII:

JavaServerPages:OverviewofJSP,JSPArchitecture&lifecycle,ComponentsofJavaServerPages, ImplicitObjects&StandardJSPTags,ScopeofJSPobjects,Dynamicallyincluding content in JSPs, Handling Form data in JSPs, Accessing Databases, Tag Libraries.**LearningOutcomes:** Student willbe able to

- UnderstandthestructureofJSP andits LifeCycle(L2)
- CreatedynamicwebpagesusingJSPTaglibraries.L4)
- ImplementJSP scopeforswitchingbetweenpages.(L4)

Unit-IV:

HIBERNATE: Introduction to Hibernate, Hibernate Architecture, Understanding ObjectPersistence, Hibernate Basics, Types of Relations, Querying Persistent Objects, HibernateQueryLanguage (HQL)

Learning Outcomes:Studentwill beableto

- UnderstandHibernateObjectrelationalmapping(L2)



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Honors

- CreateHibernate objectsforimplementingrelations betweentables.(L4)
- ImplementHibernate queriesforpersistingjavaobjects. (L4)



(Applicable from the academic year 2024-25 and onwards)

Honors

UnitV:

Spring Framework: Spring Architecture and Container, Spring Setup in Eclipse, SpringBean Factory, Bean factory VS Application Context, Dependency Injection (DI), Types of DI, BeanAuto wiring, Collections with Spring, BeanScopes, Event Handling in Spring, Introduction to Aspect Oriented Programming (AOP).

Learning Outcomes: Student will be able to

- Understand architecture of spring container. (L2)
- Implement dependency injection for setting data for beans. (L4)
- Create spring beans for handling events and aspects. (L4)

Applications:

- Building enterprise level applications like IRCTC.
- Building Financial, banking applications, gateway setc
- Online and Social media applications

Text Books:

1. JDBC, Servlets and JSP Black Book, by Kogent Solutions Inc. Santosh Kumar K, Dreamtech Publications. 2nd Edition, 2016.
2. Java Servlet & JSP Cookbook by Bruce W. Perry Publisher(s): O'Reilly Media, 2004
3. Spring and Hibernate-2ed, by K. Santosh Kumar, McGraw-Hill Education

Reference Books:

1. Spring in Action, 4ed (Manning), by Craig Walls (Author), Dreamtech.
2. Java Persistence with Hibernate: Revised of Hibernate in Action, Dreamtech, by Christian Bauer.



Year & Semester II YEAR II SEM

Course Code	Subject Name	L	T	P	C
	Introduction to Networks (ITN)	3	0	0	3

Course Objectives

- Understand the core components that make up a network, such as devices, protocols, and media.
- Learn how to work with IPv4 addresses, understand subnet masks, and perform subnet calculations to divide networks into smaller logical segments.
- Identify the different cable types and connectors used to connect devices in a local area network.
- Gain hands-on experience setting up basic network connections and performing troubleshooting checks on different operating systems (Windows, Linux, macOS, Android, and iOS)
- Learn about network switches and their role in connecting devices within a network segment and forwarding data packets.
- Learn systematic approaches to identify and resolve network issues.

Course Outcomes:

- Understand Key network terminology like bandwidth, throughput, and various network types
- Apply IPv4 addressing and subnet mask concepts to identify network and host information
- Identify and differentiate between various cables and connectors used in local area networks.
- Understand with the fundamental knowledge and hands-on skills necessary to identify and troubleshoot network connectivity problems.
- Implement effective troubleshooting strategies for resolving network connectivity issues.

Unit-I – Standards and Concepts (10 Hours)

Identify the fundamental conceptual building blocks of networks - Differentiate between bandwidth and throughput - Differentiate between LAN, WAN, MAN, CAN, PAN, and WLAN - Compare and contrast cloud and on-premises applications and services - Describe common network applications and protocols.

Learning Outcomes:

- Identify and explain the fundamental concepts that form the foundation of computer networks. This includes understanding how devices communicate and share resources over a network.
- Differentiate between various network types based on their scope and functionality over PAN, LAN, MAN, WAN.
- Identify and explain the role of fundamental network protocols in facilitating communication between devices.



Unit – II: Addressing and Subnet Formats (10 Hours)

Compare and contrast private addresses and public addresses - Identify IPv4 addresses and subnet formats - Identify IPv6 addresses and prefix formats.

Learning Outcomes:

- Understand the purpose and limitations of each type of IP address and how they are used in network configurations
- Perform basic calculations to determine the network address, subnet ID, broadcast address, and usable host range within a subnet based on the provided IP address and subnet mask
- Understand how prefix lengths are used in IPv6 to specify the network portion of the address

Unit – III: Endpoints and Media Types (10 Hours)

Identify cables and connectors commonly used in local area network - Differentiate between Wi-Fi, cellular, and wired network technologies - Describe endpoint devices - Demonstrate how to set up and check network connectivity on Windows, Linux, Mac OS, Android, and Apple iOS.

Learning Outcomes:

- Identify and differentiate between common cables and connectors used in local area networks (LANs)
- Understand the characteristics and functionalities of these cables and connectors, including their suitability for different network applications based on factors like speed, distance, and cost
- Demonstrate the basic steps involved in setting up network connectivity on various operating systems

Unit – IV: Infrastructure (10 Hours)

Identify the status lights on a Cisco device when given instruction by an engineer - Use a network diagram provided by an engineer to attach the appropriate cables - . Identify the various ports on network devices - Explain basic routing concepts - Explain basic switching concepts.

Learning Outcomes:

- Analyze and apply network knowledge to connect devices based on a provided network diagram
- Identify and differentiate between the various ports commonly found on network devices (e.g., console, Ethernet, serial, USB) and understand their typical uses.
- The fundamental concepts of network switching



Year & Semester III – I

Course Code	Subject Name	L	T	P	C
	Switching, Routing, and Wireless Essentials	3	0	0	3

Course Objectives

- ❖ Understand the concept of Layer 2 switching and how it operates within the OSI model, Configure basic VLANs on a network switch
- ❖ Understanding and configuring redundancy mechanisms in networks, specifically using Spanning Tree Protocol (STP) and EtherChannel technology.
- ❖ Student able to configure basic DHCPv4 servers and explain the functionalities of SLAAC, DHCPv6, and FHRPs in promoting network availability and reliability
- ❖ Students able to configure basic security features on switches and set up secure WLANs
- ❖ Students will gain a solid foundation in routing principles and be able to configure basic static routes on network routers

Course Outcomes:

- ❖ Configuring basic VLANs on a network switch using appropriate methods (port-based, MAC-based, etc.)
- ❖ Understanding the concepts and functionalities of Spanning Tree Protocol (STP) in preventing loops on switched networks
- ❖ Configuring a basic DHCPv4 server to automatically assign IP addresses to network devices
- ❖ Applying security measures to mitigate network vulnerabilities and protect sensitive data
- ❖ Applying static routes to connect different networks and ensure proper traffic flow

Unit-I – (8 Hours)

Switching Concepts and VLANS : Basic Device Configuration - Switching Concepts – VLANs - Inter-VLAN Routing

Learning Outcomes:

- Identify the process of frame forwarding based on MAC addresses
- Verify VLAN configuration and membership using switch commands
- Comprehend the need for inter-VLAN routing to enable communication across VLANs

Unit – II: (10 Hours)

Redundant Networks : STP - Etherchannel

Learning Outcomes:



Honors

- Explain the purpose and functionalities of Spanning Tree Protocol(STP)
- Configure basic EtherChannel
- Compare and contrast STP with other loop prevention technologies

Unit – III: (12 Hours)

Available and Reliable Networks : DHCPv4 - SLAAC and DHCPv6 Concepts - FHRP Concepts

Learning Outcomes:

- Verify DHCP server configuration and functionality to ensure successful IP address assignment to clients
- Compare and contrast DHCPv4 and DHCPv6 functionalities for IP address management.
- Understand the functionalities of FHRP as a high availability routing protocol.

Unit – IV: (8 Hours)

L2 Security and WLANs : LAN Security Concepts - Switch Security Configuration - WLAN Concepts - WLAN Configuration

Learning Outcomes:

- Understand the importance of network segmentation
- Configure basic security features on network switches
- Analyze the challenges associated with wireless security

Unit – V: (10 Hours)

Routing Concepts and Configuration: Routing Concepts - IP Static Routing - Troubleshoot Static and Default Routes

Learning Outcomes:

- Understand the concept of routing tables and how they direct network traffic
- Configure basic static routes for specific destinations or networks.
- Understand the role of the default route and troubleshoot issues related to missing or incorrect default routes

Contemporary Topics need to mention (Compulsory)

Text Books:

Switching, Routing, and Wireless Essentials Companion Guide, Cisco Networking Academy

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Honors

Published by: Cisco Press Hoboken, New Jersey.

ISBN-13: 978-0-13-672935-8 ISBN-10: 0-13-672935-5

References Books:

CCNA : Cisco Certified Network Associate study guide / Todd Lammle. — 7th ed. Wiley Publishing, Inc.

ISBN 978-0-470-90107-6



Year & Semester : III - II

Course Code	Subject Name	L	T	P	C
	Enterprise Networking, Security, and Automation	3	0	0	3

Course Objectives

- Configure a single-area OSPFv2 network using a network simulator or real equipment.
- Understand the principles of Network Address Translation (NAT) for IPv4 and its role in network security and addressing.
- Analyze different VPN technologies like PPTP, L2TP/IPsec, and OpenVPN
- Apply network troubleshooting methodologies to identify and resolve common network issues.
- Understand the principles of network automation and its role in automating network configuration and management tasks.

Course Outcomes:

- Apply the different OSPFv2 components like areas, routers, neighbors, and LSAs
- Understand the fundamental concepts of network security, including threats, vulnerabilities, and security controls.
- Apply the various technologies used to connect geographically dispersed locations in a WAN
- Apply network design principles to optimize WAN performance, scalability, and security
- Apply the knowledge to design, implement, and manage automated network solutions.

Unit-I – (09 Hours)

OSPF Concepts and Configuration: Single-Area OSPFv2 Concepts - Single-Area OSPFv2 Configuration

Learning Outcomes:

- Analyze how link state advertisements and Dijkstra's algorithm work within OSPF.
- Configure a single OSPFv2 network for basic routing functionality.
- Verify OSPF routing table entries and troubleshoot basic configuration issues.

Unit – II: (09 Hours)



(Applicable from the academic year 2024-25 and onwards)

Honors

Network Security: Network Security Concepts - ACLs Concepts - ACLS for IPv4 Configuration - NAT for IPv4

Learning Outcomes:

- Configure basic IPv4 ACLs to control traffic flow through the network.
- Understand the benefits and applications of Network Address Translation (NAT) for IPv4 networks.
- Configure static NAT to translate private network addresses for internet access.

Unit – III: (10 Hours)

WAN: WAN Concepts - VPN and IPsec Concepts

Learning Outcomes:

- Understand the principles of IPsec (Internet Protocol Security) used to secure VPN tunnels.
- Analyze the functionalities of different VPN technologies (e.g., PPTP, L2TP/IPsec, OpenVPN)
- Configure basic VPN tunnels for secure remote network access

Unit – IV: (10 Hours)

Optimize, Monitor, and Troubleshoot Networks: QoS Concepts - Network Management - Network Design - Network Troubleshooting

Learning Outcomes:

- Implement basic QoS mechanisms like prioritization and shaping to optimize network traffic flow.
- Utilize network management tools and techniques to monitor network health and performance.
- Analyze network design principles and their impact on network efficiency and scalability.

Unit – V: (10 Hours)

Network Virtualization and Automation: Network Virtualization - Network Automation

Learning Outcomes:

- Understand the principles and benefits of network automation for managing network tasks efficiently.
- Identify common network automation tools and platforms
- Analyze the advantages and challenges of implementing network automation solutions.

Contemporary Topics need to mention (Compulsory)

Software-Defined Networking (SDN) , IPv6 Security, Cloud-based VPNs, Cloud-based Network Architectures



Text Books:

Enterprise Networking, Security, and Automation Companion Guide (CCNAv7) Cisco Networking Academy ISBN-13: 978-0-13-663432-4

ISBN-10: 0-13-663432-X

References Books:

A Practical Introduction To Enterprise Network And Security Management. [2 ed.] CRC Press.

ISBN: 978-0-367-64251-8 (hbk), ISBN: 978-1-032-04802-4 (pbk), ISBN: 978-1-003-12369-9 (ebk)

Weblinks

https://ptgmedia.pearsoncmg.com/images/9780136634324/samplepages/9780136634324_Sample.pdf

<https://www.oreilly.com/library/view/enterprise-networking-security/9780136634171/>

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1):

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
HC32.1	3	3	1	2	1								1	2	
HC32.2	3	3	1	2	1								1	2	
HC32.3	3	3	1	2	1								1	2	
HC32.4	3	3	1	2	1								1	2	
HC32.5	3	3	1	2	1								1	2	



Year & Semester: IV - I

Course Code	Subject Name	L	T	P	C
	Wireless Sensor Networks	3	0	0	3

Course Objectives

- Define WSN and Dynamic modulation scaling.
- Explore working of the MAC protocols
- Demonstrate Routing and Data gathering protocols
- Illustrate working of Embedded OS.
- Explore a wide range of WSN applications in different sectors

Course Outcomes:

- Understand the basics, characteristics and challenges of Wireless Sensor Network
- Apply the knowledge to identify appropriate physical and MAC layer protocol
- Apply the knowledge to identify the suitable routing algorithm based on the network and user requirement
- Analysis of OS used in Wireless Sensor Networks and build basic modules
- Analyze specific WSN application using a case study approach

Unit-I – CHARACTERISTICS OF WSN (8 Hours)

Characteristic requirements for WSN – Challenges for WSNs – WSN vs Adhoc Networks – Sensor node architecture – Commercially available sensor nodes – Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

Learning Outcomes:

- Identify and explain the key characteristics
- Differentiate between Wireless Sensor Networks (WSNs) and Ad-hoc Networks
- Understand the role and functionalities of each component within the sensor node.

Unit – II: MEDIUM ACCESS CONTROL PROTOCOLS (10 Hours)



Honors

Fundamentals of MAC protocols – Low duty cycle protocols and wakeup concepts – Contention based protocols – Schedule-based protocols – SMAC – BMAC – Traffic adaptive medium access protocol (TRAMA) – The IEEE 802.15.4 MAC protocol.

Learning Outcomes:

- Describe the main challenges of MAC protocols in wireless sensor networks (WSNs)
- Understand the concept of low duty cycle operation and its importance
- Evaluate the performance characteristics of contention-based protocols, including throughput, latency, and energy efficiency.

Unit – III: ROUTING AND DATA GATHERING PROTOCOLS (10 Hours)

Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing – Gradient-based routing – Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing – LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP – Data aggregation - data aggregation operations – Aggregate Queries in Sensor Networks – Aggregation Techniques – TAG, Tiny DB.

Learning Outcomes:

- Identify the key routing challenges in WSNs compared to traditional wired networks
- Analyze popular hierarchical routing protocols
- Analyze location-based routing protocols, Real-Time Routing Protocols

Unit – IV: EMBEDDED OPERATING SYSTEMS (10 Hours)

Operating Systems for Wireless Sensor Networks – Introduction – Operating System Design Issues – Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS – OSPM – EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules – Configurations and Wiring – Generic Components – Programming in Tiny OS using NesC, Emulator TOSSIM.

Learning Outcomes:

- Understand the role and importance of operating systems in managing the resources and functionalities of Wireless Sensor Networks.
- Compare and contrast prominent WSN operating systems like TinyOS, Mate, MagnetOS, MANTIS, OSPM, EYES OS, SenOS, EMERALDS, and PicOS.
- Understand the strengths and weaknesses of each operating system in terms of features, resource management, and suitability.



Unit – V: APPLICATIONS OF WSN (10 Hours)

WSN Applications – Home Control – Building Automation – Industrial Automation – Medical Applications – Reconfigurable Sensor Networks – Highway Monitoring – Military Applications – Civil and Environmental Engineering Applications – Wildfire Instrumentation – Habitat Monitoring – Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard – Target detection and tracking – Contour/edge detection – Field sampling

Learning Outcomes:

- Identify the key characteristics of Wireless Sensor Networks (WSNs) that make them suitable for various applications.
- Analyze a specific WSN application through a Case Study
- Develop a basic understanding of common data analysis techniques used with WSN data

Contemporary Topics need to mention (Compulsory)

Text Books:

1. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem S. Ohraby, Daniel Minoli and Taieb Znati, John Wiley & Sons, 2007
2. Protocols and Architectures for Wireless Sensor Network, Holger Karl and Andreas Willig John Wiley & Sons, Ltd, 2005

References Books:

Title of the Reference book, Author Name, publisher Name, year of publication, Edition

1. A survey of routing protocols in wireless sensor networks, K. Akkaya and M. Younis, Elsevier
2. Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349
3. TinyOS Programming, Philip Levis
4. Wireless Sensor Network Designs, Anna Hać, John Wiley & Sons Ltd

Weblinks

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1):

CO	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	1	3								2		
CO2	3	2	2	1	3								2		
CO3	3	2	2	1	3								2		



Honors

CO4	3	3	2	1	3								2		
CO5	3	3	2	1	3								2		

II Year & II Semester

Course Code	Subject Name	L	T	P	C
	CYBER SECURITY	3	0	0	3

Course Objectives:

1. Understand the fundamental concepts and principles of cybersecurity.
2. Understand Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
3. To Provide the importance of Cyber Security and the integral role of Cyber Security professionals.
4. Recognize the importance of cybersecurity in protecting digital assets and information.
5. Analyze real-world cyber-attack scenarios and case studies.

Course Outcomes:

1. Understand Cyber Security architecture principles
2. Analyze the System and application security threats and vulnerabilities
3. Estimate operational cyber security strategies and policies.
4. Apply security model to handle mobile, wireless devices and related security issues.
5. Analyze the functionality of Security Technologies and Controls in Cybersecurity

UNIT - I: (8 Hours)

Introduction to Cyber Security: Need for Cyber security - History of Cyber security - Defining Cyberspace and Cyber security, scope of Cyber security, Importance of Cyber security in the modern world, Evolution of cyber threats, Importance of Cyber security in the digital age.

Foundations of Cyber Security: Cyber Security principles, threat models, and cyber laws. Confidentiality, integrity, and availability (CIA) Triad– Cyber security Framework, Security principles and concepts, Risk management.to better understand the dynamics of Cyber Security.

Learning Outcomes: student will be able to

- Outline the Importance of Cyber security. (L2)



(Applicable from the academic year 2024-25 and onwards)

Honors

- Understand the Security architecture principles and concepts. (L2)
- Understand the Design of Cyber security Framework. (L2)

UNIT-II: (10 Hours)

Common Threats and Attack Vectors: Introduction, Proxy Servers and Anonymizers, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Social Engineering attacks: Introduction, Phishing, spear phishing, pretexting, Identity Theft (ID Theft).

Learning Outcomes: student will be able to

- Understand about the Cyber security Threats and Attacks. (L2)
- Summarize the various types of application security vulnerabilities(L2)
- Analyze the System and application security threats and vulnerabilities(L4)

UNIT-III: (12 Hours)

Introduction to Cyber Crime, law and Investigation: Introduction to Cybercrime, Definition and scope of cybercrime, Categories of cybercrimes, Impact of cybercrime, Cybercrime and Information Security, classifications of cybercrimes, Cybercrime: The Legal Perspectives, cybercrime and the Indian IT Act 2000, a Global perspective on Cybercrimes.

Cyber laws: Introduction to Cyber Laws, Need for Cyber laws The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards.

Learning Outcomes: student will be able to

- Extend The Categories of cybercrimes and Impact of cybercrime(L2)
- Understand about the Need for Cyber laws and Cybercrime Scenario in India(L2)
- Estimate operational cyber security strategies and policies(L5)
- Develop an understanding of cybercrimes and various legal perspectives involved(L3)

UNIT-IV: (10 Hours)

Cybercrime-Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Authentication Service Security, Attacks on Mobile/Cell Phones.

Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Learning Outcomes: student will be able to

- Understand Various devices and related security issues (L2)
- Develop a security model to handle Policies and Measures in Computing era(L3)
- Develop a security model to handle mobile, wireless devices and related security issues of an organization (L3)

UNIT-V: (8 Hours)



Honors

Security Technologies and Controls in Cybersecurity: Access control mechanisms, Encryption, Firewalls, intrusion detection systems (IDS), intrusion prevention systems (IPS), Network Security, Security Information and Event Management (SIEM), functionality of cyber security tools.

Legal and Ethical Aspects of Cyber Security: Laws and regulations governing cyber security, Ethical considerations in cyber security practices, Privacy issues.

Learning Outcomes: student will be able to

- Analyze the functionality of Security Technologies and Controls in Cybersecurity(L4)
- Outline the Ethical considerations in cyber security practices(L2)
- Understand the functionality of cyber security tools(L2)

Application:

- Web Firewall
- Antivirus and Antimalware
- Bots
- Threat management systems
- Network Security Surveillance

Contemporary Topics

Critical infrastructure security, Endpoint security, Application security, Cloud security, Diverse Attack Vectors, Supply Chain Attacks.

Text Books:

1. Computer Security: Principles and Practice, Third Edition, William Stallings, Lawrie Brown, Pearson Education, 2014.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, 1st Edition Publication Wiley, 2011.
3. William Stallings, Effective Cybersecurity: A Guide to Using Best Practices and Standards, 1st edition, 2019.
4. Mark Rhodes, Ousley, Information Security, 1st Edition, MGH, 2013.

Reference Books:

1. Principles of Information Security, Michael E. Whitman and Herbert J. Mattord, Cengage Learning.
2. Charles J. Brooks, Christopher Grow, Philip A. Craig, Donald Short, Cybersecurity Essentials, Wiley Publisher, 2018.
3. Yuri Diogenes, Erdal Ozkaya, Cyber security - Attack and Defense Strategies, Packt Publishers, 2018.

Weblinks:

1. <https://www.cybrary.it/course/entry-level-cybersecurity-training>
2. <https://www.professormesser.com/security-plus/sy0-601/sy0-601-video/sy0-601-comptia-security-plus-course/>
3. <https://www.cto.int/strategic-goals/cybersecurity/web-links/>

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1):

SNO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	3	2	1	-	-	-	-	-	-	-	-	1	-	-	1
	3	3	2	2	-	-	-	-	-	-	-	1	2	-	1
	3	2	2	-	-	-	-	-	-	-	-	2	2	-	-
	3	2	1	1	2	-	-	-	-	1	-	1	-	-	1
	3	2	2	2	2	-	-	-	-	1	-	1	1	2	-
	3	2	2	2	2	-	-	-	-	1	-	1	2	2	1

* For Entire Course, PO & PSO Mapping

Subject Code	Subject Name	L	T	P	C
	Secure Coding	3	0	0	3

Course Objectives:

1. To understand the security development process.
2. Knowledge of outline of the techniques for developing a secure application.
3. To handling dynamic memory management effectively.
4. Knowledge on stored procedures and XSS attacks.
5. Acquire knowledge on software architecture and design.

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

1. Analyze secure systems and various security principles.
2. Understand the development of process of software leads to secure coding practices
3. Apply Secure programs and various risk in the dynamic memory management.
4. Understand XSS related attacks and remedies
5. Understand various software architecture models.

UNIT-I:

Introduction-Need for secure systems, Proactive security development process, Security principles to live by and threat modeling.

Learning Outcomes: student will be able to

- Understand the need of secure system (L2).
- Analyze security development process(L4).
- Analyze various threats in secure systems (L4).

UNIT-II:

Secure Coding in C-Character strings- String manipulation errors, String Vulnerabilities and exploits Mitigation strategies for strings, Pointers, Mitigation strategies in pointer based vulnerabilities Buffer Overflow based vulnerabilities.



Honors

Learning Outcomes: student will be able to

- Describe the string manipulation errors (L2).
- Analyze the string buffer overflow Vulnerabilities (L4).
- Analyze mitigation strategies for strings (L4).

UNIT–III:

Secure Coding in C++ and Java-Dynamic memory management, Common errors in dynamic memory management, Memory managers, Double –free vulnerabilities, Integer security, Mitigation strategies.

Learning Outcomes: student will be able to

- Analyze errors in dynamic memory management (L4).
- Analyze double free vulnerabilities (L4).
- Apply integer security to various applications (3).

UNIT–IV:

Database and Web Specific Input Issues-Quoting the Input, Use of stored procedures, Building SQL statements securely, XSS related attacks and remedies.

Learning Outcomes: student will be able to

- Understand the stored procedures (L2).
- Implement SQL statements related to security (L5).
- Analyze XSS attacks and remedies (L4).

UNIT–V:

Software Security Engineering-Requirements engineering for secure software: Misuse and abuse cases, SQUARE process model Software security practices and knowledge for architecture and design.

Learning Outcomes: student will be able to

- Describe Misuse and abuse cases in requirements engineering (L2).
- Understand software security practices (L2).
- Understand software architecture and design (L2).

Text Book:

1. Michael Howard, David LeBlanc, “Writing Secure Code”, Microsoft Press, 2nd Edition, 2003.

Reference Books:

1. Robert C. Seacord, “Secure Coding in C and C++”, Pearson Education, 2nd edition, 2013.
2. Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, “Software Security Engineering: A guide for Project Managers”, Addison-Wesley Professional, 2008.

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1):

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2										2	2	2	2



Honors

CO2	3	2	2		1						2	2	2	2
CO3	3	2	2		1						2	2	2	2
CO4	3	2	2		1						2	2	2	2
CO5	3	2			1						2	1	2	2
CO.*	3	2	2		1						2	2	2	2

** For Entire Course, PO & PSO Mapping*

Subject Code	Subject Name	L	T	P	C
	Vulnerability Assessment & Penetration	3	0	0	3

Course Objectives:

1. To identify penetration testing process.
2. To identify the various information gathering and scanning procedures of security systems.
3. To identify various system hacking procedures.
4. To understand the impact of hacking in real time machines.
5. To understand the impact of hacking in wireless networks.

Course Outcomes:

1. Understand Penetration testing process.
2. Understand information gathering methodologies.
3. Analyze various Vulnerabilities assessments.
4. Apply System Hacking Techniques in real time applications.
5. Understand Bypassing WLAN Authentication

UNIT-I: Introduction: Penetration Testing phases/Testing Process, types and Techniques, Blue/Red Teaming, Strategies of Testing, Non Disclosure Agreement Checklist, Phases of hacking, Open-source/proprietary Pentest Methodologies.

Learning outcomes: Student should be able to

1. Understand penetration testing phases. (L2)
2. Understand penetration testing types and strategies. (L2)
3. Understand hacking phases. (L2)

UNIT –II: Information Gathering and Scanning : Information gathering methodologies- Foot printing, Competitive Intelligence- DNS Enumerations- Social Engineering attacks, Port Scanning- Network Scanning- Vulnerability Scanning- NMAP scanning tool- OS Fingerprinting- Enumeration.

Learning outcomes: Student should be able to

1. Understand various information gathering methodologies. (L2)
2. Analyze various social engineering attacks. (L4)
3. Analyze Vulnerability Scanning approach. (L4)
4. Analyze operating system based Vulnerabilities. (L4)



Honors

UNIT-III: System Hacking: Password cracking techniques- Key loggers- Escalating privileges- Hiding Files, Double Encoding, Steganography technologies and its Countermeasures. Active and passive sniffing- ARP Poisoning, MAC Flooding- SQL Injection - Error- based, Union-based, Time-based, Blind SQL, Out-of-band, Injection Prevention Techniques.

Learning outcomes: Student should be able to

1. Understand various password cracking techniques. (L2)
2. Analyze various double encoding algorithms. (L4)
3. Analyze various security attacks. (L4)

UNIT IV: Advanced System Hacking: Broken Authentication, Sensitive Data Exposure, XML External Entities, Broken Access Code, XSS - Stored, Reflected, DOM Based.

Learning outcomes: Student should be able to

1. Analyze broken authentication techniques. (L4)
2. Analyze various XML entities. (L4)
3. Develop XML scripts for hacking . (L5)

UNIT V: Wireless Pentest: Wi-Fi Authentication Modes, Bypassing WLAN Authentication, Types of Wireless Encryption, WLAN Encryption Flaws, AP Attack, Attacks on the WLAN Infrastructure, DoS-Layer1, Layer2, Layer 3, DDoS Attack, Client Disassociation, Wireless Hacking Methodology, Wireless Traffic Analysis.

Learning outcomes: Student should be able to

1. Understand bypassing authentication in WLAN. (L2)
2. Analyze DDoS attacks. (L4)
3. Understand how clients are disassociated. (L2)
4. Analyze data patterns in wireless network. (L4)

Textbooks:

Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver , June 2016
PacktPublishing

Reference Books:

- Mastering Modern Web Penetration Testing By Prakhar Prasad,October 2016 PacktPublishing.
 - SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication
- COURSE OUTCOMES VS POs MAPPING(DETAILED; HIGH: 3;MEDIUM:2;LOW:1):**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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Honors

CO1	3	2	2			2					2	2	2	2	2
CO2	3	2	2			2					2	2	2	2	2
CO3	3	2				2					2	2	2	2	2
CO4	3	2				2					2	2	2	2	2
CO5	3	2				2					2	2	2	2	2
CO.*	3	2	2			2					2	2	2	2	2

** For Entire Course, PO & PSO Mapping*



Honors

Subject Code	Subject Name	L	T	P	C
R19CSE-PE3201.2	Malware Analysis (Professional Elective – II)	3	0	0	3

Course Objectives:

- To understand the purpose of computer infection program.
- To implement the covert channel and mechanisms.
- To test and exploit various malware in open source environment.
- To analyze and design the famous virus and worms.
- Understand the Reverse Engineering (RE) Methodology
- Disassemble products and specify the interactions between its subsystems and their functionality

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

1. Explain the characteristics of Malware and its effects on Computing systems.
2. Predict the given system scenario using the appropriate tools to Identify the vulnerabilities and to perform Malware analysis.
3. Analyze the given Portable Executable and Non-Portable Executable files using Static and dynamic analysis techniques.
4. Demonstrate the Malware functionalities.
5. Apply anti-reverse engineering in different Applications

UNIT-I:

Malware Basics- General Aspect of Computer infection program, Non Self Reproducing Malware, How does Virus Operate, Virus Nomenclature, Worm Nomenclature, Recent Malware Case Studies.

UNIT- II:

Basic Analysis- Antivirus Scanning, x86 Disassembly, Hashing, Finding Strings, Packed Malware, PE File Format, Linked Libraries & Functions, PE Header File &Section.

UNIT-III:

Advanced Static & Dynamic Analysis-IDA Pro, Recognizing C code constructs, Analyzing malicious windows program, Debugging, OllyDbg, Kernel Debugging with WinDbg, Malware Focused Network Signatures.

UNIT-IV:

Malware Functionalities-Malware Behavior, Covert Malware Launch, Data Encoding, Shell code Analysis.

UNIT-V:

Reverse Engineering Malware (REM): REM Methodology, Resources for Reverse-Engineering Malware (REM) Understanding Malware Threats, Malware indicators, Malware Classification, Examining Clam AV-Signatures.

Text books:

1. Michael Sikorski, Andrew Honig “Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software” publisher Williampollock

Reference Books:

1. ErciFiliol, “Computer Viruses: from theory to applications”, Springer, 1st edition, 2005.

Year Semester	Artificial Intelligence for Problem Solving	L	T	P	C
		3	0	0	3



Course Objectives:

This course deals with

- Autonomous agent behaviour in solving problems intelligently.
- Imagining the consequence of AI decision making system to identify the wide variety of search methods that agents can employ for problem solving.

Course Outcome

Students will be able to

- Understand the philosophy of AI and State Space Search for problem solving.
- Explore the operations of Heuristic Search and Population Based Methods.
- Apply various optimal search techniques and Space Saving Algorithms
- Develop Game Playing Algorithms using planning and decomposition problems.
- Develop systems using Rule Based Systems and Constraint Satisfaction.

Unit-I (10 Hours)

AI Philosophy: Introduction: History, Can Machines think? Winograd Schema Challenge, Language and Thought, Wheels & Gears, **Philosophy:** Mind, Reasoning, Computation, Dartmouth Conference, The Chess Saga, Epiphenomena **State Space Search:** Depth First Iterative Deepening.

Unit-II (08 Hours)

Heuristic Search: Best First Search, Hill Climbing, Solution Space, TSP, Escaping Local Optima, Stochastic Local Search. **Population Based Methods:** Genetic Algorithms, SAT, TSP, emergent Systems, Ant Colony Optimization

Unit-III(10 Hours)

Finding Optimal Paths: Branch & Bound, A*, Admissibility of A*, Informed Heuristic Functions. **Space Saving Versions of A*:** Weighted A*, IDA*, RBFS, Monotone Condition, Sequence Alignment, DCFS, SMGS, Beam Stack Search

Unit-IV(10Hours)

Game Playing: Game Theory, Board Games and Game Trees, Algorithm Minimax, AlphaBeta and SSS*. **Automated Planning:** Domain Independent Planning, Blocks World, Forward & Backward Search, Goal Stack Planning, Plan Space Planning. **Problem Decomposition:** Means Ends Analysis, Algorithm Graphplan, Algorithm AO*

Unit-V(10Hours)

Rule Based Expert Systems: Production Systems, Inference Engine, Match-Resolve-Execute, Rete Net. **Deduction as Search:** Logic, Soundness, Completeness, First Order Logic, Forward Chaining, Backward Chaining. **Constraint Processing:** CSPs, Consistency Based Diagnosis, Algorithm Backtracking, Arc Consistency, Algorithm Forward Checking

Books and references

Text Book:



1. Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.

Reference Books:

1. Stefan Edelkamp and Stefan Schroedl. Heuristic Search: Theory and Applications, Morgan Kaufmann, 2011.
2. John Haugeland, Artificial Intelligence: The Very Idea, A Bradford Book, The MIT Press, 1985.
3. Pamela McCorduck, Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence, A K Peters/CRC Press; 2 edition, 2004.
4. Zbigniew Michalewicz and David B. Fogel. How to Solve It: Modern Heuristics. Springer; 2nd edition, 2004.
5. Judea Pearl. Heuristics: Intelligent Search Strategies for Computer Problem Solving, Addison-Wesley, 1984.
6. Elaine Rich and Kevin Knight. Artificial Intelligence, Tata McGraw Hill, 1991.
7. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009.
8. Eugene Charniak, Drew McDermott. Introduction to Artificial Intelligence, Addison-Wesley, 1985.
9. Patrick Henry Winston. Artificial Intelligence, Addison-Wesley, 1992.

Link:

https://onlinecourses.nptel.ac.in/noc21_cs79/preview



Year Semester	Social Network Analysis	L	T	P	C
		3	0	0	3

Course Objective:

- Social network analysis is to understand a community by mapping the relationships that connect them as a network, and then trying to draw out key individuals, groups within the network and/or associations between the individuals.

Course Outcomes:

- Understand the importance of social network analysis and various network measures.
- Summarize network growth models and applications of link analysis
- Apply different graph visualization tools on community detection and link predictions.
- Development of models using cascading behavior with promising network effects.
- Development of Recommendation Systems

Unit-1:(10 Hours)

Introduction to Social Network Analysis, Introduction to Colab, Introduction to NetworkX, **Network Measures**- Basics, Node Centrality, Transitive and Reciprocity, Similarity and Degeneracy.

Unit-2: (10 Hours)

Network Growth Models-Properties of real world network, Random Network Model, Ring Lattice, Network Model, Watts Strogatz Model, **Link Analysis**- Applications, Signal Networks, Strong and Weak Ties.

Unit 3:(10 Hours)

Graph Visualization Tools. Community Detection - Applications, Types of communities, Detection Methods, Overlapping, Community Detection Vs Community v’s Search. **Link Prediction**- Applications, Temporal changes in network, Prediction Networks and Heuristic Models.

Unit 4:(10 Hours)

Cascade Behavior- Models, Probabilistic Cascades, Epidemic Models, Independent Models, Cascade Prediction. **Network Effects Anomaly Detection**- Outliers and Network Based Anomalies, Challenges Anomaly detection in static and dynamic models.,

Unit-5:(08 Hours)

Graph Representation Learning, Coding on Graph Representation Learning- Criteria on GRL, Representation Learning Methods, **Applications and Case Studies**- Malicious activities on OSNs and Recommendation Systems.

Books and references

1. Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021



Honors

2. Network Science, Albert-Lazzlo Barabasi
3. Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faus

Link:

https://onlinecourses.nptel.ac.in/noc22_cs117/preview



	Deep Learning for Computer Vision	L	T	P	C
		3	0	0	3

Course Objective:

- Recognise and describe how mathematical and scientific concepts are applied in computer vision.
- Identify and interpret appropriate sources of information relating to computer vision.
- Apply knowledge of computer vision to real life scenarios.

Course Outcomes:

- Describe how mathematical and scientific concepts are applied in computer vision through images.
- Identify appropriate sources of information and architecture relating to computer vision.
- Understand the concept of visualization using CNN.
- Apply the concepts of advanced CNN and RNN techniques for computer vision problems.
- Apply knowledge of computer vision to real life scenarios.

Unit-1: (10 Hours)

Introduction and Overview: Introduction to Image Formation: Capture and Representation; Linear Filtering, Correlation and Convolution. **Visual Features and Representations:** Edge, Blobs, Corner Detection; Scale Space and Scale Selection; SIFT, SURF; HoG, LBP, etc.

Unit-II:(10 Hours)

Visual Matching: Bag-of-words, VLAD; RANSAC, Hough transform; Pyramid Matching; Optical Flow. **Deep Learning Review-** Review of Deep Learning, Multi-layer Perceptions, Back propagation. **Convolutional Neural Networks (CNNs)-** Introduction to CNNs; Evolution of CNN Architectures: AlexNet, ZFNet, VGG, InceptionNets, ResNets, DenseNets

Unit-III:(10 Hours)

Visualization and Understanding CNNs:Visualization of Kernels; Backprop-to-image/Deconvolution Methods; Deep Dream, Hallucination, Neural Style Transfer; CAM,Grad-CAM, Grad-CAM++; Recent Methods (IG, Segment-IG, SmoothGrad)

Unit-IV(10 Hours)

CNNs for Recognition and Verification (Siamese Networks, Triplet Loss, Contrastive Loss, Ranking Loss); CNNs for Detection: Background of Object Detection, R-CNN, Fast R-CNN, Faster R-CNN, YOLO, SSD, RetinaNet; CNNs for Segmentation: FCN, SegNet, U-Net, Mask-RCNN. **Recurrent Neural Networks (RNNs):** Review of RNNs; CNN + RNN Models for Video Understanding: Spatio-temporal Models, Action/Activity Recognition

Unit-V:(08 Hours)

Attention Models: Introduction to Attention Models in Vision; Vision and Language: Image Captioning, Visual QA, Visual Dialog; Spatial Transformers; Transformer Networks. **Deep Generative Models:** Deep Generative Models: GANs, VAEs; Other Generative Models: PixelRNNs, NADE, Normalizing Flows. Applications.



Books and references

- Ian Goodfellow, Yoshua Bengio, Aaron Courville, [Deep Learning](#), 2016
- Michael Nielsen, [Neural Networks and Deep Learning](#), 2016
- Yoshua Bengio, [Learning Deep Architectures for AI](#), 2009
- Richard Szeliski, [Computer Vision: Algorithms and Applications](#), 2010.
- Simon Prince, [Computer Vision: Models, Learning, and Inference](#), 2012.
- David Forsyth, Jean Ponce, [Computer Vision: A Modern Approach](#), 2002.

Link:

https://onlinecourses.nptel.ac.in/noc20_cs88/preview



Year Semester	AI for Health Care	L	T	P	C
		3	0	0	3

Course Objective:

- The students should be able to understand how AI is transforming the practice of medicine.
- The students should learn the practical experience in applying machine learning to concrete problems in medicine

Course Outcomes:

After completion of course, students would be able to:

- Apply tree-based machine learning to estimate patient survival rates.
- Analyse convolutional neural network image classification and segmentation models to make diagnoses of lung and brain disorders.
- Apply natural language processing to extract information from unstructured medical data.
- Apply survival models to build realistic applications.
- Understand different types of prognosis models related to different diseases.

Unit-I: (10 Hours)

Disease detection with computer vision- Medical Image Diagnosis, Eye Disease and Cancer Diagnosis, Building and Training a Model for Medical Diagnosis, Training, prediction, and loss, Image Classification and Class Imbalance, Generating More Samples, Model Testing

Unit-II: (10 Hours)

Evaluating models- Sensitivity, Specificity, and Evaluation Metrics, Accuracy in terms of conditional probability, Confusion matrix, ROC curve and Threshold. **Image segmentation on MRI images-** Medical Image Segmentation, MRI Data and Image Registration, Segmentation, 2D U-Net and 3D U-Net Data augmentation and loss function for segmentation, Different Populations and Diagnostic Technology, External validation

Unit-III: (10 Hours)

Linear prognostic models- Medical Prognosis, Atrial fibrillation, Liver Disease Mortality, Risk of heart disease, Evaluating Prognostic Models, Concordant Pairs, Risk Ties, Permissible Pairs. **Prognosis with Tree-based models-** Decision trees for prognosis, fix overfitting, Different distributions, Missing Data example, Imputation

Unit-IV: (10 Hours)

Survival Models and Time- Survival Model, Survival function, collecting time data, Estimating the survival function. Build a risk model using linear and tree-based models. Hazard Functions, Relative risk, Individual vs. baseline hazard, Survival Trees, Nelson Aalen estimator.

Unit-V: (08 Hours)

Medical Treatment Effect Estimation- Analyze data from a randomized control trial, Average treatment effect, Conditional average treatment effect, T-Learner, S-Learner, C-for-benefit.

Books and References



Honors

- Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again, Eric Topol, Basic Books, 1st edition 2019.
- Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes, Arjun Panesar, Apress, 1st ed. Edition, 2019.
- Artificial Intelligence in Healthcare, 2020, ISBN 978-0-12-818438-7, Elsevier Inc.

Links

1. <https://www.coursera.org/learn/ai-for-medical-diagnosis>
2. <https://www.coursera.org/learn/ai-for-medical-prognosis#syllabus>
3. <https://www.coursera.org/learn/ai-for-medical-treatment/#syllabus>



Year Semester	BIO-INFORMATICS: APPLICATIONS AND ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objective :

- Bioinformatics is an interdisciplinary field of science for analysing and interpreting vast biological data using computational techniques.
- Major aspects of bioinformatics such as the development of databases, computationally derived hypothesis, algorithms, and computer-aided drug design are illustrated in detail.

Course Outcomes:

- Understand DNA and protein sequence databases and analysis.
- Illustrate the secondary structures and 3D structural analysis.
- Summarize the potential of protein tertiary structure and work on classification.
- Interpret the protein stability, protein structure, folding rates, stability upon mutation, and intermolecular interactions.
- Development of computer-aided drug design using docking and QSAR studies.

Unit-I: (10 Hours)

Introduction, DNA sequence analysis, DNA Databases. Protein structure and function, protein sequence databases, sequence alignment. PAM matrix, Global and local alignment, BLAST: features and scores.

Unit-II:(10 Hours)

Multiple sequence alignment, Conservation score, phylogenetic trees. Protein sequence analysis, hydrophobicity profiles, non-redundant datasets. Protein secondary structures, Ramachandran plot, propensity, secondary structure prediction

Unit-III:(10 Hours)

Protein tertiary structure, Protein Data Bank, visualization tools, structural classification. Protein structural analysis, protein structure prediction.

Unit-IV:(10 Hours)

Protein stability, energetic contributions, database, stabilizing residues. Protein folding rates, proteins interactions, binding site residues

Unit-V:(08 Hours)

Computer aided drug design, docking, screening, QSAR. Development of algorithms, awk programming, machine learning techniques, applications using WEKA

Books and references



Honors

- M. Michael Gromiha, Protein Bioinformatics: From Sequence to Function, Academic Press, 2010
- D.E. Krane and M.L. Raymer, Fundamental concepts of bioinformatics, Pearson Education Inc. 2006

Link:

https://archive.nptel.ac.in/content/syllabus_pdf/102106065.pdf

https://onlinecourses.nptel.ac.in/noc21_bt06/preview



Year Semester	GPU Architecture and Programming	L	T	P	C
		3	0	0	3

Course Objective:

- Design of multi- and many-core processors such as graphics processing units (GPUs).
- Philosophy of GPU concepts, including the evolution of GPU computing at high-level.
- Overview of GPU architecture, and key differences from CPU architecture.

Course Outcomes:

- Understand the basic architecture of GPU and Pipeline Process.
- Apply CUDA Programming and Multi-dimensional programming of dataspacing.
- Illustrate the necessity of Warp Scheduling and Memory Access.
- Summarize the role of GPU in optimization case studies.
- Apply Open CL in developing heterogeneous components.

Syllabus:

Unit-I: (10 Hours)

Review of Traditional Computer Architecture – Basic five stage RISC Pipeline, Cache Memory, Register File, SIMD instructions. GPU architectures - Streaming Multi Processors, Cache Hierarchy, The Graphics Pipeline

Unit-II:(10 Hours)

Introduction to **CUDA programming** and Multi-dimensional mapping of dataspace, Synchronization

Unit-III:(10 Hours)

Warp Scheduling- Host System- External Hardware and GPU roles – policies and features , **Divergence and Memory Access Coalescing**- Differences between Threads and Arrays in Coalescing.

Unit-IV:(08 Hours)

Optimization Case Studies-Optimizing Reduction Kernels, Kernel Fusion, Thread and Block.

Unit-V:(10 Hours)

OpenCL -Basics- OpenCL for Heterogeneous Computing, Application Design : Efficient Neural Network Training/Inferencing

Books and references



(Applicable from the academic year 2024-25 and onwards)

Honors

- “Computer Architecture -- A Quantitative Approach” - John L.Hennessy and David A. Patterson
- "Programming Massively Parallel Processors" - David Kirk and Wen-mei Hwu
- Heterogeneous Computing with OpenCL” -- Benedict Gaster, Lee Howes, David R. Kaeli

Link:

https://onlinecourses.nptel.ac.in/noc20_cs41/preview