| GANPAT UNIVERSITY | | | | | |
|---|---|---|---|---|---|
| FACULTY OF DIPLOMA ENGINEERING | | | | | |
| Programme | Diploma in Computer Engineering/ Information Technology | | | | |
| Semester | IV | | Version | 1.0.0.0 | |
| Effective from Academic Year | | 2025-26 | Effective for the batch Admitted in | | JULY 2025 |
| Course Code | 1CEIT4102 | Course Name | Computer Network | | |

## I. TEACHING-LEARNING AND ASSESSMENT SCHEME

| Course Type | Course code | Course Title | Teaching & Learning Scheme | | | | | | | | | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Credit | | | | Actual Contact Hrs/week | | | SLH | Total Learning Hrs/Week | TH | | | PR | | | SLA | Total |
| | | | CL | TL | LL | Total | CL | TL | LL | | | CE | SEE | Total | CE | SEE | Total | | |
| SEC | 1CEIT4102 | Computer Network | 3 | - | 1 | 4 | 3 | - | 2 | 2 | 7 | 40 | 60 | 100 | 30 | 20 | 50 | 20 | 170 |

| Abbreviation: | **CL-** Classroom Learning | **TL -** Tutorial Learning | **LL -** Laboratory Learning |
|---|---|---|---|
| | **SLH -** Self Learning Hours | **SLA -** Self Learning Assessment | **CE -** Continuous Evaluation |
| | **SEE –** Semester End Examination | | |

## II. PRE-REQUISITES

Basic knowledge of computers, operating systems, number systems, electronics, and command-line usage.

## III. INDUSTRY /EMPLOYER EXPECTED OUTCOMES

- Understand the fundamentals of computer networks, including network components, topologies, transmission media, and communication models used in industry.
- Interpret network protocols, addressing schemes, data flow mechanisms, and layered architectures such as OSI and TCP/IP models.
- Analyze network architectures, switching techniques, routing methods, and common network performance and security issues.
- Develop and configure basic network setups, including LAN and WLAN, using appropriate networking devices.
- Apply computer networking concepts in simple real-world scenarios such as file sharing, client-server communication, and internet-based applications.
- Use network simulators and diagnostic tools effectively for network configuration, testing, monitoring, and troubleshooting.

## IV. COURSE LEARNING OUTCOMES

At the end of the course, students will be able to achieve the following course learning outcomes

**CO1.** Explain fundamental concepts of computer networks including types of networks, network topologies, network servers, and switching techniques to analyze basic networking scenarios.

**CO2.** Explain OSI and TCP/IP reference models and analyze the role of major network protocols used at different layers for effective data communication.

**CO3.** Apply concepts of IPv4 and IPv6 addressing, subnetting, NAT, and IP configuration to perform basic IP address calculations and network addressing tasks.

**CO4.** Classify transmission media and wireless technologies and explain the working, standards, and applications of Wi-Fi, Bluetooth, and mobile communication systems.

**CO5.** Identify networking devices, routing algorithms, routing protocols, security threats, and apply basic network commands and tools for network monitoring and analysis.

| V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT: | | | | |
|---|---|---|---|---|
| **Name of Unit** | **Theory Learning outcomes (TLO's) aligned to CO's** | **Learning Content mapped with Theory Learning outcomes (TLO's)&CO's** | **Marks** | **Hours** |
| **Unit-1**<br><br>**Basic of Computer Network** | **TLO 1.1** Identify and explain the need, benefits, applications and used in real-world scenarios.<br>**TLO 1.2** Classify different types of computer networks and explain the uses, merits, and demerits of LAN, WAN, MAN, WLAN, and VLAN<br>**TLO 1.3** Describe BUS, RING, STAR, MESH, and TREE with their applications, merits, and demerits.<br>**TLO 1.4** Explain the applications and functions of FILE, MAIL, FTP and DNS servers in computer networks.<br>**TLO 1.5** Describe circuit and packet switching techniques used in networks. | **1.1** Understand fundamental concepts of computer networks.<br>**1.2** Category of Computer networks.<br>**1.3** Network topology structures and applications<br>**1.4** Types of network servers.<br>**1.5** Different Switching technologies. | **10** | **7** |
| **Unit-2**<br><br>**Network Reference Models and Protocols** | **TLO 2.1** Introduction of OSI and TCP/IP Model.<br>**TLO 2.2** Describe OSI model in details.<br>**TLO 2.3** Describe TCP/IP model in details.<br>**TLO 2.4** Explain the role of TCP, UDP, HTTP, ICMP, IGMP, FTP, ARP, DHCP, SMTP, POP, POP3<br>**TLO 2.5** Highlight similarity and differences between OSI and TCP/IP model. | **2.1** Network Communication models.<br>**2.2** Structure of OSI model.<br>**2.3** Structure of TCP/IP Model.<br>**2.4** Network Protocols.<br>**2.5** Differences OSI and TCP/IP models. | **10** | **8** |
| **Unit-3**<br><br>**Network Addressing and Subnetting concept** | **TLO 3.1** Explain the concept and purpose of network addressing.<br>**TLO 3.2** Study of IP address space, notations, classful and classless addressing, including special and loopback addresses.<br>**TLO 3.3** Illustrate the IPv4 packet format and state the purpose of its fields in packet delivery.<br>**TLO 3.4** Illustrate the IPv6 packet format and state the purpose of its fields in packet delivery. | **3.1** Basics of networks addressing<br>**3.2** Different IP address scheme.<br>**3.3** Structure and fields of the IPv4 packet format.<br>**3.4** Structure and fields of the IPv6 packet format.<br>**3.5** Differences IPv4 vs IPv6.<br>**3.6** Recognize static and dynamic IP addressing.<br>**3.7** IP addressing and subnetting<br>**3.8** Role of Network Address Translation (NAT). | **12** | **10** |

| | | | | |
|---|---|---|---|---|
| | **TLO 3.5** State and identify differences between IPv4 and IPv6.<br>**TLO 3.6** Comparison and Features of Static and Dynamic IP.<br>**TLO 3.7** Apply basic subnetting and IP address calculations.<br>**TLO 3.8** Describe NAT for public-to-private IP address translation. | | | |
| **Unit-4**<br><br>**Transmission Media & Wireless Communication** | **TLO 4.1** Classify guided transmission media with uses and limitations<br>**TLO 4.2** Classify unguided transmission media with uses and limitations<br>**TLO 4.3** Outline the IEEE 802.11 Wi-Fi standards and their features.<br>**TLO 4.4** Describe the features and evolution of mobile network.<br>**TLO 4.5** Describe the architecture of 5G networks and outline the key enabling technologies.<br>**TLO 4.6** Explain fundamentals and applications of Bluetooth technology.<br>**TLO 4.7** Illustrate the Bluetooth layered architecture and the role of LMP, L2CAP, SDP protocols.<br>**TLO 4.8** Explain piconet and scatternet topologies. | **4.1** Guided transmission media<br>**4.2** Unguided transmission media<br>**4.3** IEEE 802.11 Wi-Fi standards.<br>**4.4** Evolution of mobile networks.<br>**4.5** 5G architecture and technologies.<br>**4.6** State applications of Bluetooth.<br>**4.7** Bluetooth layered architecture.<br>**4.8** Bluetooth network topology. | **16** | **10** |
| **Unit-5**<br><br>**Network Devices & Security Basics** | **TLO 5.1** Identify different networking devices and their functions.<br>**TLO 5.2** Distinguish network devices based on function and application.<br>**TLO 5.3** Identify different types and function of routing algorithms.<br>**TLO 5.4** Recognize different routing protocols and their functions<br>**TLO 5.5** Describe Encryption basics using (WEP, WPA, WPA2)<br>**TLO 5.**6 Network commands: ping, ipconfig, tracert, netstat, nslookup, arp.<br>**TLO 5.7** Network Monitoring and analysis using Wireshark and Packet Tracer. | **5.1** Understand Network devices And functions.<br>**5.2** Comparison of network devices.<br>**5.3** Routing algorithms.<br>**5.4** Routing protocols and their functions<br>**5.5** Wireless Network Security basics.<br>**5.6** Network troubleshooting commands.<br>**5.7** Monitoring and analysis tools For packet analysing. | **12** | **10** |

| VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL | | | |
|---|---|---|---|
| **SR. NO** | **PRACTICAL/LABORATORY LEARNING OUTCOME(LLO)** | **PRACTICAL TITLES** | **RELEVANT Cos** |
| 1 | **LLO 1.1** Setup and test basic LAN communication between two PC. | Establishment and testing of peer-to-peer LAN connectivity. | CO1 |
| 2 | **LLO 1.3** Plan and configure a working LAN setup for a given requirement. | Design and implementation of a wired Local Area Network (LAN). | CO1 |
| 3 | **LLO 1.4** Enable resource sharing on a LAN setup. | Share drives, folders, and printers in a local network. | CO1 |
| 4 | **LLO 2.1** Analyze and troubleshoot network connectivity issues using CLI tools. | Network troubleshooting using command-line tools (ping, tracert, ipconfig) | CO2 |
| 5 | **LLO 2.2** Configure network topology using virtual environment | Design and configure network topology using Packet Tracer. | CO2 |
| 6 | **LLO 2.3** Analyze packets using network protocol analyzer. | Packet capture and protocol analysis using Wireshark | CO2 |
| 7 | **LLO 2.4** Configure FTP server using virtual environment. | Configuration and testing of FTP server using virtual environment. | CO2 |
| 8 | **LLO 2.5** Configure DNS server using virtual environment. | Configuration and testing of DNS server using virtual environment. | CO2 |
| 9 | **LLO 3.1** Configure systems with both static and DHCP-based IP addressing. | Configuration of static and dynamic IP addressing using DHCP. | CO3 |
| 10 | **LLO 3.2** Divide IP network using subnetting techniques. | IP subnetting and network address calculation. | CO3 |
| 11 | **LLO 4.1** Prepare UTP cables correctly and verify functionality. | Crimp cross and straight Ethernet cable using RJ-45 tester. | CO4 |
| 12 | **LLO 4.2** Configure wireless router. | Set up a wireless router and basic security settings. | CO4 |
| 13 | **LLO 4.3** Connect devices to Wi-Fi and test connectivity. | Connecting wireless devices and verifying network connectivity. | CO4 |
| 14 | **LLO 5.1** Recognize and describe roles of devices like routers, switches, hubs, NICs, cables. | Study and identification of networking devices and transmission media. | CO5 |
| 15 | **LLO 5.2** Apply network security measures to protect systems. | Implementation of basic network security using firewall and antivirus. | CO5 |

## VII. SUGGESTED MICRO PROJECT/ASSIGNMENTS/ACTIVITIES FOR SELF LEARNING/SKILL DEVELOPMENT (SELF LEARNING)

**Micro Projects (Mini Applications / Use Cases)**

- Configure and simulate basic LAN/WAN connectivity between multiple devices.
  *Skills*: Network configuration, IP addressing, device connectivity, packet flow analysis.
- Implement IP addressing and subnetting for a given network scenario.
  *Skills*: Subnet calculation, static/dynamic IP assignment, network planning.
- Simulate routing using RIP, OSPF, or static routes in a network simulator.
  *Skills*: Routing configuration, protocol selection, packet path verification.

- Test network security by configuring firewalls, authentication, and access control.
  *Skills*: Security configuration, threat mitigation, network monitoring.
- Study a real-world network (e.g., office LAN or Wi-Fi network) and present its block diagram and working.
  *Skills*: Network analysis, documentation, technical communication.

**Self-Learning / Skill Building Activities**

1. Practice basic network configuration and simulation using tools such as Packet Tracer or online network simulators.
   *Goal***:** Improve understanding of network setup and data communication flow.
2. Prepare a categorized list of network devices and protocols (Router, Switch, Hub, TCP, UDP, IP, DNS) with their functions and applications.
   *Goal***:** Strengthen knowledge of core networking components and protocols.
3. Analyze IP addressing problems including subnetting and CIDR calculations for given network scenarios.
   *Goal***:** Develop analytical and logical skills related to network addressing.
4. Draw network diagrams for LAN, WAN, WLAN, and VLAN configurations before implementation.
   *Goal***:** Enhance logical thinking and structured network design skills.
5. Observe and document packet flow, addressing, and protocol behavior using network simulation tools.
   *Goal***:** Understand data transmission and protocol operation at different network layers.
6. Compare features of traditional networks with modern technologies such as cloud networking, SDN, and 5G networks.
   *Goal***:** Build perspective on the evolution of networking technologies.
7. Identify and correct common network configuration and connectivity errors during simulation or practical sessions.
   *Goal***:** Improve troubleshooting and debugging skills in networking.
8. Prepare a short report on network security mechanisms such as firewalls, authentication, and encryption with real-world examples.
   *Goal***:** Understand basic security practices used in industry networks.
9. Watch video lectures or demonstrations on OSI and TCP/IP models and submit a brief summary.
   *Goal***:** Reinforce theoretical networking concepts through visual learning.
10. Create a poster or presentation on topics such as network topologies, IP addressing, or 5G architecture.
    *Goal***:** Improve technical communication skills and conceptual clarity.

| **VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD/SOFTWARE** | |
|---|---|
| 1 | Computer Systems Windows/Linux (minimum i3, 4 GB RAM) |
| 2 | Network Switch (8/16/24 Port) |
| 3 | Wireless Router / Access Point |
| 4 | RJ-45 Crimping Tool |
| 5 | LAN Tester / Network Cable Tester |
| 6 | Packet Tracer / GNS3 Software (Installed) |
| 7 | Wireshark (Installed on systems) |

| IX. LIST OF REFERENCE BOOKS | | | |
|---|---|---|---|
| **SR.NO** | **TITLE** | **AUTHOR** | **PUBLICATION** |
| 1 | Data Communications and Networking | Behrouz A. Forouzan | McGraw-Hill Education |
| 2 | Computer Networks | Andrew S. Tanenbaum | Pearson Education |
| 3 | A Practical Guide to Networking Fundamentals | Greg Tomsho | 1st Edition, 2012 |
| 4 | Computer Network Technology | M. Goyal | Laxmi Publications Latest |

| X. LINK OF LEARNING WEB RESOURCE | |
|---|---|
| 1 | https://nptel.ac.in/courses/106105183 |
| 2 | https://www.netacad.com/ |
| 3 | https://www.geeksforgeeks.org/computer-network-tutorials/ |
| 4 | https://www.w3schools.com/cybersecurity/cybersecurity_network_security.php |
| 5 | https://www.wireshark.org/docs/ |
| 6 | https://www.cloudflare.com/learning/network-layer/ |

| XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Unit** | **Unit Title** | **Aligned Cos** | **Learning Hours** | **R-Level** | **U-Level** | **A-Level** | **Total Marks** |
| 1 | Basic of Computer Network | CO1 | 7 | 4 | 4 | 2 | 10 |
| 2 | Network Communication Architecture | CO2 | 8 | 4 | 4 | 2 | 10 |
| 3 | Fundamentals of IP Addressing and Subnetting | CO3 | 10 | 3 | 3 | 6 | 12 |
| 4 | Transmission Media & Wireless Communication | CO4 | 10 | 6 | 6 | 4 | 16 |
| 5 | Network Devices & Security Basics | CO5 | 10 | 5 | 4 | 3 | 12 |
| | **Grand Total** | | **45** | **22** | **21** | **17** | **60** |

| XII. COs AND POs AND PSOs MAPPING | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Outcome (Cos)** | **Programme Outcomes (POs)** | | | | | | | **Programme Specific Outcomes (PSOs)** | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 1 | 1 | 0 | 1 | 0 | 3 | 2 | 1 |
| CO2 | 3 | 3 | 1 | 0 | 0 | 1 | 0 | 3 | 2 | 1 |
| CO3 | 2 | 3 | 0 | 3 | 1 | 0 | 1 | 3 | 3 | 1 |
| CO4 | 1 | 3 | 2 | 0 | 2 | 1 | 0 | 3 | 3 | 2 |
| CO5 | 1 | 3 | 1 | 2 | 0 | 1 | 0 | 2 | 2 | 2 |
| **Legends: -** *3-High; 2-Moderate/Medium; 1-Slight/Low; 0-None* | | | | | | | | | | |