

# RAMAKRISHNA MISSION VIDYAMANDIRA

## NEP Syllabus B.Sc. Computer Science Honours

### Semester-V

**Course Code: 5CMSMJ3**

**Course Type: Major Course**

#### Course Outcome:

- Define and explain network fundamentals including topologies, protocols, models, and transmission media.
- Illustrate and compare communication techniques and protocols for reliable transmission.
- Apply networking concepts to configure LANs and devices using standard tools.
- Implement client-server programs and simulate network scenarios using NS-3.
- Analyze network performance and evaluate protocols through simulation and packet analysis.
- Design and configure network systems with routing, switching, VLANs, NAT, and DHCP.

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### 5CMSMJ3: Computer Networks

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**Credit: 3**

**Marks: 50**

**Introduction to Computer Networks:** Network definition, network topologies, network classifications, network protocol, layered network architecture, overview of OSI reference model, overview of TCP/IP protocol suite. **[4L]**

**Data Communication Fundamentals and Techniques:** Analog and digital signal, digital transmission: line coding, block coding, code modulation, analog transmission: shift keying, multiplexing techniques, transmission media: guided and unguided media, satellite communication: geostationary, low orbit, medium orbit, GPS satellite, data rate limitations: Nyquist theorem and Shannon capacity. **[6L]**

**Networks Switching Techniques and Access Mechanisms:** Circuit switching, packet switching- connectionless datagram switching, connection-oriented virtual circuit switching. **[3L]**

**Data Link Layer Functions and Protocols:** Error detection techniques: parity bit, CRC, checksum and error correction technique: Hamming code, data-link control- framing and flow control, error recovery protocols- stop and wait ARQ, go back-n ARQ, selective repeat ARQ, ARP, point-to-point protocol. **[7L]**

**Multiple Access Protocol and Networks:** CSMA/CD protocols, Ethernet LAN, connecting LAN and back-bone networks- repeaters, hubs, switches, bridges, router and gateways. **[4L]**

**Networks Layer Functions and Protocols:** Logical addressing, IPv4 (classless and classful), CIDR, ICMP, NAT, IPv6 (basic idea), routing, unicast and multicast routing, routing algorithms: distance vector routing, link-state routing, path vector routing. **[8L]**

**Transport Layer Functions and Protocols:** Transport services-error and flow control fundamentals, transport layer protocols: connection-oriented (TCP), connectionless (UDP).

[7L]

**Internet Technologies:** Distributed and client-server computing, WWW, URL, Browser, Web Documents, Domain Name Server (DNS): Level, Domains, Generic and Country wise domain, E Mail: Architecture, User Agent, Case Study: SMTP, Web Based Mail. Other application layer protocols: TELNET, SSH, FTP, HTTP.  
[6L]

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### 5CMSMJC3 (Practical): Computer Networks Laboratory

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**Credit: 1**

**Marks: 25**

**Network Programming:** Fundamental ideas on client-server programming using socket and their implementation.

**Network Simulation using NS-3 Network Simulator:**

- **Basics of Network Simulation:** Introduction, Platform required to run network simulator, Backend environment of network simulator, Installation of NS-3 simulator.
- **Simulating a Local Area Network:** Simulating a LAN using NS-3, Implementation of various MAC protocols, Setting up of various network topologies.
- **Network Performance Evaluation using NS-3:** Setting up of network that carries various application protocols and analyzing the performance.

**Hands-on Networking Basics:** Familiarization with Networking cables (CAT5, CAT6, UTP), Connectors (RJ-45, T connector), Hubs, Switches, LAN installation & configuration, Set up a simple LAN, Check the usage of ipconfig, ping, traceroute, Set static IP addresses manually, Install and use Wireshark to capture and inspect packets.

**Hands-on Routing and Switching:** Configure a basic router to route between two networks, Configure a basic switch, Create and configure a basic virtual LAN, Configure DHCP Server, Configure and test NAT.

### Recommended Books

1. Data Communications and Networking by Behrouz A. Forouzan, 5th Edition, TMH.
2. Data and Computer Communication by William Stallings, 6th Edition, Pearson.
3. Computer Networks by Tanenbaum, 5<sup>th</sup> Edition, Pearson.
4. UNIX Network Programming – Networking APIs: Sockets and XTI”, Vol. 1 by W. Richard Stevens, Second Edition, Prentice Hall.
5. NS Simulator for Beginners by Eitan Altman, Tania Jimenez, Morgan & Claypool Publishers.
6. An Introduction to Network Simulator 3 by Jack L. Burbank, First Edition, Wiley-Blackwell.