Course Objective:

The students will have knowledge about the fundamental issues in network protocol design and implementation with the principles underlying TCP/IP protocol design; historical development of the Internet Protocol Version-6; IPv6 and QoS, IP network migrations and applications.

1. Internet and the Networking Protocols …… [3 hours]

- 1.1. Historical Development
- 1.2. OSI Model
- 1.3. Internet IP/UDP/TCP
- 1.4. IPv4 Addressing Review

2. Next Generation Internet Protocol …….. [14 hours, 20 marks]

2.1. Internet Protocol Version 6 (IPv6)

- 2.1.1. History of IPv6
- 2.1.2. IPv6 Header Format
- 2.1.3. Problems with IPv4
- 2.1.4. Features of IPv6
- 2.1.5. IPv6 Addressing format and Types

2.2. ICMPv6

- 2.2.1. Features
- 2.2.2. General Message Format
- 2.2.3. ICMP Error & Informational Message types
- 2.2.4. Neighbor Discovery
- 2.2.5. Path MTU Discovery

3. Security and Quality of Service in IPv6 ……..…… [5 hours, 10 marks]

- 3.1. Types of Threats
- 3.2. Security Techniques
- 3.3. IPSEC Framework
- 3.4. QoS in IPv6 Protocols

4. Routing with IPv6 ……..…… [6 hours, 12 marks]

- 4.1. Routing in the Internet and CIDR
- 4.2. Multicasting
- 4.3. Unidirectional Link Routing
- 4.4. RIPng
- 4.5. OSPF for IPv6
- 4.6. PIM-SM & DVMRP for IPv6

5. IPv4/IPv6 Transition Mechanisms …….. [8 hours, 14 marks]

5.1. Tunneling

- 5.1.1. Automatic Tunneling
- 5.1.2. Configured tunneling

- 5.2. Dual Stack
- 5.3. Translation
- 5.4. Migration Strategies for Telcos and ISPs.

6. IPv6 Deployment …….. [6 hours, 12 marks]

6.1. Challenges and Risks
6.2. IPv6 Deployment Plan
6.3. IPv6 DNS (AAAA & A6 records)
6.4. IPv6 enabled Proxy, Web & Mail Servers

7. Advanced Applications …….. [3 hours]

7.1. MPLS
7.2. NGN

Practical:

For practical, one PC to one student either in virtual environment or real environment will be provided. Students will be divided into group which consists of 3 students. The working environment and machine connectivity will look like the following:

Tools Needed: TCPDUMP & WIRESHARK

1. Enable IPv6 in Windows/Linux
2. IPv6 Header Analysis
3. IPv6 Packet analysis (neighbor/router solicitation/discovery)
4. Unicast Routing Implementation using Zebra-OSPF & OSPF phase analysis
5. Multicast Routing Implementation using XORP-PIM/SM & PIM/SM phase analysis
6. IPv6 DNS/WEB/Proxy implementation & test
7. Case Study

Reference:

1. *Joseph Davice, Understanding IPv6*
2. *Silvia Hagen:* IPv6 Essentials, O'reilly
3. *S. A. Thomas:* IPng and the TCP/IP Protocols, Wiley, 1995
4. *O. Hersent, D. Gurle, J.-P. Petit:* IP Telephony, Addison-Wesley, 2000.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks Distribution*
2	14	20
3	5	10
4	6	12
5	8	14
6	6	12
1,7	6	12
Total	45	80

*There may be Minor deviation in marks distribution.