NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B.Tech. Computer Science and Engineering
Course Code:	2CSDE83
Course Title:	Modern Networks
Course Type:	Departmental Elective
Year of Introduction:	2021-22

Credit Scheme

L	T	Practical Component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLO):

At the end of the course, students will be able to –

1. interpret the modern networking concepts and trends
2. demonstrate basic skills for cellular networks design
3. apply the modern networking fundamentals on real-time network analysis
4. design various types of networks using appropriate tools

Syllabus: **Total Teaching hours: 45**

Unit	Syllabus	Teaching hours
Unit-I	**Network Concepts and Congestion Control**: Networking Principles, Network elements, Performance of networks, Router architecture and switching fabric in routers, congestion control in network, Analysis of TCP, QoS and fairness, Traffic shaping and TCP flow and congestion control	08
Unit-II	**Software Defined Networking**: Data Plane, Control Plane, Application Plane, Controller design, Virtualization, OpenFlow protocol for SDN, Network Function Virtualization	04
Unit-III	**Data Center Networking:** Data center architectures, Data enter congestion control, Queuing and traffic patterns, Data center network protocols, End host architectures, ECMP and load balancing, Multipath TCP, DCTCP, Deadline-aware DCTCP, Low latency protocols for data center	08
Unit-IV	**Next Generation Mobile Networks:** Basics of cellular networks, GSM, GPRS, 3G, 4G, LTE - architecture and working, 5G architecture and objectives, working principles, Beamforming and hardware technologies for mmW communications, Software Defined radio	10

Unit-V	**IPv6 and Lightweight IP Stack:** Need of µIP, I/O processing and packet forwarding, Buffer management and API for µIP, Protocols implementations for µIP, IPv6 addressing, Anycast and multicast with IPv6, IPv4 and IPv6 interoperability	5
Unit-VI	**Case Studies:** Backbone of Internet, Internet exchange points and BGP, Large scale data centers, Peer-to-peer systems, Content Delivery Networks, Multimedia networks, Video streaming networks, Content-centric Networks, Li-Fi, Blockchain Technology, Cognitive radio networks, Bare Metal Networking	10

Self-Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

1. William Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud, Addison-Wesley
2. Kurose and Ross, Computer Networking: A Top-Down Approach, Addison-Wesley
3. William Stallings, High-speed networks and Internets – Performance and quality of service, Prentice Hall
4. Huitema, C., Routing in the Internet, Prentice-Hall,
5. Keshav, S., An Engineering Approach to Computer Networking, Addison-Wesley
6. Jean-Philippe Vasseur, Interconnecting Smart Objects with IP, Morgan Kaufman Publisher
7. Asif Oseiran, Jose F.Monserrat and Patrick Marsch, 5G Mobile and Wireless Communications Technology, Cambridge University Press.
8. Martin Sauter, From GSM to LTE - Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband, John Wiley & Sons Ltd.
9. W. Richard Stevens and Gary R. Wright, The TCP/IP Illustrated, Volume 1: The Protocols, Addison Wesley Longman
10. W. Richard Stevens and Gary R. Wright, "The TCP/IP Illustrated, Volume 2: The Implementation", Addison Wesley Longman.
11. Syed Hassan Ahmed, Safdar Hussain Bouk and Dongkyun Kim, Content-Centric Networks - An Overview, Applications and Research Challenges
12. Naoaki Yamanaka, High-Performance Backbone Network Technology, CRC Press.

	Sr. No.	Practical Title	Hours
Suggested List of Experiments:	1	To configure an IPv4 network using packet tracer and perform static routing and dynamic routing using RIP, RIPv2 and RIPng	04
	2	To configure an IPv6 network using packet tracer and perform address assignment to nodes, static routing, dynamic routing and implement DHCP server to automatically assign IPv6 addresses	04
	3	To configure Autonomous networks using Border Gateway Protocol in packet tracer.	02
	4	To implement a basic TCP Client Server echo application using sockets in C language.	02
	5	To define data, control and application planes in software defined networking in Openflow.	04
	6	To simulate cellular network for LTE and 5G	04
	7	To implement a basic IPv6 μIP service for configuring and testing IPv6 nodes	02
	8	To configure video streaming server and stream over network for the client player	04
	9	To study various consensus algorithms for blockchain implementation. For the application of your choice, apply appropriate consensus algorithm.	02
	10	To demonstrate the use of blockchain for the application of your choice using the consensus algorithm implemented in practical 9.	02
Suggested Case List:	-NA-		