

MANIPAL UNIVERSITY JAIPUR

Department of Data Science and Engineering

Course Hand-out

A. Basic Details:

Programme Name:	CSE-DS
Course Name:	Computer Networks
Course Code:	DSE2202
LTPC (Lecture Tutorial Practical Credits):	4
Session:	Jan-June 2025
Class:	DS, IV Sem
Course Coordinator:	Dr. Shitanshu Jain
Course Instructor(s):	Dr. Pooja Gupta, Dr. Neha V Sharma, Dr. Ginika Mahajan, Dr. Malvinder S Bali, Dr. Srikanta Pradhan
Additional Practitioner(s) – if any (Industry Fellow/ Visiting Faculty/ Adjunct Faculty, etc.):	Nil

B. Introduction: The course on **Computer Networks** provides a comprehensive understanding of the fundamental concepts, principles, and practices involved in the design, implementation, and management of computer networks. It explores how devices communicate with each other, the architecture of networks, and the protocols that govern data transmission. This course is designed to provide both theoretical knowledge and practical skills, enabling students to develop, analyze, and troubleshoot computer networks effectively.

The main objective of this course is to familiarize students with modern computer networks, focusing on the TCP/IP model and its layered structure, which serves as the foundation for today's networking systems.

C. Course Outcomes:

CO Statement	со	Level	Target Attainment %	Target Attainment level
Recognise the layered communication architectures based on TCP/IP.	1	2	75%	2
Understand the various Routing Protocols/Algorithms and addressing.	2	2	75%	2
Apply the principles of congestion control and trade-offs in fairness and efficiency.	3	2	75%	2
Attribute the concepts of data transfer in UDP & TCP.	4	2	75%	2
Know the key Application Layer protocols such as DNS, HTTP, SNMP, SMTP, FTP.	5	2	75%	2

Information about attainment levels:

Attainment (%)	Level
< 60 %	0
≥ 60% < 70%	1
≥ 70% < 80%	2
≥ 80	3

D. Program Outcomes and Program Specific Outcomes

- [PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
- [PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- [PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- [PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- [PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

- [PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.
- [PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- [PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices.
- [PO.9]. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- [PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- [PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- [PO.12]. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

- [PSO.1]. Understand the role of mathematics, statistics, and AI techniques in the field of data science & engineering.
- [PSO.2]. Apply the acquired knowledge and expertise to perform data analytics tasks for multidimensional data sets.
- [PSO.3]. Develop effective and scalable industrial solutions for real-world socio-economic problems using data analytics tools and techniques.

PROGRAM EDUCATIONAL OBJECTIVES

- [PEO.1]. Acquire and improve data science abilities to compete in a potential job as a data scientist and analyst.
- [PEO.2]. Establish entrepreneurial skills to provide new and scalable solutions for tackling real-life complex data processing methodologies, paving the way for startups and self-employment.
- [PEO.3]. Pursue higher studies to carry out research and development in the fields of advanced data science and artificial intelligence.
- [PEO.4]. Integrate sensitivity towards all facets of ethical, environmental, and social concerns with holistic development.

E. Assessment Plan:

Criteria	Description	Maximum Marks
	Mid-Term Examination	30
Internal Assessment	(Close/ Open Book)	
(Summative)	Class Work Sessional (CWS): Quiz, MOOC, Research work Assignment, Video Assignment, etc.	30
End Term Exam	End Term Exam	40
(Summative)	(Close/ Open Book)	
	Total	100

F. Syllabus:

Introduction to Computer Networking Concepts: Layered Architectures, OSI Reference Model, TCP/IP Protocol Suite. Physical Layer: Basics of communications- Physical Topology, Physical media types and their important bandwidth and bit-error-rate characteristics- Wired and Wireless media including copper cables, optical fibre and wireless. Data Link Layer: Logical Link Control (LLC) sub-layer- Framing, Error control, reliable transmission, and Automatic Repeat Request (ARQ) protocols including Stop-and-Wait, Go-back-N, Selective Repeat, MAC sublayer: Media access protocol. Network layer: Addressing, Subnetting, Internet Protocol (IP) suite- IPv4 and IPv6 headers, Routing protocols- Distance-vector and Link-state Approaches- Interior and Exterior Gateway Protocol, ICMP, NAT, ARP, and RARP. Transport layer: UDP, TCP- Connection establishment and termination, sliding window, flow and congestion control. Application Layer: Introduction to DNS, SMTP, SNMP, FTP, and HTTP.

Textbook:

- 1. Forouzan, B. A. (2017). TCP/IP protocol suite (6th ed.). McGraw-Hill Education.
- 2. Tanenbaum, A. S., & Wetherall, D. J. (2018). Computer networks (6th ed.). Pearson.

References books:

- 1. Stallings, W. (2021). Data and computer communications (11th ed.). Pearson.
- 2. Kurose, J. F., & Ross, K. W. (2024). Computer networking: A top-down approach (8th ed.). Pearson.

G. Lecture Plan:

Le ct ur	Topic	Session Outcome	Correspon ding CO	Mode of delivery	Mode of assessing CO
e No					
1	Introduction of course	Understanding of Course objectives evaluation	DSE2202.1	Lecture	Mid-Term, End- Term and Quiz
2	Introduction of Computer Networks	Understanding of computer networking, importance, and applications.	DSE2202.1	Lecture	Mid-Term, End- Term and Quiz
3	Layered architecture, principles, and OSI model overview (7 layers)	Understanding of Concept of layered architecture and the functionality of each OSI layer.	DSE2202.1	Lecture	Mid-Term, End- Term and Quiz
4	Overview of TCP/IP protocol suite and its	Understanding of Structure and functionality of the TCP/IP protocol stack.	DSE2202.1	Lecture	Mid-Term, End- Term and Quiz
5	Comparison of the OSI model and TCP/IP Model	Understanding of the comparison of OSI and TCP/IP Model	DSE2202.1	Lecture	Mid-Term, End- Term and Quiz
6	Introduction to physical topologies (bus, star, ring, mesh, hybrid).	Understanding of different network topologies and their advantages/disadvant ages.	DSE2202.1	Lecture	Mid-Term, End- Term and Quiz
7	Copper cables, fiber optics, and wireless media types.	Understanding properties and uses of different physical media types.	DSE2202.1	Lecture	Mid-Term, End- Term and Quiz
8	Importance of bandwidth and biterror rate in communication	Understanding of how bandwidth and error rate affect network performance	DSE2202.1	Lecture	Mid-Term, End- Term and Quiz
9	Purpose and responsibilities of the data link layer.	Understanding of role of the data link layer in networking	DSE2202.2	Lecture	Mid-Term, End- Term and Quiz

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			Functions of NAT			Term and Quiz

26	Function of ARP	Understanding of	DSE2202.3	Lecture	Mid-Term, End-				
		Function of ARP			Term and Quiz				
27	Function of RARP	Understanding of	DSE2202.3	Lecture	Mid-Term, End-				
		Function of RARP			Term and Quiz				
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28	Overview of Transport	erview of Transport Understanding of DSE2202.4 Lecture Mid-Teri							
	Layer	transport layer's role			Term and Quiz				
		in communication.							
29	Elements of Transport	Understanding of	DSE2202.4	Lecture	Mid-Term, End-				
	Protocols,	elements of transport			Term and Quiz				
	Addressing,	protocols							
30	Working of User	Understanding of	DSE2202.4	Lecture	Mid-Term, End-				
	Datagram Protocol	features and use			Term and Quiz				
0.1	(UDP).	cases of UDP.	D05000 4		MIT E				
31	TCP Basics	Understanding of TCP	DSE2202.4	Lecture	Mid-Term, End-				
32	TCP Service Model,	connection lifecycle.	DSE2202.4	Looturo	Term and Quiz				
32	TCP Service Model,	Understanding of Understanding of TCP	DSE2202.4	Lecture	Mid-Term, End- Term and Quiz				
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33	Sliding window	Understanding how	DSE2202.4	Lecture	Mid-Term, End-				
	protocol in TCP.	sliding windows	3022202	2001410	Term and Quiz				
	p. 0.00001	ensure efficient data							
		flow.							
34	Mechanisms for	Understanding how	DSE2202.4	Lecture	Mid-Term, End-				
	managing flow and	TCP ensures reliable			Term and Quiz				
	congestion in TCP.	communication.							
35	TCP Connection	Understanding of TCP	DSE2202.4	Lecture	Mid-Term, End-				
	Establishment, TCP	connection			Term and Quiz				
	Connection Release	establishment and							
20	TOD Transmission	Release	DSE2202.4	Looturo	Mid Torres Fred				
36	TCP Transmission	Understanding of TCP Transmission	DSE2202.4	Lecture	Mid-Term, End- Term and Quiz				
	Policy, Window Management-1	Policy			Terrir and Quiz				
37	Overview of	Understanding of	DSE2202.5	Lecture	Mid-Term, End-				
37	Application Layer	interaction of	D3L2202.3	Lecture	Term and Quiz				
	Application Layer	applications with the			Torrir aria Quiz				
		network.							
38	Client Server Model	Understanding of	DSE2202.5	Lecture	Mid-Term, End-				
		Learning Client			Term and Quiz				
		Server							
39	Structure of DNS.	Understanding of how	DSE2202.5	Lecture	Mid-Term, End-				
		DNS translates			Term and Quiz				
		domain names to IP							
		addresses.							
40	Hierarchy of DNS	Understanding of	DSE2202.5	Lecture	Mid-Term, End-				
		Hierarchy of DNS			Term and Quiz				

41	Working of DNS	Understanding of	DSE2202.5	Lecture	Mid-Term, End-
		Working of DNS			Term and Quiz
42	Working of SMTP for	Understanding of	DSE2202.5	Lecture	Mid-Term, End-
	email communication	how emails are sent			Term and Quiz
		using SMTP			
43	Working of SNMP for	Understanding of	DSE2202.5	Lecture	Mid-Term, End-
	managing devices on	how SNMP monitors			Term and Quiz
	a network.	and manages			
		networks.			
44	File transfer	Understanding of	DSE2202.5	Lecture	Mid-Term, End-
	operations using FTP.	functionality of FTP.			Term and Quiz
45	Working of HTTP for	Understanding of	DSE2202.5	Lecture	Mid-Term, End-
	web communication.	how data is			Term and Quiz
		exchanged over the			
		End Term Exami	nation		

Important Update:

- 1. As per NAAC Reforms 2024- Binary Accreditation Stakeholder Consultation (University), the mode of delivery should include the followings:
 - 1. Lecture based teaching-learning
 - 2. Group-teaching and learning
 - 3. Individual learning/ self-study
 - 4. Inquiry based learning
 - 5. Kinaesthetic learning
 - 6. Game Based learning

- 7. Expeditionary learning
- 8. Technology based learning
- 9. Peer teaching
- 10. Learning through problem-solving
- 11. Flipped Classroom, etc.

Course coordinators should include at least 5 pedagogical approaches from the pedagogical approaches as specified above and mention the same in respective lecture types / Mode of delivery.

It is expected that, MUJ-TEC will conduct workshops on these pedagogical in the coming time for more clarity.

2. In addition, some lectures should be marked as * that indicates the lectures to be covered by additional practitioners (Industry Fellow/ Visiting Faculty/ Adjunct Faculty, etc.)

H. Course Articulation Matrix:

СО	Statement	Correlation with Program Outcomes										Correlation with Program Specific Outcomes				
	Ctatomont	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	Recognize the layered communication architecture based on TCP/IP.	2	1	1			2		3				3	3	2	
DSE2202.2	Understand the various Routing Protocols/Algorithms and addressing.	2	1	1			2		3				3	3	2	
DSE2202.3	Apply the principles of congestion control and trade-offs in fairness and efficiency.	2	1	1			2		3				3	3	2	
DSE2202.4	Attribute the concepts of data transfer in UDP & TCP.	2	1	1			2		3				3	3	2	
DSE2202.5	Know the key Application Layer protocols such as DNS, HTTP, SNMP, SMTP, FTP.	2	1	1			2		3				3	3	2	