MODEL ENGINEERING COLLEGE, THRIKKAKARA

DEPARTMENT OF COMPUTER ENGINEERING
B.TECH IN COMPUTER SCIENCE AND ENGINEERING

LAB MANUAL

CSL332 NETWORKING LAB

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Managed by Institute of Human Resources Development
A Govt.of Kerala Establishment
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	Vision	**Mission**
Institution (Model Engg. College)	Evolve into an academy of excellence to serve the knowledge society.	M1: Implement quality education through Teaching Learning Process. M2: Inculcate culture of technical innovations and creativity. M3: Instill high standards of professional ethics and social values.
Department (Computer Engineering)	Evolve into a center of excellence to serve the emerging knowledge society.	M1: Impart quality education to the graduate and undergraduate students in Computer Science and Engineering. M2:Inculcate students with technical knowledge and human values to create socially committed Engineers. M3: Empower the students to succeed in innovative research and developments to serve the computational needs of the society.

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PROGRAM 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, review 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.

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PO 5: Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling 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 practice.
PO 9: Individual and team work	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.

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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: Hardware & Software	An ability to analyze, design, and develop system software, secure application software, intelligent systems, computer architecture, and network based computing solutions.
PSO 2: Problem Solving	An ability to analyze & design algorithms, and implement the solutions incorporating various programming concepts.
PSO 3: Project Management	An ability to apply diverse software project development approaches to tackle real time problems.

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PROGRAM EDUCATIONAL OBJECTIVES

PEO 1: Lifelong Learning	To produce graduates with a solid foundation in Computer Science & Engineering and broad knowledge in mathematics, applied science and basic engineering with competence for higher studies and to pursue a profession in computing.
PEO 2: Entrepreneurship	To impart an educational foundation that enables them to be good entrepreneurs and be adaptive to the advancements in the latest technologies.
PEO 3: Social Commitment & Leadership	To make them capable to function in multi-disciplinary teams, ethically and responsibly, contributing to the information technology requirements of the society.

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LAB RULES

1. BE PUNCTUAL FOR THE LAB.

2. STUDENTS SHOULD LEAVE THEIR FOOTWEAR OUTSIDE THE LAB IN THE SPACE PROVIDED.

3. KEEP YOUR BELONGINGS OUTSIDE THE LAB.

4. RECORD ENTRY AND EXIT TIME IN THE LOG-REGISTER WHILE USING THE LAB.

5. COME WELL PREPARED WITH RECORD FOR DOING THE EXPERIMENT.

6. AVOID STEPPING ON ELECTRICAL WIRES OR COMPUTER CABLES.

7. DO NOT SHIFT OR INTERCHANGE ANY PART OF THE COMPUTER WITH ANOTHER.

8. FOR ANY HARDWARE PROBLEM, REPORT TO THE LAB-IN-CHARGE / LAB STAFF.

9. STUDENTS SHOULD MAINTAIN SILENCE AND DECORUM IN THE LAB.

10. STUDENTS SHOULD LOG OFF THE COMPUTERS AND ARRANGE THEIR

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SEATS BEFORE LEAVING THE LABORATORY..

11.   VIOLATION OF LAB RULES WILL NECESSITATES IN THE LOSS OF YOUR

LAB PRIVILEGES

INSTRUCTIONS FOR MAINTAINING THE LAB RECORD

1. The index page should be filled properly by writing the corresponding experiment number, name and date on which the experiment was performed.
2. Every experiment conducted in the lab should be noted in the fair record.
3. For every experiment in the fair record the right hand page should contain:
   - **Title:** The experiment heading on top of the page in capital letters with experiment number and date of experiment.
   - **Aim:** The aim of experiment in one or two sentences clearly.
   - **Algorithm:** Steps for doing the experiment.
   - **Result:** The result of the experiment must be summarized.
4. The left hand page should contain:
   - A **print out of the code** used for the experiment
   - **Sample output** obtained for a set of input.

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SYLLABUS

*Mandatory (Note: At least one program from each topic in the syllabus should be completed in the Lab)

1. Getting started with the basics of network configuration files and networking commands in Linux.*

2. To familiarize and understand the use and functioning of system calls used for network programming in Linux.*

3. Implement client-server communication using socket programming and TCP as transport layer protocol*

4. Implement client-server communication using socket programming and UDP as transport layer protocol*

5. Simulate sliding window flow control protocols.* (Stop and Wait, Go back N, Selective Repeat ARQ protocols)

6. Implement and simulate algorithms for Distance Vector Routing protocol or Link State Routing protocol.*

7. Implement Simple Mail Transfer Protocol.

8. Implement File Transfer Protocol.*

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9. Implement congestion control using a leaky bucket algorithm.*

10. Understanding the Wireshark tool.*

11. Design and configure a network with multiple subnets with wired and wireless LANs using required network devices. Configure commonly used services in the network.*

12. Study of NS2 simulator.*

Networking Lab-Practice Questions

1. a) View the configuration, including addresses of your computers network interfaces.
   b) Test the network connectivity between your computer and several other computers.
   c) View the active TCP connections in the computer after visiting a website.
   d) Find the hardware/MAC address of another computer in the network using ARP.

2. Write the system calls used for creating sockets and transferring data between two nodes.

3. a) Implement a multi-user chat server using TCP as transport layer protocol.
   b) Implement a simple web proxy server that accepts HTTP requests and forwarding to remote servers and returning data to the client using TCP.

4. Implement a Concurrent Time Server application using UDP to execute the program at a remote server. Client sends a time request to the server, server sends its system time back to the client. Client displays the result.

5. a) Implement Stop-and-Wait ARQ flow control protocol.
   b) Implement Go-Back--N ARQ flow control protocol.

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    c) Implement Selective Repeat ARQ flow control protocol.
6. Implement Distance Vector Routing algorithm or Link State Routing algorithm.
7. Implement Simple Mail Transfer Protocol.
8. Develop a concurrent file server which will provide the file requested by a client if it exists. If not, the server sends appropriate messages to the client. Server should also send its process ID (PID) to clients for display along with the file or the message.
9. Implement leaky bucket algorithm for congestion control.
10. a) Using Wireshark, Capture packets transferred while browsing a selected website. Investigate the protocols used in each packet, the values of the header fields and the size of the packet.
    b) Using Wireshark, observe three way handshaking connection establishment, three way handshaking connection termination and Data transfer in client server communication using TCP.
    c) Explore at least the following features of Wireshark: filters, Flow graphs (TCP), statistics, and protocol hierarchies.
11. Design and configure a network (wired and wireless LANs) with multiple subnets using required network devices. Configure at least three of the following services in the network- TELNET, SSH, FTP server, Web server, File server, DHCP server and DNS server.
12. a) The network consists of TCP source node (n0) and destination node (n1) over an area size of 500m x 500m. Node (n0) uses Agent/TCP/Reno as the sending TCP agent and FTP traffic source. Node (n1) is the receiver of FTP transfers, and it uses Agent/TCPsink as its TCP-agent for the connection establishment. Run the simulation for 150 seconds and show the TCP window size in two static nodes scenarios with any dynamic routing protocol. Run the script and analyze the output graph for the given scenario.
    b) Simulate the transmission of ping messages over a star network topology

consisting of 'n' nodes and find the number of packets dropped due to congestion using an NS2 simulator.

c) Simulate Link State Protocol or Distance Vector Routing protocol in NS2.

CSL332 NETWORKING LAB COURSE OUTCOMES

CSL 332.1	Use network related commands and configuration files in Linux Operating System. (Cognitive Knowledge Level: Understand).
CSL 332.2	Develop network application programs. (Cognitive Knowledge Level: Apply)
CSL 332.3	Develop network application protocols. (Cognitive Knowledge Level: Apply)
CSL 332.4	Analyze network traffic using network monitoring tools. (Cognitive Knowledge Level: Apply)
CSL 332.5	Design and set up a network and configure different network protocols. (Cognitive Knowledge Level: Apply)
CSL 332.6	Develop simulation of fundamental network concepts using a network simulator. (Cognitive Knowledge Level: Apply)

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CO-PO MAPPING

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 1O	PO 11	PO 12
CSL 332.1	3	2	2					1		1		1
CSL 332.2	3	3	3	3				1		1		1
CSL 332.3	3	3	3	3				1		1		1
CSL 332.4	3	3	3	3	3			1		1		1
CSL 332.5	3	3	3	3	3	1		1		1		1

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CSL 332.6	3	3	3	3	3			1		1		1

CO-PSO MAPPING

Course outcomes	PSO 1	PSO 2	PSO 3
CSL 332.1	2		
CSL 332.2	3		
CSL 332.3	3		
CSL 332.4	2		

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CSL 332.5		2	2
CSL 332.6		2	2

List of Experiments-CO Mapping

Exp. No.	Experiment	CO
1	Getting started with the basics of network configuration files and networking commands in Linux.	CO1
2	To familiarize and understand the use and functioning of system calls used for network programming in Linux.	CO1
3	Implement client-server communication using socket programming and TCP as transport layer protocol.	CO2
4	Implement client-server communication using socket programming and UDP as transport layer protocol.	CO2
5	Simulate sliding window flow control protocols. (Stop and Wait, Go back N, Selective Repeat ARQ protocols)	CO3

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6	Implement and simulate algorithms for Distance Vector Routing protocol.	CO3
7	Implement Simple Mail Transfer Protocol.	CO3
8	Implement File Transfer Protocol.	CO3
9	Implement congestion control using a leaky bucket algorithm.	CO2
10	Understanding the Wireshark tool.	CO4
11	Design and configure a network with multiple subnets with wired and wireless LANs using required network devices. Configure commonly used services in the network.	CO3
12	Study of NS2 simulator. Simulate Link State Protocol in NS2.	CO5

Reference Books:

1. W. Richard Stevens, Bill Fenner, Andy Rudoff, UNIX Network Programming: Volume 1, The Sockets Networking API, 3rd Edition, Pearson, 2015
2. Lisa Bock, Learn Wireshark: Confidently navigate the Wireshark interface and solve real-world networking problems, Packt Publishing, 2019
3. Teerawat Issariyakul, Ekram Hossain, Introduction to Network Simulator NS2,2nd Edition, Springer,2019

Evaluation Methods For Laboratory Experiments:

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Assessment Methods	Continuous Internal Evaluation				
Rubrics	R1	R2	R3	R4	R5
Marks	15	10	5	15	15
Total	60				

Criteria	Parameters evaluated	Performance indicators		
		Beginning(1)	Satisfactory(2)	Exemplary(3)

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Algorithm and Program (R1)	• Clarity of the problem • Neatness and completeness in the algorithm and program	Lack of clarity Of the problem. Algorithm and program are not accurate.	Demonstrates fair understanding of the concepts and problems. Algorithm and program needs minor correction.	Demonstrates appropriate understanding of the concepts and problems. The algorithm and the program are accurate and neat.
Viva (R2)	• Knowledge of concepts and procedure. • Pre-requisite knowledge needed for implementing the problem.	Unable to articulate the concepts and does not answer most of the questions.	Articulates fairly well and answers most of the questions correctly.	Good command over the concepts associated with the problem and answers all questions.
Record (R3)	• Promptness in submission. • Neat documentation • Accurate output	Incomplete /Late submission of the record.	Late submission. Record documentation is fair.	Record submission on time. Record documentation is complete and neat with perfect outputs.

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Time utilization and completion (R4)	• Follow the instructions given to complete the lab • Completion of the lab in allotted time.	Unable to follow the verbal and written instructions to complete the lab. Failed to complete even a part of the lab in allotted time.	Unable to follow some of the verbal and written instructions to complete the requirements of the lab The student failed to complete the entire lab in the allotted amount of time	Able to follow the verbal and written instructions to successfully complete requirements of the lab. The student completed the lab in its entirety in the allotted amount of time
Continuous assessment Test (R5)	The assessment test shall be conducted for 100 marks, which will be converted to out of 15. The marks will be distributed as, Algorithm - 30 marks, Program - 20 marks, Output – 20 marks and Viva - 30 marks.			