

Laboratory Manual

(Version 3.0)

for

Computer Networks Lab.

(MCA-161)

MCA - Ist Semester

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List of Abbreviations

BTL	Bloom's Taxonomy Level
CE	Communication Efficacy
CICP	Conduct Investigations of Complex Computing Problems
CK	Computational Knowledge
CO	Course Outcome
DAC	Departmental Advisory Committee
DDS	Design and Development of Solutions
I&E	Innovation and Entrepreneurship
I&T	Individual & Team Work
IQAC	Internal Quality Assurance Cell
LLL	Life-Long Learning
MTU	Modern Tool Usage
PA	Problem Analysis
PE	Professional Ethics
PEO	Programme Educational Objective
PMF	Project Management and Finance
PO	Programme Outcome
SEC	Societal and Environmental Concern

Declaration

Department : Department of Computer Science and Applications

Course, Year and the Semester to which Lab is offered : MCA - I Year, 1st Semester

Name of the Lab Course : Computer Networks Lab.

Course Code : MCA-161

Version No. : 3.0

Name of Course/Lab Teacher(s) : Dr. Arpita Nagpal

Laboratory Manual Committee : 1. Mrs. Vaishali Joshi, Chairperson
2. Dr. Ritika Wason, Member
3. Mr. Manish Kumar, Member
4. Mr. Uttam Singh Bist, Member
5. Prof. P. S. Grover, Margdarshak
6. Mr. Amit Sharma, Alumni & Industry Expert
7. Dr. Arpita Nagpal, Concerned Subject Teacher, Convener

Approved by : DAC Date: March, 2022

Approved by : IQAC Date: March, 2022

Signature
(Course Teacher)

Signature
(Head of Department)

Signature
(IQAC Coordinator)

1. Vision of the Department

To become a centre of excellence in the field of Computer Science and Applications to produce quality professionals in software development.

2. Mission of the Department

- M₁** To produce quality software professionals as per global industry standards.
- M₂** To foster innovation, entrepreneurial skills, research capabilities and bring all-round development amongst budding professionals.
- M₃** To promote analytical and collaborative life-long learning skills, among students and faculty members.
- M₄** To inculcate strong ethical values and professional behaviour while giving equal emphasis to social commitment and nation building.

3. Programme Educational Objectives (PEOs)

The PEOs for the MCA programme are as follows:

- PEO₁** Exhibit professional competencies and knowledge for being a successful technocrat.
- PEO₂** Adopt creative and innovative practices to solve real-life complex problems.
- PEO₃** Be a lifelong learner and contribute effectively to the betterment of the society.
- PEO₄** Be effective and inspiring leader for fellow professionals and face the challenges of the rapidly changing multi-dimensional, contemporary world.

4. Programme Outcomes (POs)

PO₁ Computational Knowledge (CK)

Demonstrate competencies in fundamentals of computing, computing specialization, mathematics, and domain knowledge suitable for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

PO₂ Problem Analysis (PA)

Identify, formulate, and analyze complex real-life problems in order to arrive at computationally viable conclusions using fundamentals of mathematics, computer sciences, management and relevant domain disciplines.

PO₃ Design and Development of Solutions (DDS)

Design efficient solutions for complex, real-world problems to design systems, components or processes that meet the specifications with suitable consideration to public health, and safety, cultural, societal, and environmental considerations.

PO₄ Conduct Investigations of Complex Computing Problems (CICP)

Ability to research, analyze and investigate complex computing problems through design of experiments, analysis and interpretation of data, and synthesis of the information to arrive at valid conclusions.

PO₅ Modern Tool Usage (MTU)

Create, select, adapt and apply appropriate technologies and tools to a wide range of computational activities while understanding their limitations.

PO₆ Professional Ethics (PE)

Ability to perform professional practices in an ethical way, keeping in mind cyber regulations & laws, responsibilities, and norms of professional computing practices.

PO₇ Life-Long Learning (LLL)

Ability to engage in independent learning for continuous self-development as a computing professional.

PO₈ Project Management and Finance (PMF)

Ability to apply knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.

PO₉ Communication Efficacy (CE)

Ability to effectively communicate with the technical community, and with society at large, about complex computing activities by being able to understand and write effective reports, design documentation, make effective presentations, with the capability of giving and taking clear instructions.

PO₁₀ Societal and Environmental Concern (SEC)

Ability to recognize and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities applicable to professional computing practices.

PO₁₁ Individual & Team Work (I&T)

Ability to work in multi-disciplinary team collaboration both as a member and leader as per need.

PO₁₂ Innovation and Entrepreneurship (I&E)

Ability to apply innovation to track a suitable opportunity to create value and wealth for the betterment of the individual and society at large.

5. Institutional Policy for Students' Conduct

The following guidelines shall be followed:-

- 5.1 All the students in their introductory Lab. shall be assigned a system, which shall be their workplace for the complete semester. Students can store records of all their Lab. assignments on their individual workstations.
- 5.2 Introductory Lab. shall include an introduction to the appropriate software/tool, followed by a basic Introductory Assignment having Practice Questions. All the students are expected to complete this assignment within a week time, as the same shall be assessed through a Lab. Test.
- 5.3 Each week the instructor, in parallel to respective topics covered in the theory lecture, shall assign a set of practical problems to the students in form of Assignments (A, B, C,). The problems in these assignments shall be divided into two parts. The first set of Problems shall be compulsory for all the students and its record need to be maintained in the Practical File, having prescribed format, as given in Appendix-A. All the students should get the weekly assignment checked and signed in the Practical File by the respective teacher in the immediate succeeding week. The second set of problems is Advanced Problems and shall be optional. Student may solve these advanced problems for their further practice.
- 5.4 Cellular phones, pagers, CD players, radios and similar devices are prohibited in the classrooms, laboratories and examination halls.
- 5.5 Laptop-size computers/Tablets may be used in lectures for the purpose of taking notes or working on team-projects.
- 5.6 The internal practical exam shall be conducted towards the end of the semester and shall include the complete set of Lab exercises conducted as syllabus. However, students shall be assessed on continuous basis through

overall performances in regular Lab. Tests, both announced and surprise and viva-voce.

- 5.7 The respective faculty shall prepare and submit sufficient number of practical sets of computing problems to the Dean (Examinations), atleast two weeks prior to the actual exam. It is the responsibility of the faculty to ensure that a set should not be repeated for more than 5 students in agiven batch.
- 5.8 The exam shall be of 3 hours duration where the student shall be expected to implement solutions to his/her assigned set of problems on appropriate software tools in the lab.
- 5.9 Once implemented, student shall also appropriately document code implemented in the assigned answer sheets, which shall be submitted at the end of the examination. All the students shall also appear for viva- voce examination during the exam.
- 5.10 Co-operate, Collaborate and Explore for the best individual learning outcomes but copying or entering into the act of plagiarism is strictly prohibited.

6. Learning Outcomes of Laboratory Work

The student shall demonstrate the ability to:

- Verify and Implement the concepts and theory learnt in class.
- Code and use Software Tools to solve problems and present their optimal solutions.
- Apply numerical/statistical formulas for solving problems/questions.
- Develop and apply critical thinking skills.
- Design and present Lab as well as project reports.

- Apply appropriate methods for the analysis of raw data.
- Perform logical troubleshooting as and when required.
- Work effectively as a member of a team in varying roles as need be.
- Communicate effectively, both oral and written.
- Cultivate ethics, social empathy, creativity and entrepreneurial mindset.

7. Course/Lab Outcomes (COs)

CO₁ Interpret suitable Network Simulator. (BTL2)

CO₂ Apply network configuration skills to design specific network scenarios. (BTL3)

CO₃ Make use of various connecting devices and LAN connectivity to build networks. (BTL3)

CO₄ Simulate the working and analyze the performance of various communication protocols. (BTL4)

CO₅ Evaluate routing in the networks and compare different routing algorithms. (BTL5)

CO₆ Work in teams to design networks for real life scenarios by applying the concepts of all the layered architecture. (BTL6)

8. Mapping of CO's with PO's

Table 1: Mapping of CO's with PO's

PO/CO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PO ₆	PO ₇	PO ₈	PO ₉	PO ₁₀	PO ₁₁	PO ₁₂
CO ₁	√	√	√		√							
CO ₂	√	√	√	√	√	√				√		
CO ₃	√	√	√	√	√	√				√		
CO ₄	√	√	√	√	√	√				√	√	
CO ₅	√	√	√		√	√	√		√	√		
CO ₆							√	√	√		√	√

9. Course/Lab Description

Course (Lab) Title : Cloud Computing Lab.

Course (Lab) Code : MCA-161

Credits : 01

Pre-requisites : NA

Academic Session : August to December

Contact Hours/Week : 02 (01 Lab of 02 Hours/Week)

Internal Assessment : 40 Marks

External Assessment : 60 Marks

10. Grading Policy

Item	Points	Marks	Remarks
Weekly Lab Assignments including Practical Files	10	10	Closed Book/Open Book
Internal End-Term Practical Examination	20	10	Closed Book
Viva-Voce	10	10	Closed Book
Project	10	10	Innovative Applications of Programming
External End-Term Examinations	60	60	Closed Book (conducted and evaluated by the University)
	Total	100	

11. Lesson Plan

Week No.	Lab No.	Topics/Concepts to be Covered	Reference of Lab Manual
1.	1.	Basic networking commands	P1
2.	2.	Understand the network simulator	P2
3.	3.	Connection of PC's	P2, P3
4.	4.	Understanding transmission media in physical layer	P2, P3, P4
5.	5.	Understanding Switch, Hub	P3, P4
6.	6.	Connecting PC's over different Networks	P5, P7
7.	7.	Signal regeneration	P6
8.	8.	Network connection using Bridges	P7
9.	9.	Connecting two networks using different devices	P7
10.	10.	Routing Protocols	P8
11.	11.	Work in team to design networks	P8
12.	12.	Implement Classful Addressing	P9

12. Assignments

Assignment: P1 (Basic networking commands)

To use the basic networking command, we require to go command prompt. In command window perform some commands such as IPCONFIG can tell the IP address, MAC address, The router address and many more things of the system. Nslookup command helps to ask the DNS server the IP address of the given server's name. Traceroute command shows several details about the path that a packet takes from one device to another.

Objectives of the Assignment:

- Understand the different networking Commands
- Distinguish and understand how to you these commands

CO/BTL Covered: CO₁/BTL₂ & BTL₄

Problems:

P1 Run the basic networking commands in command prompt and give the results as per your system. The commands are:

- a) IPCONFIG
- b) IPCONFIG/ALL
- c) NSLOOKUP
- d) PING
- e) Traceroute

Assignment: P2 (Connecting two PC's through a copper cable)

Two computers can be connected on Local Area Network (LAN) through Guided transmission medias. If you have two PCs that you want to network but no router, you can connect them using an Ethernet crossover cable or establish an ad-hoc wireless network if they have Wi-Fi hardware. A Copper cross-over cable is used to connect devices of same type and at same level in a network hierarchy. Ex- Connecting PC to PC, Hub to Switch, Switch to Switch.

Objectives of the Assignment:

- Understand the concepts of transmission media's
- Understand IP address, MAC address of a computer

CO/BTL Covered: CO_{2,3}/BTL₃ & BTL₄

Problems:

- P2** To connect 2 computers without a Connecting Device, give them a IP address, check all the configurations of both computer in its command prompt.

Assignment: P3 (Connecting through a connecting device)

A Straight-through cable is used when-

1. Connecting a router to a hub.
2. Connecting a computer to switch.
3. Connecting a LAN Port to a switch, hub, computer.

Switch is a computer networking device that links network segments or network devices. A switch is a device which receives a message from any device connected to it and then transmits the message only to the device for which the message was meant to send.

Objectives of the Assignment:

- Understand Switches
- Create a LAN machine

CO/BTL Covered: CO₃/BTL₂ & BTL₆

Problems:

- P3** Connect 4 computers with a Switch.

Assignment Set: P4 (Connecting two PC's within a LAN)

A Straight-through cable is used when-

1. Connecting a router to a hub.
2. Connecting a computer to switch.
3. Connecting a LAN Port to a switch, hub, computer.

Hub is a Layer-2 networking device which transmits message to all PCs connected to it and also sends the corresponding acknowledgement of that message to all PCs.

Therefore, it is not considered as a smart networking device.

Objectives of the Assignment:

- Understand the concepts of Lan Connections
- Install and Manage the Hub with PC's

CO/BTL Covered: CO_{2,3}/BTL₃ & BTL₆

Problems:

P4 Connect 5 PCs through a Hub

Assignment Set: P5 (Connecting two PC's in different Networks)

Router is a networking device that forwards data packets between computer networks. Computer in two different local area networks need a router to communicate with each other. Router can connect two LAN's or WAN's.

Objectives of the Assignment:

- Understand the basics of router
- Understand how to connect two different LAN using router
- Understand the difference between switch and router

CO/BTL Covered: CO₃/BTL₂ & BTL₃

Problems:

P5.1 Install two Workstation or Computers in different networks with different IP address and connect them through a router.

P5.2 Demonstrate static routing by connecting 3 routers

Assignment Set: P6 (Signals Regeneration)

The data signals generally become too weak or corrupted if they tend to travel a long distance. Repeaters regenerate the signal over the same network. They don't amplify the signal. It operates in physical layer. It operates in two ports it is 2 port devices.

Objectives of the Assignment:

- Understand the basics of repeater
- Understand how to connect two different LAN using repeater

CO/BTL Covered: CO₄/BTL₂ & BTL₄

Problems:

P6.1 Install one repeater to connect two networks in different buildings and establish communication between the workstation.

Assignment Set: P7 (Connecting two networks)

Bridges are a data link layer device and can connect to different networks as well as connect different networks of different types.

Objectives of the Assignment:

- Understand the concepts of bridges
- Install bridge to connect two devices

CO/BTL Covered: CO₄/BTL₂ & BTL₄

Problems:

P6 Construct a network with 2 Switches, 4PC, 1 Bridge

Advance Problem

Construct a network with 4 Switches, 12 PCs and 4 Routers using Serial DCE Cable

Assignment Set: P8 (Dynamic Routing protocol)

A serial DCE wire is used to connect 2 routers within a WAN (different cities). We need a serial Port to connect serial DCE wires to router.

Router is an inter-networking device which is used to connect different Networks (Networks with different N/w ids; LANs and WANs).

Switch is a computer networking device that links network segments or network devices. A switch is a device which receives a message from any device connected to it and then transmits the message only to the device for which the message was meant to send.

Objectives of the Assignment:

- Understand the basics of Routing protocol
- Demonstration of Routing protocols

CO/BTL Covered: CO_{5,6}/BTL₅ & BTL₆

Problems:

- P8.1** Demonstrate dynamic routing using RIP protocol by connecting 3 networks. with 3 Switches, 9 PCs and 3 Routers should be used.
- 8.2** Construct a network with 2 Switches, 2 PCs and 3 Routers using OSPF.

Assignment Set: P9 (Classful Addressing)

The first eight bits of an IP address formerly identified the network that a particular host belonged to. This is known as classful addressing. This would have reduced the number of networks on the internet to only 254. These networks each had 16,777,216 unique IP addresses. The inefficiency of assigning IP addresses in this manner increased as the internet expanded.

After all, more than 254 companies require IP addresses, and even fewer networks require all 16.7 million available IP addresses.

An IP address is 32-bit long. An IP address is divided into sub-classes Class A, Class B, Class C, Class D, Class E

Objectives of the Assignment:

- Understand the Classful Addressing
- Demonstration of Classful Addressing

CO/BTL Covered: CO_{5,6}/BTL₅ & BTL₆

Problems:

- P9** Demonstrate classful addressing through 2940 switch and ethernet straight through cable.
