

UNIVERSITY OF JAFFNA

FACULTY OF ENGINEERING

EC4060 – COMPUTER AND DATA NETWORK

ASSIGNMENT 1 – INDEPENDENT LEARNING AND IMPLEMENTATION ASSIGNMENT

Assignment Hours – 15

Deadline – 19 January, 2024

Assignment Title:	Simulating Network Infrastructure Design for a Multi-Branch facilities
Objective:	Apply the principles of network design to create and simulate a functional network infrastructure for an institution with multiple branches.
Scenario:	The Engineering Faculty consists of 5 academic departments (Civil, Mechanical, EEE, Computer, and Interdisciplinary Studies) and 1 Administration Section , requiring a scalable and secure network.
Task:	<p>The student is tasked with designing and simulating this network while ensuring:</p> <ul style="list-style-type: none">• Unique subnet allocation for each section.• Identification of subnet information, including subnet mask, usable host range, and broadcast address.• Scalability to accommodate at least 30% future growth in each section.
Deliverables:	<p>A Report and Simulation Video</p> <ol style="list-style-type: none">1. Subnet Calculation Table2. Network Design Diagram3. Simulation File4. Configuration Scripts5. Test Report

Categorization of Devices: Separate devices for **staff** and **students** within each department.

Common Devices: Include department-specific printers and shared devices accessible only by staff.

Central CCTV System: A unified subnet for CCTV cameras covering all departments.

End Devices:

Department	Common Computers	Staff Computers	Printers	Other Devices
Computer Eng	250	50	2	Min 25
EE Eng	150	50	2	Min 15
Civil Eng	75	25	2	Min 5
Mech Eng	75	25	2	Min 10
IDS	15	25	2	Min 5
Administration	0	25	5	0

Other Devices includes special equipment related to engineering applications (e.g.: Smart Boards, 3D Printers, IoT Devices, Experimentation Apparatus, Laboratory Experiment Switches, Routers and Etc.)

Steps to Design the Network

Step 1: Categorize Subnets

Allocate separate subnets for each use cases.

Clearly outline why each subnet exists

Step 2: Virtual Lan plan

Identify the suitable virtual Lan and categorize each cases for the identified VLAN.

Ensure VLAN assignments align with subnets for logical separation and routing.

Step 2: Subnetting Plan

Calculate the Subnet and individually mention the subnet, Network address/ Prefix, Broadcast address, Usable address range.

Step 4: Design the Topology

Design the network by adding routers and switches.

Define the topology IP addresses and virtual networks.

Simulation

Step 5: Install network simulation tools and libraries

Install Cisco Packet tracer / GNS3

Step 6: Build the Network in Simulation Software

Add the devices in the simulator

Connect the devices to form the planned topology

Step 7: Configure Subnets and VLANs

Assign IP addresses to routers, switches, and end devices as per the subnet plan.

Configure VLANs on switches.

Configure inter-VLAN routing on the core router to allow controlled communication between VLANs. **(If Necessary)**

Step 8: Test and Validate

Use ping and traceroute to verify connectivity

- Between staff devices and printers.
- Between student devices within the same subnet.
- Between CCTV cameras and the administration computers.

Step 9: Scalability

Add Devices to test your decision on scalability.

Reporting

Step 10: Prepare a Comprehensive Report

Network Design Details:

- Subnetting calculations with tables for each subnet.
- VLAN plan and mapping.
- Topology diagram.

Simulation Results:

- Device connectivity (ping and traceroute results).
- VLAN and routing functionality tests.

Scalability Validation:

- Summary of added devices and network performance.

Clarity and Consistency:

- Use logical sections and avoid fragmented narration.
- Include screenshots of simulation results for proof.