Problem Statement

Bahria University is planning to open a new campus in Wah to accommodate its growing number of students and departments. The management aims to establish a fully functional and secure computer network infrastructure connecting all departments, labs, and administrative units.

You are hired as a **Network Engineer** to **design, implement, and configure** a **prototype network** for the new campus using Cisco Packet Tracer. The network should demonstrate the key functionalities of an enterprise-level setup, including VLANs, routing protocols, ACLs, DHCP, NAT, and IoT integration.

Campus Layout and Requirements

1. **Departments and Buildings**
   o The campus has **7 dedicated buildings**, each assigned to one department:
      1. Electrical Engineering (EE)
      2. Robotics & Intelligent Systems (RIS)
      3. Computer Science (CS)
      4. Computer Engineering (CE)
      5. Software Engineering (SE)
      6. Mechanical Engineering (ME)
      7. Environmental & Earth Sciences (E&ES)
2. **Building Structure**
   o Each building has 4 floors.
   o Each floor contains 2 computer labs.
   o Each lab has 30 computers connected via switches.

   Total PCs = 7 buildings × 4 floors × 2 labs × 30 PCs = 1,680 computers

3. **Central Server Room**
   o One **Central Server Room** located in the Admin block.
   o Contains servers for:
      ▪ DHCP
      ▪ DNS
      ▪ File Sharing
      ▪ Web Server
      ▪ Backup Server

Network Design Requirements

1. **Topology**
   o Use a **Hierarchical Network Model** (Core–Distribution–Access).
   o Each building has:
      ▪ Access Layer: Switches for labs.
      ▪ Distribution Layer: Building router/switch for aggregation.
   o Core Layer: Two redundant routers connecting all departments and server room.

2. **Routing Configuration**
   - o Implement Static Routing, RIP, and OSPF where appropriate:
     - Use Static Routing between small segments or isolated networks.
     - Use RIP for one group of departments (e.g., EE, ME, and E&ES).
     - Use OSPF for dynamic routing between major department routers and core.
3. **VLANs and Inter-VLAN Routing**
   - o Create VLANs based on department, function, or floor.
   - o Configure Inter-VLAN routing using Layer 3 switches or routers-on-a-stick.
   - o Assign appropriate IP address ranges using VLSM.
4. **Access Control Lists (ACLs)**
   - o Apply Standard and Extended ACLs to restrict network access:
     - Prevent students from accessing administrative servers.
     - Allow specific VLANs to reach the internet.
5. **DHCP Configuration**
   - o Configure DHCP Server (centralized or per building).
   - o Ensure automatic IP assignment to all end devices.
6. **NAT Configuration**
   - o Implement NAT (Network Address Translation) at the internet gateway.
   - o Enable private IP networks to access the internet.
7. **IoT Integration**
   - o Add IoT devices (e.g., smart lights, sensors, cameras) in each building.
   - o Connect IoT devices through a central IoT network or controller.
8. **Other Basic Configurations**
   - o Assign device hostnames and banners.
   - o Configure console and enable passwords.
   - o Set IP addressing, default gateways, and static routes.
   - o Verify connectivity through ping and traceroute tests.

Deliverables

- **Create** complete network topology in Cisco Packet Tracer.
- **Implement** working configurations of:
  - o Static Routing, RIP, and OSPF.
  - o VLANs and Inter-VLAN routing.
  - o ACLs, DHCP, NAT.
  - o IoT devices (basic connectivity).
- **Show** ping and connectivity verification screenshots in the report.
- **Provide** proper labeling and documentation for each device and interface.