## NETWORKING AND DISTRIBUTED SYSTEMS

**ISCED UNIT CODE:** 0613 554 03A

**UNIT CODE:**ICT/CU/CS/CR/07/6/MA

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Create networks and Distributed Systems

**Duration of Unit:** 220 hours

**Unit description:**

This unit specifies the competencies required to understanding networking and distributed systems concept. It involves understanding networking and distributed systems, distributed system architectures, distributed processing and file management, setting up a network in a distributed environment understanding data communication standards and IP addressing and troubleshooting a network.

**Summary of Learning Outcomes**

| Learning Outcomes | Durations (Hours) |
|---|---|
| 1. Networking and distributed systems concepts | 25 |
| 2. Distributed systems architectures | 30 |
| 3. Distributed processing and file management | 30 |
| 4. Network in a distributed environment | 55 |
| 5. Data Communication Standards and IP addressing | 30 |
| 6. Network troubleshoot | 50 |
| **TOTAL** | **220** |

**Learning Outcomes, Content and Suggested Assessment Methods**

| Learning Outcome | Content | Suggested Assessment Methods |
|---|---|---|
| 1. Networking and distributed systems | 1.1 Fundamentals of networking<br>1.1.1 Definition of network<br>1.1.2 Definition of network terminologies<br>1.1.3 Identified network components<br>1.1.4 Application and benefits of networking<br>1.2 Types of networks<br>1.2.1 LAN<br>1.2.2 MAN<br>1.2.3 WAN<br>1.2.4 PAN<br>1.3 Network topologies<br>1.3.1 Star<br>1.3.2 Ring<br>1.3.3 Mesh<br>1.3.4 Bus<br>1.4 Transmission media<br>1.4.1 Wired media<br>1.4.2 Wireless media<br>1.5 Distributed system<br>1.5.1 Definition<br>1.5.2 Application<br>1.6 Types of distributed systems<br>1.6.1 Computing<br>1.6.2 Information<br>1.6.3 Pervasive<br>1.6.4 Client server<br>1.6.5 Peer to peer | • Written tests<br>• Observation<br>• Oral tests<br>• Practical tests |

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| | 1.7 Distributed systems models<br>1.7.1 Architectural<br>1.7.2 Interaction<br>1.7.3 Fault<br>1.8 Specifying network requirements for a site<br>1.8.1 Type of network<br>1.8.2 Type of topology<br>1.8.3 Devices<br>1.9 Network security<br>1.9.1 Definition<br>1.9.2 Types of network attacks<br>1.9.2.1 Active<br>1.9.2.2 Passive<br>1.10 Components of network security<br>1.10.1 Network access control<br>1.10.2 Firewall<br>1.10.3 Intrusion prevention<br>1.10.4 Security information and event management<br>1.11 Wireless security | |
| 2 Distributed systems architectures | 2.1 Distributed architecture<br>2.1.1 Definition<br>2.1.2 Application<br>2.2 Architecture styles<br>2.2.1 Layered Architecture<br>2.2.2 Object Based Architecture<br>2.2.3 Data-centred Architecture<br>2.3 Types of distributed system architectures<br>2.3.1 Centralized<br>2.3.2 Decentralized | • Written tests<br>• Observation<br>• Oral tests<br>• Practical tests |

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| | | 2.3.3 Hybrid<br><br>2.4 Specifying distributed system architecture requirements for a simulated site<br>2.4.1 Architecture style<br>2.4.2 Type of distributed system architectures | |
| 3 | Distributed processing and file management | 3.1 Types of distributed processing<br>3.1.1 Distributed processing<br>3.1.2 Parallel processing<br>3.2 Types of file systems<br>3.3 File sharing and accessing methods<br>3.3.1 Remote access<br>3.3.2 Data caching<br>3.4 Distributed file sharing and access | • Written tests<br>• Observation<br>• Oral tests<br>• Practical tests |
| 4 | Network Set up in a distributed environment | 4.1 Tools, materials and devices<br>4.2 Connection and configuration of network devices<br>4.3 Installation and configuration of network software<br>4.4 Testing the network | • Written tests<br>• Observation<br>• Oral tests<br>• Practical tests |
| 5 | Data Communication standards and IP addressing | 5.1 OSI model<br>5.1.1 Definition<br>5.1.2 Functions of different OSI model layers<br>5.1.3 OSI layer Protocols are illustrated<br>5.2 Data communication components<br>5.2.1 Message<br>5.2.2 Sender<br>5.2.3 Receiver | |

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| | 5.2.4 Medium<br>5.2.5 Protocol<br>5.3 Network IP Address classes<br>5.3.1 Class A, B, C<br>5.3.2 Public and Private IP Address<br>5.3.3 Automatic Private IP Address | |
| 6 Network Troubleshooting | 6.1 Troubleshooting techniques<br>6.1.1 Definition<br>6.1.2 Techniques<br>6.1.3 Procedures<br>6.2 Troubleshooting tools<br>6.2.1 Ping<br>6.2.2 Tracert/traceroute<br>6.2.3 Nslookup<br>6.2.4 Netstat<br>6.2.5 Pathping/mtr | • Written tests<br>• Observation<br>• Oral tests<br>• Practical tests |

**Suggested Methods of Instruction**

- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised activities and projects in a site;
- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.

**Recommended Resources for 25 trainees**

| S/No. | Category/Item | Description/Specifications | Quantity | Recommended Ratio (Trainee: Item) |
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| 1 | **Learning Materials** | Networking and Distributed Systems textbooks or manuals | 25 copies | 1:1 |
| 2 | | OSI Model diagrams, IP classes charts, and network topology charts | 25 sets | 1:1 |
| 3 | | Printed lab exercises and simulations | 25 sets | 1:1 |
| 4 | | Practical guides for configuring routers, switches, and distributed file systems | 25 sets | 1:1 |
| 5 | **Learning Facilities** | Networked computer lab room with furniture, ventilation, power sockets | 1 lab | Shared |
| 6 | | Whiteboard/Smartboard or Projector + Screen | 1 | 1 per class |
| 7 | | Instructor station with demo setup and internet access | 1 | 1:1 |
| 8 | **Infrastructure** | Reliable electricity + Backup (UPS or Generator) | 1 setup | Shared |
| 9 | | Local Area Network (LAN) setup with internet access | 1 setup | Shared |
| 10 | | Internet access and router with DHCP and static IP configuration capability | 1 setup | Shared |
| 11 | **Tools & Equipment** | Computers with NICs (Ethernet, Windows/Linux) | 25 | 1:1 |
| 12 | | Network cables (CAT6 or CAT5e) | 30+ | 1 per PC + extras |
| 13 | | Ethernet switches (8/16/24 port unmanaged or managed) | 2–3 | 8–12 trainees per switch |
| 14 | | Wireless routers (for Wi-Fi and access point configuration) | 2 | 12–15:1 |

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| 15 | | Patch panels and cable testers | 1–2 | Shared |
| 16 | | Crimping tools + RJ45 connectors | 5 sets | 5:1 |
| 17 | | PCs/laptops with virtualization software (VMware/VirtualBox) for distributed systems | 25 | 1:1 |
| 18 | | Pre-installed network simulation software (e.g., Cisco Packet Tracer, GNS3) | 25 installations | 1:1 |
| 19 | | Operating system ISOs (Windows Server, Ubuntu, etc.) | 25 copies | 1:1 |
| 20 | | IP address planning sheets and subnetting charts | 25 | 1:1 |
| 21 | **Consumable Materials** | RJ45 connectors, electrical tape, velcro straps | As needed | Shared |
| 22 | | Writing pads, pens, markers | 25 sets | 1:1 |
| 23 | | Printing paper and ink | As needed | Shared |
| 24 | **Software & Security** | Firewall and antivirus software for training labs | 25 licenses | 1:1 |
| 25 | | Packet sniffing tools (Wireshark) | 25 installations | 1:1 |
| 26 | | Network troubleshooting tools (Ping, Traceroute, Nslookup, Netstat, Pathping) | Preinstalled | 1:1 |
| 27 | **Demonstration Kits** | Router and switch demo kits | 2–3 | 8–12:1 |
| 28 | | Distributed file system demonstration setup (e.g., shared folders, Samba, NFS) | Configured on lab machines | 1:1 |
| 29 | | Network security demo tools (SIEM dashboard, simulated firewall, IDS/IPS) | 1 virtual lab | Shared |

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| 30 | **Instructor Materials** | Instructor's PC/laptop, preloaded with network scenarios and simulations | 1 | 1:1 |
| 31 | | Lesson plans, assessment sheets, observation checklists | 1 set | 1:1 |