MAKERERE UNIVERSITY BUSINESS SCHOOL

FACULTY OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BACHELOR OF BUSINESS COMPUTING

COURSE OUTLINE: SYSTEMS AND NETWORK ADMINISTRATION

1.0 Course Metadata

Course Name	Systems and Network Administration
Course Code	BUC3129
Course Level	Year 3, Semester 1
Programme Option	System Administration and Networking (SNA)
Credits	12
Notional Hours	120

2.0 Course Description

This course develops the skills required to install, configure, secure, and maintain server operating systems and IT infrastructure in an organizational setting. It covers Linux and Windows server administration, identity and directory services, storage, virtualization, automation and scripting, cloud infrastructure fundamentals, monitoring, security hardening, and backup and disaster recovery, developing the ability to administer a mixed-OS enterprise environment.

Delivery follows a theory-practice model in which each concept is reinforced immediately with a hands-on exercise, using virtual machines, simulation environments, or cloud free-tier accounts. The course closes with a group capstone project in which learners build, secure, monitor, and document a complete mixed-OS enterprise environment for a business scenario.

3.0 Course Competences

Competence Domain	Specific Competences
Foundational Knowledge	Explain the role of a systems administrator and the components of enterprise IT infrastructure
Technical Skill	Install, configure, and administer Linux and Windows server operating systems, including centralized identity services
Technical Skill	Deploy and manage virtualized and cloud-hosted infrastructure, automated through scripting and configuration management tools
Cognitive Competence	Diagnose and resolve system, service, and performance issues using monitoring and log data
Affective Competence	Demonstrate responsible, ethical, and collaborative practice when administering and documenting IT infrastructure
Integrated Application	Design, secure, monitor, and document a complete mixed-OS enterprise systems environment

4.0 Course Learning Outcomes

By the end of this course, the learner will be able to:

- Describe the components of an IT infrastructure and draft a basic change-management record for a proposed system change.
- Install a Linux server distribution and a Windows Server instance, and apply a documented post-install hardening checklist to both.
- Deploy Active Directory Domain Services, organize accounts into OUs, and apply a Group Policy Object to enforce a security setting.
- Configure LVM-based storage and a cross-platform file share with appropriate permissions.
- Configure a systemd service and a Windows scheduled task, and diagnose a failed or hung process.
- Create, configure, and manage a virtual machine, including virtual networking and storage allocation.
- Write a script to automate a routine administrative task, and run a basic Ansible playbook against multiple hosts.
- Deploy a virtual machine on a cloud IaaS platform and configure basic cloud storage and networking for it.
- Configure a monitoring tool to track a server's key performance metrics and generate an alert on a threshold breach.
- Configure SSH key-based authentication, a host-based firewall, and a patch-management routine on a server.
- Configure a scheduled backup routine, perform a test restore, and document a disaster recovery plan with defined RPO/RTO targets.
- Design, build, secure, monitor, and document a small mixed-OS enterprise environment meeting a stated set of requirements.

5.0 Notional Hours Distribution (Total: 120)

Topic	DH	SH	AH	OH	NH
Topic 1: Foundations of System Administration	1	2	1	3	7
Topic 2: OS Installation and Configuration (Linux and Windows)	3	5	2	-	10
Topic 3: User, Group, and Identity Management	4	9	2	-	15
Topic 4: File Systems and Storage Management	3	4	3	-	10
Topic 5: Process, Service, and System Initialization Management	2	4	3	-	9
Topic 6: Server Virtualization	3	4	3	-	10
Topic 7: Automation and Scripting for System Administration	3	6	2	-	11
Topic 8: Cloud Infrastructure Fundamentals (IaaS)	2	4	3	-	9
Topic 9: System Monitoring and Logging	2	4	3	-	9
Topic 10: System Security and Hardening	3	4	3	-	10
Topic 11: Backup, Business Continuity, and Disaster Recovery	2	5	3	-	10
Topic 12: Integrative Capstone: Enterprise Systems Administration Project	2	3	2	3	10
Total	**30**	**54**	**30**	**6**	**120**

6.0 Detailed Course Content

Topic	Subtopics	Competences	Learning Outcomes	Learning Activities	Learning Methodology	Assessment Strategy (Observation / Conversation / Product)
Topic 1: Foundations of System Administration	The sysadmin role and responsibilities; IT infrastructure overview; professional ethics and acceptable-use policy; change management and documentation practice; ITSM awareness.	Explain the role of a systems administrator and apply professional and ethical standards to IT operations.	Describe the components of an IT infrastructure and draft a basic change-management record for a proposed system change.	Case discussion on a real-world IT ethics and policy dilemma; group exercise drafting a change-request document for a sample scenario; guest session with a practising IT/systems manager on real-world sysadmin responsibilities.	Case-based lecture; group documentation exercise; guest industry session	Observation: engagement during the case discussion. Conversation: justifying a position on the ethics scenario. Product: completed change-request document.
Topic 2: OS Installation and Configuration (Linux and Windows)	Installing and configuring a Linux server distribution; installing and configuring Windows Server; CLI versus GUI administration; package and update management (apt/dnf versus WSUS); post-install hardening baseline.	Install and perform baseline configuration of both Linux and Windows server operating systems.	Install a Linux server distribution and a Windows Server instance, and apply a documented post-install hardening checklist to both.	Guided installation exercise on Linux and Windows in virtual machines; peer review of a completed hardening checklist against a reference standard.	Guided installation walkthrough; hands-on configuration exercise; peer review	Observation: correct installation sequence followed. Conversation: comparing package management approaches across the two platforms. Product: two hardened server builds.
Topic 3: User, Group, and Identity Management	Local accounts on Linux and Windows; password policy and account lifecycle; Active Directory Domain Services deployment; Organizational Units and Group Policy; an orientation to LDAP/OpenLDAP.	Deploy and manage centralized identity services for a mixed-OS environment.	Deploy Active Directory Domain Services, organize accounts into OUs, and apply a Group Policy Object to enforce a security setting.	Local user and group management exercise on both platforms; AD DS deployment and OU/GPO configuration exercise; troubleshooting ticket involving a GPO that fails to apply.	Worked-example walkthrough; hands-on configuration exercise; troubleshooting ticket	Observation: correct OU and GPO structure. Conversation: explaining GPO inheritance and precedence. Product: working AD domain with an enforced policy.
Topic 4: File Systems and Storage Management	Partitioning and LVM; Windows Storage Spaces and NTFS permissions; RAID concepts; NFS and Samba/SMB file sharing; disk quotas.	Configure storage and file-sharing services across Linux and Windows servers.	Configure LVM-based storage and a cross-platform file share with appropriate permissions.	LVM configuration exercise; Samba/SMB share configuration exercise; comparison exercise contrasting RAID levels for a given workload.	Comparative demonstration; hands-on configuration exercise; comparison exercise	Observation: correct storage configuration sequence. Conversation: which RAID level suits a given workload. Product: working cross-platform file share with correct permissions.
Topic 5: Process, Service, and System Initialization Management	The Linux boot process and systemd; Windows services and the Service Control Manager; scheduling tasks with cron and Task Scheduler; process monitoring and control.	Manage system services, scheduled tasks, and running processes on Linux and Windows.	Configure a systemd service and a Windows scheduled task, and diagnose a failed or hung process.	systemd unit-file configuration exercise; Task Scheduler configuration exercise; guided troubleshooting exercise diagnosing a hung process.	Guided-discovery exercise; hands-on configuration exercise; guided troubleshooting practice	Observation: systematic diagnostic approach. Conversation: explaining systemd target dependencies. Product: working scheduled task and service configuration.
Topic 6: Server Virtualization	Hypervisor types (Type 1 and Type 2); Hyper-V and VMware ESXi/KVM; virtual machine creation and management; virtual networking and storage; containerization as a lighter-weight alternative (orientation only).	Deploy and manage virtual machines on a hypervisor platform.	Create, configure, and manage a virtual machine, including virtual networking and storage allocation.	VM deployment exercise on a hypervisor platform; comparative exercise contrasting Type 1 and Type 2 hypervisors, and VMs versus containers.	Demonstration-led lecture; hands-on configuration exercise; structured group discussion	Observation: correct VM configuration sequence. Conversation: when a container is preferable to a full VM. Product: working virtual machine with verified connectivity.
Topic 7: Automation and Scripting for	Bash scripting fundamentals; PowerShell scripting fundamentals; Infrastructure as	Write scripts and automation playbooks	Write a script to automate a routine administrative task, and run a basic	Scripting exercise automating a user-provisioning task; Ansible playbook exercise pushing a	Scripted walkthrough; hands-on automation exercise; peer-	Observation: correct script logic and structure. Conversation: explaining the benefit of

Topic	Subtopics	Competences	Learning Outcomes	Learning Activities	Learning Methodology	Assessment Strategy (Observation / Conversation / Product)
System Administration	Code concepts; writing and running a basic Ansible playbook.	to perform repetitive administrative tasks.	Ansible playbook against multiple hosts.	configuration change to multiple simulated hosts.	reviewed script exchange	idempotent automation. Product: working script and successful playbook run with output log.
Topic 8: Cloud Infrastructure Fundamentals (IaaS)	Cloud service models (IaaS, PaaS, SaaS); deploying a cloud-hosted virtual machine; cloud storage and networking basics; hybrid integration concepts.	Deploy and manage a basic cloud-hosted server instance.	Deploy a virtual machine on a cloud IaaS platform and configure basic cloud storage and networking for it.	Cloud VM deployment exercise using a free-tier cloud account; short case study comparing on-premises and cloud total cost of ownership for a given scenario.	Flipped-classroom pre-reading with in-class cloud deployment lab; case study discussion	Observation: correct deployment sequence. Conversation: trade-offs between on-premises and cloud hosting. Product: verified running cloud instance.
Topic 9: System Monitoring and Logging	Performance monitoring and baselining; centralized logging (syslog/rsyslog, Windows Event Log); an overview of monitoring tools (Nagios, Zabbix, Prometheus); configuring alerts.	Configure monitoring and centralized logging to establish a performance baseline and detect anomalies.	Configure a monitoring tool to track a server's key performance metrics and generate an alert on a threshold breach.	Monitoring tool configuration exercise establishing a baseline and an alert threshold; guided exercise interpreting a set of log entries to identify an anomaly.	Socratic questioning; hands-on configuration exercise; guided log-analysis exercise	Observation: correct alert threshold configuration. Conversation: interpreting a specific log entry. Product: working monitoring dashboard with a triggered alert log.
Topic 10: System Security and Hardening	SSH key-based authentication and PAM; host-based firewalls; SELinux/AppArmor concepts; patch management; vulnerability awareness.	Apply security hardening measures to protect a server from common threats.	Configure SSH key-based authentication, a host-based firewall, and a patch-management routine on a server.	Security-hardening configuration exercise; short case study on a real-world server breach caused by a missed patch or weak authentication.	Case-based teaching; hands-on hardening exercise; case study discussion	Observation: thoroughness of the hardening checklist applied. Conversation: risk mitigated by disabling password authentication over SSH. Product: hardened server configuration.
Topic 11: Backup, Business Continuity, and Disaster Recovery	Backup strategies (full, incremental, differential); Recovery Point Objective and Recovery Time Objective; scheduling and testing restores; disaster recovery plan documentation.	Design and test a backup and disaster recovery plan for a server environment.	Configure a scheduled backup routine, perform a test restore, and document a disaster recovery plan with defined RPO/RTO targets.	Backup configuration and test-restore exercise; group exercise drafting a disaster recovery plan for a given business scenario.	Scenario-based workshop; hands-on backup exercise; group documentation exercise	Observation: successful test restore performed. Conversation: justifying the chosen RPO/RTO targets. Product: disaster recovery plan document with a verified restore log.
Topic 12: Integrative Capstone: Enterprise Systems Administration Project	Consolidating identity, storage, virtualization, automation, monitoring, security, and backup into a single mixed-OS environment; requirements analysis; documentation standards.	Integrate the course's systems administration skills into a complete, secured, and documented enterprise environment.	Design, build, secure, monitor, and document a small mixed-OS enterprise environment meeting a stated set of requirements.	Group capstone project building a mixed-OS environment with AD, file sharing, monitoring, and a backup plan; showcase presentation and defence.	Project-based learning; group work; showcase presentation	Observation: collaboration and task division within the group. Conversation: defence of design choices at the showcase. Product: design document, working environment, and presentation.

7.0 Assessment Strategy

Assessment follows the NCHE-mandated triangulation model, combining Observation, Conversation, and Product evidence across a 50% Formative and 50% Summative split.

A. Continuous Formative Assessment		**50%**
Individual (25%)		
1. Practical Configuration Portfolio (Product)	Topic-aligned individual configuration exercises across virtual machines, cloud accounts, and lab environments.	15%
2. Individual Take-Home Design Assignment (Product)	A take-home exercise such as a disaster recovery plan or an automation script for a stated scenario.	10%
Group / Peer (25%)		
3. Group Lab Challenge Evaluations (Product)	Collaborative configuration tasks assessed jointly, with peer review against a shared checklist.	15%
4. Participation and Lab Conduct (Observation)	Engagement, diagnostic initiative, and safe practice during practical sessions.	10%
B. Summative Assessment		**50%**
1. Capstone Project: Enterprise Systems Administration (Product + Conversation)	Design, build, secure, and document a mixed-OS enterprise environment; the defence is assessed as a Conversation component.	15%
2. Comprehensive Practical Examination (Product)	Timed, hands-on system configuration and troubleshooting task in a lab environment.	35%

8.0 Learning and Teaching Resources

Virtualization software (e.g., VirtualBox, VMware Workstation, or Hyper-V), a free-tier cloud account (e.g., AWS, Azure, or GCP), Linux and Windows Server installation media, projector and lecture room facilities, and the reading list below.

9.0 Reading List

- Nemeth, E., Snyder, G., Hein, T. R., & Whaley, B. (2021). UNIX and Linux System Administration Handbook (5th ed.). Addison-Wesley.
- Limoncelli, T., Hogan, C., & Chalup, S. (2016). The Practice of System and Network Administration (3rd ed.). Addison-Wesley.
- Panek, W. (2023). MCA Windows Server Hybrid Administrator Complete Study Guide: Exam AZ-800 and AZ-801. Sybex.
- Desmond, B., Richards, J., Allen, R., & Lowe-Norris, A. F. (2013). Active Directory (5th ed.). O'Reilly Media.
- Sanderson, M. (2021). RHCSA/RHCE Red Hat Linux Certification Study Guide (8th ed.). McGraw-Hill.
- Geerling, J. (2020). Ansible for DevOps (2nd ed.). LeanPub.