Certified LAN and WAN Specialist (CLWS)

Program Summary

This instructor-led program with a combination of lecture and hands-on laboratory exercises is designed to provide students with the knowledge required for entry-level careers in computer networking, with an emphasis on Microsoft operating systems including Windows Vista and Windows Server 2012. Students will be guided through the features of the Microsoft operating systems will learn how implement, manage and maintain both workstations and servers in a Microsoft Windows networking environment. Additional topics include network infrastructure services that are required to support a Windows network including Active Directory, Name Resolution, TCP/IP and IP assignment, Windows Security, Remote Access, and Microsoft Exchange 2012.

This program also covers basic networking concepts implemented on Cisco routers. Students will be introduced to the Cisco Internetworking Operating System (IOS) and its command structure. TCP/IP addressing and implementation, including subnetting, will be covered thoroughly. Wide Area Networking (WAN) implementations including ISDN, frame relay, and serial point-to-point (including T1), will be emphasized.

This program will provide students with the skills and knowledge necessary to complete the Microsoft Certified System Engineer (MCSE) and Cisco Certified Network Associate (CCNA) certification exams.

- ➢ Certification program
- ➢ 624 Contact Hours, 39 Credit Hours, 78 Weeks

TERM 1

Course No.	Course Name	Quarter Credit Hours	Clock Hours
CLW100	Specialist I	3	48
CLW110	Specialist II	3	48
	Total	**6**	**96**

TERM 2

Course No.	Course Name	Quarter Credit Hours	Clock Hours
CLW120	Specialist III	6	96
	Total	**6**	**96**

TERM 3

Course No.	Course Name	Quarter Credit Hours	Clock Hours
CLW130	Specialist IV	3	48
CLW140	Specialist V	3	48
	Total	**6**	**96**

TERM 4

Course No.	Course Name	Quarter Credit Hours	Clock Hours
CLW150	Specialist VI	6	96
	Total	**6**	**96**

TERM 5

Course No.	Course Name	Quarter Credit Hours	Clock Hours
CLW160	Specialist VII	6	96
	Total	**6**	**96**

TERM 6

Course No.	Course Name	Quarter Credit Hours	Clock Hours
CLW170	Specialist VIII	6	96
	Total	**6**	**96**

TERM 7

Course No.	Course Name	Quarter Credit Hours	Clock Hours
CLW180	Specialist VIIII	48	48
	Total	**3**	**48**

Prerequisites
Candidates wishing to enter this course should have completed the A+ PC Hardware Technician coursework or have commensurate experience with PC hardware and basic operating system concepts.

Type of Document Received Upon Graduation
Upon successful completion of all program requirements, each student will be awarded a Certificate of Completion.

Certification Tests
All certification exams are scored on a pass/fail basis. Depending on the specific exam, a correct response to 75% - 80% of the questions will be required to achieve a passing score. Students are encouraged to take exams immediately following completion of the corresponding course.

Career Development
Students who successfully complete this program will be prepared for midlevel professional opportunities in the IT field with emphasis on planning, installation, configuration and maintenance of client workstation and server operating system, applications and network infrastructure services using Microsoft technologies as well as internetworking components to support a Local Area Network (LAN) infrastructure. Although titles may vary by hiring organizations, students with these credentials are qualified to meet the requirements of positions such as Network Engineer, Network Support Specialist, Local Area Network Engineer, Network Systems Engineer, Server Administrator, Network Administrator, Windows Server Administrator or similar designations.

This program also aligns with the following career opportunities classified by US Department of Labor under the Standard Occupational Classification (SOC) system.

- 15-1151 Computer User Support Specialist
- 15-1142 Network and Computer Systems Administrators
- 25-1021 Computer Science Teacher, Postsecondary

CLWS Program Details

<u>COURSE CLW100</u>
Title: Installation, Storage, and Compute with Windows Server 2016
Exam: Microsoft Exam 70-740

Course Description
This instructor-led course with a combination of lecture and hands-on laboratory exercises focuses primarily on the installation, storage, and compute features and functionality available in Windows Server 2016. It covers general installation tasks and considerations and the installation and configuration of Nano Server, in addition to the creation and management of images for deployment. It also covers local and server storage solutions, including the configuration of disks and volumes, Data Deduplication, High Availability, Disaster Recovery, Storage Spaces Direct, and Failover Clustering solutions. This course also covers Hyper-V and containers, along with the maintenance and monitoring of servers in physical and compute environments.

Course Objectives
This course will cover the following subjects:

Installing, upgrading, and migrating servers and workloads
- Introducing Windows Server 2016
- Preparing and installing Server Core
- Preparing for upgrades and migrations
- Migrating server roles and workloads
- Windows Server activation models

Configuring local storage
- Managing disks in Windows Server
- Managing volumes in Windows Server

Implementing enterprise storage solutions
- Overview of DAS, NAS, and SANs
- Comparing Fibre Channel, iSCSI, and Fibre Channel over Ethernet
- Understanding iSNS, DCB, and MPIO
- Configuring sharing in Windows Server 2016

Implementing Storage Spaces and Data Deduplication
- Implementing Storage Spaces
- Managing Storage Spaces
- Implementing Data Deduplication

Installing and configuring Hyper-V and virtual machines
- Overview of Hyper-V
- Installing Hyper-V
- Configuring storage on Hyper-V host servers
- Configuring networking on Hyper-V host servers
- Configuring Hyper-V virtual machines
- Managing virtual machines

Deploying and managing Windows and Hyper-V containers
- Overview of containers in Windows Server 2016
- Deploying Windows Server and Hyper-V containers
- Installing, configuring, and managing containers by using Docker

Overview of high availability and disaster recovery
- Defining levels of availability
- Planning high availability and disaster recovery solutions with Hyper-V virtual machines
- Backing up and restoring by using Windows Server Backup
- High availability with failover clustering in Windows Server 2016

Implementing failover clustering
- Planning a failover cluster
- Creating and configuring a new failover cluster
- Maintaining a failover cluster
- Troubleshooting a failover cluster
- Implementing site high availability with stretch clustering

Implementing failover clustering with Windows Server 2016 Hyper-V
- Overview of the integration of Hyper-V Server 2016 with failover clustering
- Implementing Hyper-V VMs on failover clusters
- Key features for VMs in a clustered environment

Implementing Network Load Balancing
- Overview of NLB
- Configuring an NLB cluster
- Planning an NLB implementation

Creating and managing deployment images
- Introduction to deployment images
- Creating and managing deployment images by using MDT
- Virtual machine environments for different workloads

Managing, monitoring, and maintaining virtual machine installations
- WSUS overview and deployment options
- Update management process with WSUS
- Overview of Windows PowerShell DSC
- Overview of Windows Server 2016 monitoring tools
- Using Performance Monitor
- Monitoring event logs

COURSE CLW110
Title: Networking with Windows Server 2016
Exam: Microsoft Exam 70-741

Course Description
This instructor-led course with a combination of lecture and hands-on laboratory exercises focuses on the networking features and functionality available in Windows Server 2016. It covers DNS, DHCP, and IPAM implementations, in addition to remote access solutions, such as VPN and Direct Access. It also covers DFS and BranchCache solutions, high performance network features and functionality, and implementation of software-defined networking (SDN) solutions, such as Hyper-V Network Virtualization (HNV) and Network Controller.

Course Objectives
This course will cover the following subjects:

Planning and implementing an IPv4 network
- Planning IPv4 addressing
- Configuring an IPv4 host
- Managing and troubleshooting IPv4 network connectivity

Implementing DHCP
- Overview of the DHCP server role
- Deploying DHCP
- Managing and troubleshooting DHCP

Implementing IPv6
- Overview of IPv6 addressing
- Configuring an IPv6 host
- Implementing IPv6 and IPv4 coexistence
- Transitioning from IPv4 to IPv6

Implementing DNS
- Implementing DNS servers
- Configuring zones in DNS
- Configuring name resolution between DNS zones
- Configuring DNS integration with Active Directory Domain Services (AD DS)
- Configuring advanced DNS settings

Implementing and managing IPAM
- Overview of IPAM
- Deploying IPAM
- Managing IP address spaces by using IPAM

Remote access in Windows Server 2016
- Overview of remote access
- Implementing the Web Application Proxy

Implementing DirectAccess
- Overview of DirectAccess
- Implementing DirectAccess by using the Getting Started Wizard
- Implementing and managing an advanced DirectAccess infrastructure

Implementing VPNs
- Planning VPNs
- Implementing VPNs

Implementing networking for branch offices
- Networking features and considerations for branch offices
- Implementing Distributed File System (DFS) for branch offices
- Implementing BranchCache for branch offices

Configuring advanced networking features
- Overview of high performance networking features
- Configuring advanced Microsoft Hyper-V networking features

Implementing Software Defined Networking
- Overview of SDN
- Implementing network virtualization
- Implementing Network Controller

COURSE CLW120
Title: Identity with Windows Server 2016
Exam: Microsoft Exam 70-742

Course Description
This instructor-led course with a combination of lecture and hands-on laboratory exercises focuses on the identity functionality in Windows Server 2016. It covers the installation and configuration of Active Directory Domain Services (AD DS), in addition to Group Policy implementation for non-Nano Server environments. It also covers functionality such as Active Directory Certificate Services (AD CS), Active Directory Federations Services (AD FS), and Web Application proxy implementations.

Course Objectives
This course will cover the following subjects:

Implementing Advanced Network Services
- Configuring Advanced DHCP Features
- Configuring Advanced DNS Settings
- Implementing IPAM
- Managing IP Address Spaces with IPAM

Implementing Advanced File Services
- Configuring iSCSI Storage
- Configuring BranchCache
- Optimizing Storage Usage

Implementing Dynamic Access Control
- Overview of DAC
- Implementing DAC Components
- Implementing DAC for Access Control
- Implementing Access Denied Assistance
- Implementing and Managing Work Folders

Implementing Distributed Active Directory Domain Services Deployments
- Overview of Distributed AD DS Deployments
- Deploying a Distributed AD DS Environment
- Configuring AD DS Trusts

Implementing Active Directory Domain Services Sites and Replication
- AD DS Replication Overview
- Configuring AD DS Sites
- Configuring and Monitoring AD DS Replication

Implementing AD CS
- Using Certificates in a Business Environment
- PKI Overview
- Deploying CAs
- Deploying and Managing Certificate Templates
- Implementing Certificate Distribution and Revocation
- Managing Certificate Recovery

Implementing Active Directory Rights Management Services
- AD RMS Overview
- Deploying and Managing an AD RMS Infrastructure
- Configuring AD RMS Content Protection
- Configuring External Access to AD RMS

Implementing and Administering AD FS
- Overview of AD FS
- Deploying AD FS
- Implementing AD FS for a Single Organization
- Deploying AD FS in a Business-to-Business Federation Scenario
- Extending AD FS to External Clients

Implementing Network Load Balancing
- Overview of NLB
- Configuring an NLB Cluster
- Planning an NLB Implementation

Implementing Failover Clustering
- Overview of Failover Clustering
- Implementing a Failover Cluster
- Configuring Highly Available Applications and Services on a Failover Cluster
- Maintaining a Failover Cluster
- Implementing a Multi-Site Failover Cluster

Implementing Failover Clustering with Hyper-V
- Overview of Integrating Hyper-V with Failover Clustering
- Implementing Hyper-V Virtual Machines on Failover Clusters
- Implementing Hyper-V Virtual Machine Movement

Implementing Business Continuity and Disaster Recovery
- Data Protection Overview
- Implementing Windows Server Backup
- Implementing Server and Data Recovery

COURSE CLW130
Title: Developing Microsoft Azure Solutions
Exam: Microsoft Exam 70-532

Course Description

This instructor-led course with a combination of lecture and hands-on laboratory exercises provides students the opportunity to take an existing web application and expand its functionality as part of moving it to Azure.   The course does not require any existing experience with the ASP.NET platform but does require experience with C#. This course focuses on the development considerations and decisions necessary when building a highly available solution in the cloud.

Course Objectives

This course will cover the following subjects:

Overview of the Microsoft Azure Platform
- Azure Services
- Azure Portal

Building Application Infrastructure in Azure
- Azure Virtual Machines
- Azure Virtual Machine Workloads
- Migrating Azure Virtual Machine Instances
- Highly Available Azure Virtual Machines
- Virtual Machine Configuration Management
- Customizing Azure Virtual Machine Networking
- Virtual Machine Scale Sets

Hosting Web Applications on the Azure Platform
- Azure Web Apps
- Azure Logic and Function Apps
- Configuring an App Service App
- Publishing an Azure App Service App
- Supplemental Services

Storing SQL Data in Azure
- Azure SQL Database Overview
- Managing SQL Databases in Azure
- Azure SQL Database Tools
- Securing and Recovering an Azure SQL Database Instance
- Additional Managed Database Services

Designing Cloud Applications for Resiliency
- Application Design Practices for Highly Available Applications
- Application Analytics
- Building High Performance Applications by Using ASP.NET
- Common Cloud Application Patterns
- Caching Application Data

Storing Unstructured Data in Azure
- Azure Storage Overview
- Azure Storage Tables

- Azure Redis Cache
- Azure Search
- Azure Cosmos DB

Storing and Consuming Files from Azure Storage
- Azure Storage Blobs
- Controlling Access to Storage Blobs and Containers
- Configuring Azure Storage Accounts
- Azure Files

Designing a Communication Strategy by Using Queues and Service Bus
- Azure Storage Queues
- Azure Service Bus
- Azure Service Bus Queues
- Azure Service Bus Relay
- Azure Service Bus Notification Hubs

Automating Integration with Azure Resources
- Creating Azure Scripts using Azure PowerShell
- Creating Azure Scripts using Azure CLI
- Azure Resource Manager
- Azure REST Interface
- Azure Cloud Shell

DevOps in Azure
- Continuous Integration
- Azure DevTest Labs
- Azure Resource Manager Templates
- Managed Solution Hosting

Securing Azure Web Applications
- Azure Active Directory
- Azure AD Directories
- Azure AD Offerings
- Azure Key Vault

COURSE CLW140
Title: Implementing Microsoft Azure Infrastructure Solutions
Exam: Microsoft Exam 70-533

Course Description
This instructor-led course with a combination of lecture and hands-on laboratory exercises is for students who are experienced in implementing an infrastructure solution in Microsoft Azure. Students have experience implementing and monitoring cloud and hybrid solutions as well as supporting application lifecycle management. This course teaches IT professionals how to provision and manage services in Microsoft Azure. Students will learn how to implement infrastructure components such as virtual networks, virtual machines, containers, web and mobile apps, and storage in Azure. Students also will learn how to plan for and manage Azure AD, and configure Azure AD integration with on-premises Active Directory domains.

Course Objectives
This course will cover the following subjects:

Introduction to Azure
- Cloud technology overview
- Overview of Azure
- Managing Azure with the Azure portal
- Managing Azure with Windows PowerShell
- Managing Azure with Azure CLI
- Overview of Azure deployment models
- Managing and monitoring Azure resources

Implementing and managing Azure networking
- Overview of Azure networking
- Implementing and managing virtual networks
- Configuring an Azure virtual network
- Configuring virtual network connectivity
- Overview of Azure classic networking

Implementing virtual machines
- Overview of Azure VMs
- Planning deployment of Azure VMs
- Deploying Azure VMs
- Overview of classic Azure VMs

Managing Azure VMs
- Configuring Azure VMs
- Managing disks of Azure VMs
- Managing and monitoring Azure VMs
- Managing classic Azure VMs

Implementing Azure App Service
- Introduction to App Service
- Planning app deployment in App Service
- Implementing and maintaining web apps
- Configuring web apps
- Monitoring web apps and WebJobs
- Implementing mobile apps

- Implementing Traffic Manager

Planning and implementing storage, backup, and recovery services
- Planning storage
- Implementing and managing Azure Storage
- Implementing Azure CDNs
- Implementing Azure Backup
- Planning and implementing Azure Site Recovery

Implementing containers in Azure
- Implementing Windows and Linux containers in Azure
- Implementing Azure Container Service

Implementing Azure Cloud Services
- Planning and deploying Azure Cloud Services
- Managing and maintaining Azure Cloud Services

Implementing Azure Active Directory
- Creating and managing Azure AD tenants
- Configuring application and resource access with Azure AD
- Overview of Azure AD Premium

Managing an Active Directory infrastructure in a hybrid environment
- Extending an on-premises Active Directory domain to Azure IaaS
- Implementing directory synchronization by using Azure AD Connect
- Implementing SSO in hybrid scenarios

Implementing Azure-based management and automation
- Implementing OMS
- Implementing Azure Automation
- Implementing Automation runbooks
- Implementing Azure Automation–based management

COURSE CLW150
Title: Architecting Microsoft Azure Solutions
Exam: Microsoft Exam 70-535

Course Description
This instructor-led course with a combination of lecture and hands-on laboratory exercises provides students skills to define the appropriate cloud native, cloud migration, and hybrid cloud solutions to meet the required functional, operational, and deployment requirements through the solution lifecycle. Students should know the features and capabilities of Azure services to be able to identify tradeoffs and make decisions for designing public and hybrid cloud solutions. Students should understand DevOps technologies, provisioning Azure resources using ARM templates, and designing highly resilient workloads running on Azure. This course is intended for architects who have experience building infrastructure and applications on the Microsoft Azure platform. Students should have a thorough understanding of most services offered on the Azure platform.

Course Objectives
This course will cover the following subjects:

Application Architecture Patterns in Azure
- Pattern Resources
- Performance Patterns
- Resiliency Patterns
- Scalability Patterns
- Data Patterns

Deploying Resources with Azure Resource Manager
- ARM Templates
- Role-Based Access Control (RBAC)
- Resource Policies
- Security
- Building Blocks

Building Azure IaaS-Based Server Applications
- High Availability
- Templated Infrastructure
- Domain-Connected Machines

Creating Managed Server Applications in Azure
- Infrastructure-Backed Platform-as-a-Service (PaaS)
- High-Performance Compute (HPC)
- Migration

Authoring Serverless Applications in Azure
- Azure Web App
- Azure Functions
- Integration
- High Performance

Backing Azure Solutions with Azure Storage
- Pricing
- Blob Storage
- Files
- StorSimple

Comparing Database Options in Azure
- Relational
- NoSQL Services
- Azure Cosmos DB
- Data Storage
- Data Analysis

Networking Azure Application Components
- VNETs
- Load Balancing
- External Connectivity
- Hybrid Connectivity

Managing Security and Identity for Azure Solutions
- Security Monitoring
- Data Security
- Application Security Azure Active Directory (Azure AD)
- Hybrid Identity
- Azure AD Application Integration

Integrating SaaS Services Available on the Azure Platform
- Cognitive Services
- Bot Services
- Machine Learning
- Media Services

Integrating Azure Solution Components using Messaging Services
- Event Messaging
- Integration
- IoT

Monitoring and Automating Azure Solutions
- Application Monitoring
- Platform Monitoring
- Network Monitoring
- Alerting
- Backup
- Azure Automation
- Config Management
- Auto-Scale

COURSE CLW160
Title: Configuring and Operating a Hybrid Cloud with Microsoft Azure Stack
Exam: Microsoft Exam 70-537

Course Description

This instructor-led course with a combination of lecture and hands-on laboratory exercises provides the skills students need as Azure administrators and Azure Stack operators who use Azure Stack to provide cloud services to their end users or customers from within their own data center. Students for this course should have significant experience managing and operating Azure Stack environments. Students should have a strong understanding of Azure as well as some knowledge of virtualization, networking, and identity management. Students should also understand how Azure Stack enables DevOps processes and the hybrid development model. Students will learn the ability to plan, deploy, package, update, and maintain the Azure Stack infrastructure. Students will also learn the ability to offer hybrid cloud resources and requested services, and to manage infrastructure as a service (IaaS) and platform as a service (PaaS). This course is intended for service administrators, DevOps and cloud architects who are interested in using Microsoft Azure Stack to provide cloud services to their end-users or customers from within their own datacenter.

Course Objectives

This course will cover the following subjects:

Overview of Azure Stack
▪   What is Azure Stack?
▪   Comparing Azure Stack with Microsoft Azure
▪   Comparing Azure Stack to Windows Azure Pack

Foundational Components of Microsoft Azure Stack
▪   Windows Server 2016 and System Center 2016
▪   Identity and Authentication

Deploying Microsoft Azure Stack
▪   Microsoft Azure Stack Architecture
▪   Azure Stack Prerequisites
▪   Installing Azure Stack

Offering Microsoft Azure Stack Resources
▪   Working with Plans and Offers
▪   Microsoft Azure Stack Marketplace
▪   Enabling Multi-Tenancy in Azure Stack
▪   Integrating Azure Stack with Windows Azure Pack

Microsoft Azure Stack and DevOps
▪   Technologies used in Microsoft Azure Stack for DevOps
▪   Azure Resource Manager Templates
▪   Third-party Resource Providers

Infrastructure as a Service and Microsoft Azure Stack
▪   Software Defined Networking improvements with Microsoft Azure Stack and Windows Server 2016
▪   Azure Stack Storage
▪   Virtual Machines in Microsoft Azure Stack

Platform as a Service and Microsoft Azure Stack
- Understanding the Platform as a Service.
- SQL Server and MySQL Server Providers in Microsoft Azure Stack.
- App Service Resource Provider.
- Azure Key Vault.
- Azure Functions.

COURSE CLW170
Title: Cisco Certified Network Associate
Exam: 100-105

Course Objectives
This course will cover the following subjects:

Operation of IP Data Networks
- Recognize the purpose and functions of various network devices such as Routers, Switches, Bridges and Hubs
- Select the components required to meet a given network specification
- Identify common applications and their impact on the network
- Describe the purpose and basic operation of the protocols in the OSI and TCP/IP models
- Predict the data flow between two hosts across a network
- Identify the appropriate media, cables, ports, and connectors to connect Cisco network devices to other network devices and hosts in a LAN

LAN Switching Technologies
- Determine the technology and media access control method for Ethernet networks
- Identify basic switching concepts and the operation of Cisco switches
- Configure and verify initial switch configuration including remote access management
- Verify network status and switch operation using basic utilities
- Describe how VLANs create logically separate networks and the need for routing between them
- Configure and verify VLANs
- Configure and verify trunking on Cisco switches
- Identify enhanced switching technologies
- Configure and verify PVSTP operation

IP Addressing
- Describe the operation and necessity of using private and public IP addresses for IPv4 addressing
- Identify the appropriate IPv6 addressing scheme to satisfy addressing requirements in a LAN/WAN environment
- Identify the appropriate IPv4 addressing scheme using VLSM and summarization to satisfy addressing requirements in a LAN/WAN environment
- Describe the technological requirements for running IPv6 in conjunction with IPv4
- Describe IPv6 addresses

IP Routing Technologies
- Describe basic routing concepts
- Configure and verify utilizing the CLI to set basic router configuration
- Configure and verify operation status of a device interface
- Verify router configuration and network connectivity using
- Configure and verify routing configuration for a static or default route given specific routing requirements
- Differentiate methods of routing and routing protocols
- Configure and verify OSPF
- Configure and verify interVLAN routing (Router on a stick)
- Configure SVI interfaces
- Manage Cisco IOS Files
- Configure and verify EIGRP (single AS)

COURSE CLW180
Title: Cisco Certified Network Associate
Exam: 200-105

Course Objectives
This course will cover the following subjects:

IP Services
- Configure and verify DHCP (IOS Router)
- Describe the types, features, and applications of ACLs
- Configure and verify ACLs in a network environment
- Identify the basic operation of NAT
- Configure and verify NAT for given network requirements
- Configure and verify NTP as a client
- Recognize High availability (FHRP)
- Configure and verify syslog
- Describe SNMP v2 and v3

Network Device Security
- Configure and verify network device security features
- Configure and verify switch port security
- Configure and verify ACLs to filter network traffic
- Configure and verify an ACLs to limit telnet and SSH access to the router

Troubleshooting
- Troubleshoot and correct common problems associated with IP addressing and host configurations
- Troubleshoot and resolve VLAN problems
- Troubleshoot and resolve trunking problems on Cisco switches
- Troubleshoot and resolve ACL issues
- Troubleshoot and resolve Layer 1 problems
- Identify and correct common network problems
- Troubleshoot and resolve spanning tree operation issues
- Troubleshoot and resolve routing issues
- Troubleshoot and resolve OSPF problems
- Troubleshoot and resolve EIGRP problems
- Troubleshoot and resolve interVLAN routing problems
- Troubleshoot and resolve WAN implementation issues
- Monitor NetFlow statistics
- Troubleshoot EtherChannel problems

WAN Technologies
- Identify different WAN Technologies
- Configure and verify a basic WAN serial connection
- Configure and verify a PPP connection between Cisco routers
- Configure and verify frame relay on Cisco routers
- Implement and troubleshoot PPPoE