COURSE SYLLABUS

Cisco Certified Network Professionals

CCNP **BSCI** (Exam 642-901)

50 Cragwood Rd, Suite 350
South Plainfield, NJ 07080

Victoria Commons, 613 Hope Rd Building #5,
Eatontown, NJ 07724

130 Clinton Rd,
Fairfield, NJ 07004

Avtech Institute of Technology Course

Instructor:
Course Duration:
Date/Time:
Training Location:

Course Description

This course is designed to help the students get to the point that who can pass the **CCNP BSCI Exam 642-901** based on the skills, knowledge, and experience already have obtained, with the least amount of time required. Also, it makes students much more knowledgeable about how to do the job.

The Building Scalable Cisco Internetworks (BSCI 642-901) is a qualifying exam for the Cisco Certified Network Professional CCNP®, Cisco Certified Design Professional CCDP®, and Cisco Certified Internetwork Professional CCIP™ certifications. The BSCI 642-901 exam will certify that the successful candidate has important knowledge and skills necessary to use advanced IP addressing and routing in implementing scalability for Cisco ISR routers connected to LANs and WANs. The exam covers topics on Advanced IP Addressing, Routing Principles, Multicast Routing, IPv6, Manipulating Routing Updates, Configuring basic BGP, Configuring EIGRP, OSPF, and IS-I. The associated Certifications are: CCNP, CCIP and CCDP.

The teaching material and method help the students to pass the BSCI exam:

- Helps the students discover which test topics have not master
- Provides explanations and information to fill in the knowledge gaps
- Supplies exercises and scenarios that enhance the ability to recall and deduce the answer to test questions
- Provide practice exercises on the topics and the testing process via test questions

Learning Objectives

Part I: Network Architecture and Design

1.0 Network Architecture Framework and Design Models

1.1. Converged Networks
  1.1.1. Voice and video traffic, Mission-critical traffic, Transactional traffic, Routing Protocol traffic, Network management traffic
1.2. Cisco Intelligent Information Network
  1.2.1. Integration of networked resources and information assets that have been largely unlinked
  1.2.2. Intelligence across multiple products and infrastructure layer
  1.2.3. Active participation of the network in the delivery of services and applications
1.3. Cisco Service-Oriented Network Architecture Framework

1.3.1. Networked infrastructure layer
1.3.2. Interactive services layer
1.4. Cisco Enterprise Architecture
1.5. Cisco Hierarchical Network Model
1.5.1. Access layer
1.5.2. Distribution layer
1.5.3. Core layer (also referred to as the backbone)
1.6. Cisco Enterprise Composite Network Model
1.6.1. Enterprise Campus, Enterprise Edge, Service Provider Edge
1.6.2. Building, Building Distribution, Edge Distribution
1.6.3. Server, Management
1.6.4. E-Commerce, Corporate Internet
1.6.5. VPN and Remote Access
1.6.6. WAN, ISP, PSTN
1.6.7. Frame Relay/Asynchronous Transfer Mode (ATM)
1.7. Routing and Routing Protocols with the Enterprise Composite Network Model
1.7.1. EIGRP, OSPF, IS-IS

Part II: IP Routing Protocols

2.0 IP Routing Principles
2.1. IP Routing Overview
2.1.1. Principles of Static Routing
2.1.2. Principles of Dynamic Routing
2.1.3. Principles of On-Demand Routing
2.2. Characteristics of Routing Protocols
2.2.1. Distance Vector, Link-State, and Hybrid Routing Protocols
2.2.2. Classful Routing Protocol Concept
2.2.3. Classless Routing Protocol Concept
2.3. RIP
2.3.1. Characteristics of RIPv1 and RIPv2
2.3.2. RIP Configuration Commands
2.4. IP Routing Protocol Comparisons
2.4.1. Administrative Distance
2.4.2. Floating Static Routes
2.4.3. Criteria for Inserting Routers in the IP Routing Table
2.4.4. Comparing Routing Protocols

3.0 Implement Enhanced Interior Gateway Routing Protocol (EIGRP) operations
3.1. Explain the functions and operations of EIGRP (e.g., DUAL)
3.1.1. EIGRP Overview
3.1.1.1. EIGRP Capabilities and Attributes
3.1.1.2. Underlying Process and Technologies
3.1.2. EIGRP Terminology and Operation
3.1.2.1. EIGRP Terminology

- 3.1.2.2. Populating EIGRP Table
- 3.1.2.3. EIGRP Packets
- 3.1.2.4. EIGRP Neighbors
- 3.1.2.5. Initial Route Discovery
- 3.1.2.6. Route Selection
- 3.1.2.7. Routing Table and EIGRP DUAL
- 3.1.2.8. DUAL Example

3.2. Configure EIGRP routing Protocol (e.g., Stub Routing, authentication, etc.)

- 3.2.1. Configuring and Verifying EIGRP
  - 3.2.1.1. Basic EIGRP Configuration
  - 3.2.1.2. Configuring the IP default-network command for EIGRP
  - 3.2.1.3. Route Summarization
  - 3.2.1.4. EIGRP Load Balancing
  - 3.2.1.5. EIGRP and WAN Links
- 3.2.2. Configuring EIGRP Authentication
  - 3.2.2.1. Router Authentication
  - 3.2.2.2. EIGRP MD5 Authentication
- 3.2.3. Using EIGRP in an Enterprise Network
  - 3.2.3.1. EIGRP Scalability
  - 3.2.3.2. EIGRP Route Summarization
  - 3.2.3.3. EIGRP Queries and Stuck-in Active
  - 3.2.3.4. Preventing SIA Connections
  - 3.2.3.5. Limiting the EIGRP Query Range
  - 3.2.3.6. Graceful Shutdown

3.3. Verify or troubleshoot EIGRP routing configurations

- 3.3.1. Verifying EIGRP Operation with command
- 3.3.2. Debug

4.0 Configuring the Open Shortest Path First (OSPF) Protocol

4.1. OSPF Protocol Overview

- 4.1.1. Link-State Routing Protocols
- 4.1.2. OSPF Adjacencies
- 4.1.3. OSPF Metric Calculation
- 4.1.4. Link-State Data Structures

4.2. OSPF Packets

- 4.2.1. Version Number, Type, Packet Length, Router ID, Area ID, Checksum, Authentication Type, Authentication
- 4.2.2. Establishing OSPF Neighbor Adjacencies: Hello
- 4.2.3. Exchange Process and OSPF Neighbor Adjacency States
- 4.2.4. OSPF Link-State Sequence Numbers

4.3. Configuring Basic OSPF Routing

- 4.3.1. Router OSPF Command
- 4.3.2. Single-Area OSPF Configuration Example
- 4.3.3. Multiarea OSPF Configuration Example
- 4.3.4. Verifying OSPF Operations
- 4.3.5. OSPF Router ID

4.4. OSPF Network Types
- 4.4.1. Types of OSPF Networks
  - 4.4.1.1. Point-to-point
  - 4.4.1.2. Broadcast
  - 4.4.1.3. Nonbroadcast multi-access (NBMA)
- 4.4.2. Adjacency Behavior for a Point-to-Point Link
- 4.4.3. Adjacency Behavior for a Broadcast Network
- 4.4.4. Adjacency Behavior for a Nonbroadcast Multiaccess Network
- 4.4.5. OSPF over Frame Relay Configuration Options
- 4.4.6. OSPF over NBMA Topology Modes of Operation
- 4.4.7. Selecting the OSPF Network Type for NBMA Networks
- 4.4.8. OSPF Broadcast Mode Configuration
- 4.4.9. OSPF Nonbroadcast Mode Configuration
- 4.4.10. OSPF Configuration in Point-to-Multipoint Mode
- 4.4.11. Cisco Point-to-Multipoint Nonbroadcast Mode
- 4.4.12. Using Subinterfaces in OSPF over Frame Relay Configuration
- 4.4.13. Displaying OSPF Adjacency Activity

5.0 Advanced OSPF Protocol Configuration

5.1. Types of OSPF Routers and LSAs
- 5.1.1. Frequent shortest path first (SPF) algorithm calculations
- 5.1.2. Large routing table
- 5.1.3. Large LSDB
- 5.1.4. Small routing tables
- 5.1.5. Reduced link-state update (LSU) overhead
- 5.1.6. Internet router
- 5.1.7. Backbone router
- 5.1.8. ABR
- 5.1.9. ASBR

5.2. Interpreting the OSPF LSDB and Routing Table
- 5.2.1. Configuring OSPF LSDB Overload Protection
- 5.2.2. Changing the Cost Metric

5.3. OSPF Route Summarization
- 5.3.1. Configuring OSPF Route Summarization on an ABR
- 5.3.2. Configuring OSPF Route Summarization on an ASBR
- 5.3.3. Router summarization Configuration Example at an ABR and an ASBR

5.4. Creating a Default Route in ODPF
- 5.4.1. The default-information originate Command

5.5. OSPF Special Area Types
- 5.5.1. Standard area, backbone area (transit area), Stub area, Totally stubby area, NSSA
- 5.5.2. Configuring Stub Areas, Configuring Totally Stubby Areas, Interpreting Routing Tables in Different Types of OSPF Areas
- 5.5.3. Configuring NSSAs

5.6. OSPF Virtual Links
- 5.6.1. Configuring OSPF Virtual Links
- 5.6.2. Verifying OSPF Virtual Link Operation

5.7. Configuring OSPF Authentication
- 5.7.1. Types of Authentication
- 5.7.2. Configuring Simple Password Authentication
- 5.7.3. Verifying and Troubleshooting Simple Password Authentication
- 5.7.4. Configuring and Troubleshooting MD5 Authentication

6.0 Implement multiarea OSPF operations

6.1. Explain the functions and operations of multiarea OSPF.
6.2. Configure multiarea OSPF routing. (e.g., Stub, NSSA, authentication, etc.)
6.3. Verify or troubleshoot multiarea OSPF routing configurations.

7.0 Configuring the integrated Intermediate System-to –Intermediate System (IS-IS) Protocol

7.1. Describe the features and benefits of integrated IS-IS
7.2. Introducing IS-IS and Integrated IS-IS Routing
- 7.2.1. IS_IS Routing: Levels and Routers
- 7.2.2. Integrated IS-IS Routing Design Principles and Issues
- 7.2.3. The ES-IS Protocol
- 7.2.4. OSI Routing Levels
- 7.2.5. Comparing IS-IS to OSPF

7.3. IS-IS Routing Operation
- 7.3.1. NSAP Address
- 7.3.2. IS-IS Router Operation
- 7.3.3. OSI and IS-IS PDUs
- 7.3.4. Implementing IS-IS in different Network Types
- 7.3.5. Link-State Database Synchronization

7.4. Configure and verify integrated IS-IS
- 7.4.1. Integrated IS-IS Configuration
- 7.4.2. Optimizing IS-IS
- 7.4.3. Configuring IP Route Summarization in IS-IS

7.5. Verifying IS-IS Configuration and Structures
- 7.5.1. Verifying IS-IS Configuration
- 7.5.2. Verifying CLNS IS-IS Structure

8.0 Implement Cisco IOS routing features

8.1. Describe, configure or verify route redistribution between IP routing IGPs. (e.g., route-maps, default routes, etc.)
8.2. Describe, configure or verify route filtering (i.e., distribute-lists and passive interfaces)
8.3. Describe and configure DHCP services (e.g., Server, Client, IP helper address, etc.)

9.0 Manipulating Routing Updates

9.1. Using Multiple IP Routing Protocols
- 9.1.1. Considerations When Migrating to Another Routing Protocol
- 9.1.2. Planning and Implementing a New IP Address Allocation
- 9.1.3. Migrating to a New Routing Protocol
- 9.1.4. Redistribution Overview

9.1.5. Redistribution Implementation Considerations
9.1.6. Configuration Redistribution
9.2. Controlling Routing Update Traffic
9.2.1. Passive interface, Default routes, Static routes, Distribute lists, Route maps, Manipulating administrative distance
9.2.2. Static and Default Routes
9.2.3. Using Distribute Lists to Control Routing Updates
9.2.4. Using Route Maps to Control Routing Updates
9.2.5. Using Administrative Distance to Influence the Route-Selection Process
9.2.6. Verifying Redistribution Operation
9.3. DHCP Overview
9.3.1. Verifying DHCP
9.3.2. Configuring DHCP services
9.3.3. Configuring a DHCP Server
9.3.4. Configuring a DHCP Relay Agent
9.3.5. Configuring a DHCP Client

10.0 Implement Border Gateway Protocol (BGP) for enterprise ISP connectivity

10.1. Describe the Terminology, functions and operations of BGP
10.1.1. BGP Use Between Autonomous Systems
10.1.2. Using BGP in an Enterprise Network
10.1.3. BGP Multihoming Operations
10.1.4. When to Use or Not to Use BGP
10.1.5. BGP Characteristics
10.1.6. BGP Neighbor Relationships
10.1.7. BGP on All Routers in a Transit Path
10.1.8. BGP Synchronization
10.1.9. BGP Message Type
10.1.10. BGP Attributes
10.1.11. The Route Selection Decision Process
10.2. Configuring BGP
10.2.1. Peer Group[
10.2.2. Entering BGP Configuration Mode
10.2.3. Defining BGP Neighbors and Activating BGP Sessions
10.2.4. Shutting Down a BGP Neighbor
10.2.5. Defining the Source IP Address
10.2.6. EBGP Multihop and Changing the Next-Hop Attribute
10.2.7. Defining the Networks that BGP Advertises
10.2.8. Configuring BGP or verify BGP operation in a non-transit AS (e.g., authentication)
10.2.9. BGP Neighbor Authentication
10.2.10. Configuring BGP Synchronization
10.2.11. Resetting BGP Sessions
10.3. Verifying and Troubleshooting BGP
10.3.1. show and debug commands
10.3.2. Understanding and Troubleshooting BGP Neighbor States

10.4. Configure BGP path selection. (i.e., Local Preference, AS Path, Weight or MED attributes)
- 10.4.1. BGP Path Manipulation Using Route Maps
  - 10.4.1.1. BGP Path Manipulation
  - 10.4.1.2. Setting Local Preference
  - 10.4.1.3. Setting the MED with Route Maps
  - 10.4.1.4. Implementing BGP in an Enterprise Network

10.5. Verifying and Troubleshooting BGP

10.6. Basic BGP Path Manipulation Using Route Maps

Part III: IP Multicast

11.0 Implement multicast (PIM) forwarding

11.1. Describe IP Multicast (e.g., Layer-3 to Layer-2 mapping, IGMP, etc.)
- 11.1.1. Multicast Versus Unicast
- 11.1.2. Multicast Applications
- 11.1.3. Advantages and Disadvantages of Multicast
- 11.1.4. Multicast IP Addresses
- 11.1.5. Layers 2 Multicast Addresses
- 11.1.6. Learning About Multicast Sessions

11.2. IGMP and CGMP
- 11.2.1. IGMP Version 1 (IGMPv1), IGMP Version 2 (IGMPv2), IGMP Version 3 (IGMPv3)
- 11.2.2. Determining Which IGMP Version is Running
- 11.2.3. Multicast with Layer 2 Switches
- 11.2.4.

11.3. Describe, configure, or verify IP multicast routing (i.e., PIM Sparse-Dense Mode)

11.4. PIM Routing Protocol
- 11.4.1. PIM Terminology
- 11.4.2. Multicast Distribution Trees
- 11.4.3. PIM-DIM, PIM-SM,
- 11.4.4. PIM Sparse-Dense Mode

11.5. IP Multicast Configuration and Verification
- 11.5.1. Configuring PIM-SM and PIM Sparse-Dense Mode
- 11.5.2. Configuring a Router to be a Member of a Group or a Statically Connected Member
- 11.5.3. Verifying IP Multicast
- 11.5.4. Verifying IGMP Groups and IGMP Snooping

Part IV: IP Version 6

12.0 Implement IPv6

12.1. Introducing IPv6
- 12.1.1. Features of IPv6
- 12.1.2. IPv6 Address Space
- 12.1.3. The Need for Larger Address Space

12.2. Describe IPv6 addressing operations
- 12.2.1. IPv6 Packet Header
- 12.2.2. MTU Discovery
- 12.2.3. IPv6 Address Representation
- 12.2.4. IPv6 Address Types
- 12.2.5. Interface Identifiers in IPv6 Addresses
- 12.2.6. IPv6 Global Unicast Addresses, IPv6 Link-Local Unicast Addresses, IPv6 Anycast Addresses, and IPv6 Multicast Address
- 12.2.7. IPv6 Mobility

12.3. Describe IPv6 interoperation with IPv4

12.4. IPv6 Configuration and Using OSPF and Other Routing Protocols for IPv6
- 12.4.1. IPv6 Routing Protocols
- 12.4.2. OSPFv3 Compared to OSPFv2
- 12.4.3. OSPF LSA Types for IPv6
- 12.4.4. IPv6 Configuration
- 12.4.5. OSPFv3 Configuration
- 12.4.6. Verifying IPv6 and OSPFv3
- 12.4.7. Translation Mechanisms

12.5. Describe, configure or verify OSPF routing with IPv6 addressing

12.6. Transitioning IPV4 to IPv6
- 12.6.1. Dual Stack
- 12.6.2. Tunneling

Prerequisite

Valid CCNA certification

A working knowledge of the OSI reference model

An understanding knowledge of the OSI reference model

The ability to operate and configure a Cisco router

Working knowledge of the TCP/IP stack

Contact Hours

_____ Contact Hours (Lecture ___ Hours / Lab ____ Hours)

Semester Credit Hours

_____ Semester credit hours

Text / Lab Books

CCNP BSCI (Building Scalable Cisco Internet works)

- Master **all 642-901 exam topics** with the official study guide

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Teaching Strategies

A variety of teaching strategies may be utilized in this course, including but not limited to, lecture, discussion, written classroom exercises, written lab exercises, performance based lab exercises, demonstrations, quizzes and examinations. Some quizzes may be entirely or contain lab based components. A mid-course and end course examination will be given.

CCNP Exams & Recommended Training

Required Exam(s)	Recommended Training
642-901 BSCI	Building Scalable Cisco Internetworks (BSCI)
642-812 BCMSN	Building Cisco Multilayer Switched Network (BCMSN)
642-825 ISCW	Implementing Secure Converged Wide Area Networks (ISCW)
642-845 ONT	Optimizing Converged Cisco Networks (ONT)
OR	
642-892 Composite	Building Scalable Cisco Internetworks (BSCI) Building Cisco Multilayer Switched Network (BCMSN)
642-825 ISCW	Implementing Secure Converged Wide Area Networks (ISCW)
642-845 ONT	Optimizing Converged Cisco Networks (ONT)

Method of Evaluating Students

Grade Distribution

Class Attendance	10
Mid Term	30

Finals	50
Special Projects Makeup projects	10
Total	**100%**

Grading Policy

At the end of each course, each student is assigned a final grade as follows:

Point Range	Interpretation	Grade	Quality Points
90 – 100	Excellent	A	4.0
80 – 89	Very Good	B	3.0 – 3.9
70 – 79	Average	C	2.0 – 2.9
60 – 69	Poor	D	1.0 – 1.9
Below 60	Failure	F	0
N/A	Withdrawal	W	0
N/A	Pass	P	0
N/A	Incomplete	I	0

A student earning a grade of D or above is considered to have passed the course and is eligible to pursue further studies. A student receiving a grade of F has failed the course. A failed course must be repeated and passed to meet Avtech Institute's graduation requirements, in addition to an overall program GPA of 2.0.

Requirements for Successful Completion of the Course

At a minimum, students must achieve the following:

- A passing grade of **D** or above
- Completion of all required examinations
- Submission of all required lab exercises and projects and;
- Adherence to the school attendance policy.

Equipment Needed

Industry standard desktop computer for lab exercises.

Equipment Breakdown Lab room

Videos and Projector

Library Assignments

To be determined by the instructor.

Portfolio Assignment

Student program outcome portfolios are required to demonstrate student competencies. In conjunction with your course structure, please select a project/paper that best demonstrates what you have learned in this course and add it to your program portfolio.

Course Policies

Disruptive Behavior

Disruptive behavior is an activity that interferes with learning and teaching. Inappropriate talking during class, surfing inappropriate website, tardiness, cheating, alcohol or drug use, use of cell phone, playing lout music during class, etc. all disrupt the learning process.

Copyright Infringement

Specific exemptions to copyright infringement are made for student use in the context of learning activities. Graphic design students often download images from the Internet, or scan images from publications. As long as this work is for educational purpose, and subject to faculty permission, this is not a problem.

Plagiarism

Faculty cannot tolerate the ***misrepresentation of work as the student's own***. This often involves the use by one student or another student's design, whether voluntarily or involuntarily. In the event that plagiarism is evident and documented, all students involved in the conscious decision to misrepresent work must receive an F as the grade for the project. A second occurrence may result in suspension for the rest of the quarter, and return to the school only after a review by the Academic Standards Committee.

Attendance

Attendance and Lateness

In education and the workplace, regular attendance is necessary if individuals are to excel. There is a direct correlation between attendance and academic success. Attendance is mandatory. All students must arrive on time and prepared to learn at each class session. At the faculty member's discretion, students may be marked absent if they arrive more than 15 minutes late to any class. More that five absences in a class that meets twice per week or more that two absences in a class that meets once per week may result in a failure.

Make-Up Work

Late Projects and Homework

All projects and homework must be handed in on time. Homework should be emailed to your instructor if you are going to miss a class. Work that is submitted one week late will result in the loss of one full grade; and work that is submitted two weeks late will result in the loss of two full grades; more than two weeks late you will receive a failing grade on the project.