# Raritan Valley Community College
# Academic Course Outline

# CISY 253 - Advanced Computer Networking

## I. Basic Course Information

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| A. Course number and Title: | **CISY 253**- **Advanced Computer Networking (TCP/IP)** |
| B. New or Modified Course: | **Modified** |
| C. Date of Proposal: | Semester: **Spring** Year: **2015** |
| D. Effective Term: | Spring 2016 |
| E. Sponsoring Department | **Computer Science (CS)** |
| F. Semester Credit Hours: | **3** |
| G. Weekly Contact Hours: | **4** Lecture **2** Lab **2** |
| H. Prerequisites: | **A grade of C or better in CISY 119 – Networking Essentials** |
| I. Laboratory Fees: | **Yes, at current rate** |
| J. Department Chair: | **Dr. Tom Edmunds – tedmunds@raritanval.edu** |

## II. Catalog Description

*Prerequisite: A grade of C or better in CISY 119 - Networking Essentials* This course builds on the foundations of modern communication networks covered in CISY 119, Networking Essentials. The principle focus of this course is on the TCP/IP family of network protocols as they apply to all types of networks including LANs, WANs, and the Internet. Particular attention is directed towards the functions of the TCP/IP Protocols, the makeup of network datagrams for each protocol and the inter-dependencies of all protocols for successful communication. The topics of Network Security, IP Routing, IPv6 and Network Management are covered in some depth. Offered in the Spring Semester.

## III. Statement of Course Need

A. Computer Networks have become a common part of everyday life for business, education, and pleasure. The explosion of the Internet and growing technologies such as wireless communications and voice over IP

are causing a shortage in Network Engineers and Network Designers. This course is the second of three required courses in the Networking Curricula and gives the students an in-depth view of the TCP/IP family of protocols and services upon which the Internet is built. Detailed knowledge of TCP/IP is essential for today`s students who desire a career in networking at any level.

B. This course has a lab component. Students are required to use a Packet Sniffer (Wireshark, for example) to interpret and analyze packets on the network in the classroom in real time. Some setup of test networks will require access to the Cisco Networking Academy Lab.

C. Transferability of Course: This course generally transfers as a Computer Science Elective or a Free Elective.

## IV. Place of Course in College Curriculum

A. Free Elective

B. This course meets a program requirement for:

1. Computer Networking A.A.S. degree,
2. Computer Networking and Security Traditional Emphasis Certificate

C. This course serves as a CIS Elective on the Computer Science Elective List

D. Course Transferability: a) for New Jersey schools go to the NJ Transfer website, www.njtransfer.org; b) for all other colleges and universities, go to their individual websites.

## V. Outline of Course Content

This course explores the following topics:

NOTE: This outline may be adapted by individual Instructors in terms of sequence of presentation.

**UNIT I – Introduction to TCP/IP**

* History of TCP/IP
* TCP/IP Standards and IETF RFCs
* Review of the OSI Model
* The TCP/IP Networking Model
* Introduction to TCP/IP Protocols, Services, Encapsulation and Protocol Analysis

**UNIT II – IP Addressing**

- Class Addresses
- Special Addresses: Broadcast, Multicast, Unicast
- IP Networks, Subnets and Subnet Masks
- Introduction to CIDR, Private Addressing and NAT
- Classful Addressing Subnetting Procedures

**UNIT III – Data Link Layer Protocols used with TCP/IP**

- PPP
- Ethernet and Ethernet Frame Types
- Token Ring and Token Ring Frame Types
- ARP, RARP, Proxy ARP

**UNIT IV – Network Layer TCP/IP Protocols**

- IP Datagrams: sending, routing, fragmentation and reassembly
- IP Header Fields and Functions

**UNIT V – Internet Control Message Protocol (ICMP)**

- ICMP Header Fields and Functions
- PING, TRACEROUTE, PATHPING
- Maximum Transmission Unit (MTU)
- Security Issues with ICMP

**UNIT VI – Transport Layer TCP/IP Protocols**

- UDP – a connectionless protocol
- TCP – a connection-oriented protocol
- TCP Connection Processes
- Sequence Numbers and Positive Acknowledgement Processes
- TCP Error Recover
- TCP Congestion Control Mechanisms
- TCP Sliding Window
- TCP Header Fields and Functions

**UNIT VII – TCP Services**

- FTP and TFTP
- Telnet
- SMTP
- HTTP
- SNMP

**UNIT VIII – Domain Name System (DNS)**

- History and Background
- DNS Processes
- DNS Caching
- NSLOOKUP Command
- DNS Query/Response Model and Packet Formats

**UNIT IX – Dynamic Host Configuration Protocol (DHCP)**

- DHCP Processes
- DHCP Lease Assignment and Renewal Processes
- IP Address Management using DHCP
- DHCP Packet Structure
- DHCP Relay Agent
- DHCP Scopes

**UNIT X – Securing TCP/IP Environments**

- Principles of IP Security
- Common Points of IP Attacks
- Maintaining IP Security
- IPSec Protocol
- Firewalls and Proxy Servers
- Security Policy Development

**UNIT XI – IP Routing**

- Routing Table Construction
- Route Convergence
- Loop Avoidance Processes
- Multicast versus Broadcast Routing Updates
- Interior Gateway Protocols
- Routing to the Internet
- Securing Routers

**UNIT XII – Network Management**

- Principles of Network Management
- Simple Network Management Protocol (SNMP)

**UNIT XIII – IP Version 6 (IPv6)**

- The IPv6 Address Space
- Routing with IPv6
- Auto-configuration

## VI. General Education and Course Learning Outcomes

### A. General Education Learning Outcomes

After completion of this course, the student will be able to:

1. Apply quantitative reasoning to synthesize and interpret data and solve networking problems or diagnose their performance (GE-NJ IL)

**B. Course Learning Outcomes:**

At the conclusion of the course, students will be able to:

1. Describe the OSI Reference Model including the name and function(s) of each layer, equipment types associated with each layer, and protocols associated with each layer
2. Describe the TCP/IP Communications Model including the name and function(s) of each layer, equipment types associated with each layer, and protocols associated with each layer
3. Demonstrate the ability to decode Ethernet frames, IP packets, and TCP or UDP segments using a software Protocol Analyzer (Wireshark, for example)
4. Demonstrate the ability to perform both Classful and Classless Subnetting Techniques for IPv4 networks

**C. Assessment Instruments**

1. Laboratory Results – gather and explain data on network operations, protocol analysis, and troubleshooting (Learning Outcome 3)
2. Exam Questions designed to test abilities in four Course Learning Outcomes and General Education Goal 1 (above)

**VII. Grade Determinants**

Instruments may include:

A. Homework assigned from the text book and/or Instructor's Notes
B. Optional Research Paper
C. Class Participation
D. Periodic Examinations and/or Quizzes
E. Final Examination
F. Optional in-class exercises (other than the Lab assignments) assigned by the Instructor

## VIII. Text and Materials

Suggested Textbook--*Guide to TCP/IP Fourth Edition* by Chappell and Tittel, Prentice Hall, 2013

(Please Note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.)

## IX. Resources

A. Library (for optional research paper)
B. Computer Lab with Access to the Internet and ability to run a Network Packet Sniffer (e.g. Wireshark)
C. Access to the Cisco Academy Networking Lab