

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)**Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)**

Semester-IV

Course Title: Computer Networking

(Course Code: 4340703)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	4 th Semester

1. RATIONALE

Computers and computer networks are the sole of the computer-based information systems. In present times, whether it is small or big organization they own their private computer networks to handle computer-based information systems. Therefore in every organisation, establishing, commissioning (making operational) and maintaining secure computer networks has becomes one of the essential jobs of a diploma computer engineer too. This course is therefore designed to help the computer engineering diploma holders to develop this competency

2. COMPETENCY

The course content should be taught and implemented with the aim to develop various types of related skills leading to the achievement of the following competency

- **Use Software and hardware technology to establish, commission (make operational) and maintain secure computer networks.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

The practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

- a) Classify various types of networks base on their construction, usage and scope
- b) Differentiate OSI and TCP/IP models
- c) Select proper transmission media and devices based on network requirements.
- d) CompareIPv4 and IPv6 addressing scheme
- e) Identify various types of network security threats

6	Determine Class and Network Address for given IPv4 address and subnet mask.			IV	02	
	IPv4 address	Subnet Mask	Class			Subnet
	172.16.2.10	255.255.255.0				
	10.6.24.20	255.255.240.0				
	10.30.36.12	255.255.255.0				
7	Subnet the IP address 216.21.5.0 into 30 hosts in each subnet.			IV	02	
8	Identify valid IPv6 addresses and if invalid IPv6 address then write reason for the same: a) 2001 : db8: 3333 : 4444 : 5555 : 6666 : 7777 : 8888 b) :: c) 225.1.4.2 d) 2001: db8: : e) :: 1234 : 5678 f) 2001 : db8: : 1234 : 5678 g) 2001:0db8:0001:0000:0000:0ab9:C0A8:0102 h) fe80:2030:31:24			IV	02	
9	Study of firewall in providing network security.			V	02	
10	Run basic utilities and network commands: ipconfig, ping, tracert, netstat, pathping , route				04	
11	Micro Project				14	
	Total				38	

Note

- i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.
- ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Regularity	20
2	Problem Analysis	20
3	Development of the Solution	20
4	Testing of the Solution	20
5	Mock viva test	20
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTS AND SOFTWARE REQUIRED

These major equipment/instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure conduction of practical in all institutions across the state in proper way so that the desired skills are developed in students.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer with latest configuration with various Network management software.	3,4,5
2	Various Network devices, different types of network cables, Network Interface Card, Crimping Tool, UTP Cable Tester, Layer 2 Switch., Wireless Access point and Wireless router, Impacting Tool, Network cable connectors. Network Trainer Kit	3,4,5

7. AFFECTIVE DOMAIN OUTCOMES

The following **sample** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfil the development of this competency.

- a) Work as a leader/a team member.
- b) Follow ethical practices.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- i. 'Valuing Level' in 1st year
- ii. 'Organization Level' in 2nd year.
- iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major Underpinning Theory is formulated as given below and only higher level UOs of *Revised Bloom's taxonomy* are mentioned for development of the COs and competency in the students by the teachers. (Higher level UOs automatically includes lower level UOs in them). If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit –1: Basics of Computer Network	1 a. List the applications of Computer Networks. 1 b. Differentiate various line configurations.	1.1 Definition & need of networks 1.2 Categories of Computer Networks base on scope and connection 1.3 Line Configuration 1.4 Network Topology

	<p>1 c. Design a computer network considering particular topology.</p> <p>1 d. Categories computer network based on scope and connection</p> <p>1 e. Explain use of various types of servers.</p>	<p>1.5 Standard Organizations and Protocols</p> <p>1.6 Applications and features of different types of servers: File server, Print Server, Mail Server, Web Server, Proxy Server</p>
Unit– 2: The Reference Model for network communication	<p>2 a. List all layers of OSI and TCP/IP.</p> <p>2 b. Describe functions of each layer.</p> <p>2 c. Compare OSI and TCP/IP Model.</p>	<p>2.1 OSI model & function of each Layer</p> <p>2.2 TCP/ IP model& function of each Layer</p> <p>2.3 Comparison of OSI & TCP/IP Models</p>
Unit– 3: Transmission Media & Network devices	<p>3 a. List guided and unguided transmission media.</p> <p>3 b. Select appropriate transmission media for a given network.</p> <p>3 c. Explain use of various Network devices.</p> <p>3 d. Differentiate Layer 2 and Layer 3 Switches.</p>	<p>3.1 Types of TransmissionMedia</p> <p>3.2 Guided Media: Twisted Pair, CoaxialCable, Fiber</p> <p>3.3 Un Guided Media: Electromagnetic spectrum, Radio Transmission,MicrowaveTransmission,InfraredTransmission,SatelliteCommunication</p> <p>3.4 Network Devices: Repeaters, Hubs, Switches, Routers, Access Points, Gateways. Bridges</p> <p>3.5 Difference between Layer 2 and Layer 3 Switches.</p>
Unit–4: IP Protocol	<p>4 a. Describe IP v4 and IP v6 protocol.</p> <p>4b. Illustrate subnet and usage of subnet masking.</p> <p>4 c. Differentiate IPv4 and IPv6.</p>	<p>4.1 IPProtocol–IPv4: Characteristics, Advantages and Disadvantages, Packet structure, Address classes, Subnet & masking, Reserved Address.</p> <p>4.2 IP Protocol – IP v6: Characteristics, Addressing modes, Address types, Special Address</p> <p>4.3 Difference between IPv4 and IPv6</p>
Unit–5: Network Security Aspects	<p>5a. Define Security Basics. List and discuss various security terms, recent trends in computer security.</p> <p>5 b. Describe various types of threats that exist for computers and networks</p> <p>5 c. Describe working principle of FIREWALLS.</p>	<p>5.1 Security Basics – Confidentiality, Integrity, Availability</p> <p>5.2 Threats to security: Viruses and Worms, Intruders, Insiders, Criminal organizations, Terrorists, Information warfare</p> <p>5.3 Firewalls: working, design principles</p>

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Computer Network	07	3	6	6	15
II	The Reference Model for networkcommunication	07	3	6	0	9
III	Transmission Media & Network devices	10	6	10	0	16
IV	IP Protocol	09	4	6	10	20
V	Network Security Aspects	09	4	6	0	10
Total		42	22	34	16	70

Legends: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare small reports (of 1 to 5 pages for each activity). For micro project report should be as per suggested format, for other activities students and teachers together can decide the format of the report. Students should also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

- Undertake micro-projects in teams.
- http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php, this website gives output for various computer network practicals, students are expected to solve examples and crosscheck with output.
- An hour of problem solving for various network topology and IPv4 addresses-subnetting problems may be organized and students are encouraged to participate
- Students are encouraged to register themselves in various MOOCs such as: Swayam, edx, Coursera, Udemy etc to further enhance their learning.
- List different types of Network operating system
- Identify type of Network in your Institute.

- g) Prepare a design of Network in your Institute
- h) Visit your Institute server room and various places where Racks and servers installed, identify various Network components, collect information about installation of necessary hardware and software.
- i) Visit any ISP in your area.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) Guide student(s) in undertaking micro-projects.
- c) Managing Learning Environment
- d) Diagnosing Essential Missed Learning concepts that will help for students.
- e) Guide Students to do Personalized learning so that students can understand the course material at his or her pace.
- f) Encourage students to do Group learning by sharing so that teaching can easily be enhanced.
- g) **'CI' in section No. 4** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
- h) About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature is to be given to the students for **self-learning**, but to be assessed using different assessment methods.
- i) With respect to **section No.10**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- j) Guide students on how to address issues on environment and sustainability using the knowledge of this course

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total work load on each student due to the micro-project should be about **14 (fourteen) student engagement hours** (i.e., about one hour per week) during the course. The students ought to submit micro-project by the end of the semester (so that they develop the industry-oriented COs).

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs. Similar micro-projects could be added by the concerned course teacher:

- a) Develop a small Network. (Hands on Training.)
- b) Install Windows 2003/Windows 2008 Network operating System
- c) Install & Configure File Server.
- d) Install & Configure Print Server.
- e) Install & Configure Mail Server.
- f) Install & Configure Proxy Server.
- g) Install & Configure Web Server
- h) Install a small wireless network using access points.
- i) Set, Configure& Test secured network.
- j) Case study on any one layer of OSI model.
- k) Case study on various Line Configuration in Computer Networks
- l) Case study on guided and unguided transmission media.
- m) Case study on different types of Network devices.
- n) Case study on Difference between Layer 2 and Layer 3 Switches.
- o) Case study on various Network Services.
- p) Case study on various Network Applications
- q) Case study on IPv4 Address scheme
- r) Case study on IPv4 Address – subnetting
- s) Case study on various types of threats that exist for computers and networks
- t) Case study on different methods of dealing with threats that exist for computers and networks
- u) Case study on various physical security components that can protect any computer and network.
- v) Case study on various types of malicious software that exists.
- w) Case study on FIREWALLs.
- x) Configure Web browser security settings.
- y) Configure a system for various security experiments.
- z) Case study on Demonstration of wireless network between mobile device and PC for file transfer.
- aa) Animate any one Network topology.

13. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1.	Computer Networks	Andrew S Tannebaum & David J Wetherall	Pearson, 2012
2.	Information Technology Today	S. Jaiswal	Galgotia Publications
3.	Computer Networks	Bhushan Trivedi	Oxford University Press, 2013
4.	Data Communication & Networking,	Forouzan	Tata McGraw Hill

5.	Data&Computer Communication,	WilliamsStallings	PrenticeHallofIndia
6.	NetworksforComputer ScientistsandEngineers	YouluZheng&Shakil Akhtar	OxfordUniversityPress,2012
7.	PrinciplesOfComputerSecurityCompTIA Security+ AndBeyond(ExamSY0-301),3rd EditionBooks	Conklin, Wm. ArthurGregoryWhite,DwayneWilliams,Roger Davis,ChuckCothren ,CoreySchou	Mc Graw HillISBN:9781259061196,2012

14. SUGGESTED LEARNING WEBSITES

- a) http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php
- b) <https://www.javatpoint.com/computer-network-tutorial>
- c) <https://www.geeksforgeeks.org/basics-computer-networking>
- d) <https://nptel.ac.in/courses/106106091>
- e) https://www.cisco.com/c/en_in/products/security/what-is-network-security.html
- f) Network Simulator Tool: GNS3v0.8.5, NetSimK

15. PO-COMPETENCY-CO MAPPING

Semester IV	Computer Networking(Course Code:)									
	POs and PSOs									
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1	PSO 2	PSO 3 (If needed)
Competency Use Software and hardware technology to establish, commission (make operational) and maintain secure computer networks										
<u>Course Outcomes</u>										
CO a) Classify various types of networks base on their construction, usage and scope	2	2	-	-	-	-	1			
CO b) Differentiate OSI and TCP/IP models	2	-	-	-	-	-	1			
CO c) Select proper transmission media and devices based on network requirements.	2	2	1	1	-	-	1			
CO d) Compare IPv4 and IPv6 addressing schemes.	2	1	1	1	-	-	-			
CO e) Identify various types of network security threats	2	1	1	1	1	-	1			

Legend: '3' for high, '2' for medium, '1' for low or '-' for the relevant correlation of each competency, CO, with PO/ PSO

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE**GTU Resource Persons**

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1	Shri P. P. Kotak Principal	Government Polytechnic, Rajkot	9825469617	Kotakp2003@yahoo.com
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