



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Diploma Engineering**

**Level: Diploma**

**Branch: Mechatronics Engineering /**

**Subject Code: DI05020041**

**Subject Name: Networking System and Communication**

|                                |         |
|--------------------------------|---------|
| <b>w. e. f. Academic Year:</b> | 2026-27 |
| <b>Semester:</b>               | 5th     |
| <b>Category of the Course:</b> | PEC-04  |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Prerequisite: -</b> | ----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Rationale:</b>      | One of the major components of Mechatronics Engineering is Networking System and Communication. Through networks we can share hardware, Software, Processing, Data and Applications besides getting global connectivity for internet based communication and services. For Diploma students, It is important to understand the function of computer networks and obtain requisite knowledge about hardware and software requirements of networks and acquire skills to establish a network using necessary hardware & software tools and configure various services over it. The objectives of this course are to make students learn the technology of establishing, commissioning (making operational) and maintaining computer networks. |

## 2. Course Outcome:

After Completion of the Course, Student will able to:

| No | Course Outcomes                                                                                                                                                | RBT Level |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 01 | Analyze the key Concepts of data communication, the various physical network topologies and layered models.                                                    | R/ U      |
| 02 | Select proper transmission media and devices based on network requirements.                                                                                    | R/ U/ A   |
| 03 | Manage contemporary network infrastructures and configure fundamental network devices based on criteria and analyze Communication protocols of hardware layer. | R/ U/ A   |
| 04 | Use Internet protocols and standards.                                                                                                                          | R /U / A  |
| 05 | Understanding of network security, cryptography, IP security, web security, Information security standards.                                                    | R/U/A     |



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## 3. Suggested Specification Table with Marks (Theory):

| Sr. No. | Unit Title                                        | Teaching Hours | Distribution of Theory Marks (in %) |     |     |   |   |   | Total Marks |
|---------|---------------------------------------------------|----------------|-------------------------------------|-----|-----|---|---|---|-------------|
|         |                                                   |                | R                                   | U   | A   | N | E | C |             |
| 1.      | Fundamentals of Networking System & Communication | 08             | 04                                  | 08  | -   | - | - | - | 12          |
| 2.      | Networking Devices                                | 08             | 06                                  | 06  | 02  | - | - | - | 14          |
| 3.      | Networking System Hardware Layers                 | 13             | 06                                  | 06  | 06  | - | - | - | 18          |
| 4.      | Networking System Software Layers                 | 08             | 06                                  | 08  | 02  | - | - | - | 16          |
| 5.      | Network Security                                  | 08             | 04                                  | 04  | 02  | - | - | - | 10          |
|         |                                                   | 45             | 26                                  | 32  | 12  | - | - | - | 70          |
|         |                                                   |                | 37%                                 | 46% | 17% | - | - | - | 100%        |

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

## 4. Teaching and Examination Scheme: (\*): PA (Progressive Assessment)

| Teaching Scheme<br>(in Hours) |    |    | Total Credits<br>L+T+ (PR/2) | Assessment Pattern and Marks |       |                      |         | Total<br>Marks |
|-------------------------------|----|----|------------------------------|------------------------------|-------|----------------------|---------|----------------|
| L                             | T  | PR | C                            | Theory                       |       | Tutorial / Practical |         |                |
|                               |    |    |                              | ESE<br>(E)                   | PA(M) | PA (I)               | ESE (V) |                |
| 03                            | 00 | 02 | 04                           | 70                           | 30    | 20                   | 30      | 150            |

**Course Content:**



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| Unit No. | Course Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | No. of Hours | % of Weightage |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------|
| 1.       | <b>Fundamentals of Networking System &amp; Communication</b><br>1.1 Need, Advantages and Applications of Computer Networks<br>1.2 Physical topologies of Network<br>1.3 Internet Standards: Protocol, Interface, Services, Primitives, semantics, syntax<br>1.4 Network Classification (i) Based on Transmission Technologies: Point-to point, broadcast (ii) Based on scale: PAN, LAN, WAN, MAN, VPN, Internet (iii) Based on Architecture: Peer to Peer, Client Server, advantages of Client Server over Peer- to-Peer Model<br>1.5 Layering of Models<br>1.6 OSI and TCP/IP models and their comparison<br>1.7 Concept of Internet model.<br>1.8 Concepts in Data Communication Networking | 08           | 18%            |
| 2.       | <b>Networking Devices</b><br>2.1 Classification of Transmission Media: Role of different devices<br>2.2 Repeaters, Hubs, Bridges, Switches(layer 2 and layer 3)<br>2.3 Routers<br>2.4 Access Points<br>2.5 Introduction to Network management system (OS, CLI, administrative Functions, Interfaces)<br>2.6 Ethernet, Fast Ethernet, Gigabit Ethernet<br>2.7 Wireless LAN                                                                                                                                                                                                                                                                                                                     | 08           | 18%            |
| 3.       | <b>Networking System Hardware Layers</b><br>3.1 Physical Layer: Transmission media<br>3.2 Physical Layer Interfaces: Types of Connectors and Signals<br>3.3 Circuit switching<br>3.4 Cable modem<br>3.5 Sub Layers of Data Link Layer and functions: Error control, Flow control examples<br>3.6 Data link protocol HDLC, PPP, Multiple Access, CSMA, CSMA/CD, CSMA/CA.<br>3.9 Network Layer: Packet Switching,<br>3.10 Virtual circuits, and datagram, Static and Dynamic Routing Algorithms<br>3.11 Types of IP Addressing<br>3.12 IP layer protocols<br>3.13 IPv4 and IPv6 comparison<br>3.14 Line coding types                                                                            | 13           | 28%            |



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|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |             |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------|
| 4. | <b>Networking System Software Layers</b><br>4.1 Transport Layer: Elements of Transport protocols - TCP & UDP, Connection oriented and connection less network.<br>4.2 Application Layer: DNS- Domain Name System, Internet Services, Electronic Mail<br>4.3 Voice and Video over IP<br>4.4 Social services: Forum, Newsgroup, blog                                                                                                                   | 08        | 18%         |
| 5. | <b>Network Security</b><br>5.1 Introduction to Network Security, Cryptography, symmetric and asymmetric encryption algorithms<br>5.2 IP security: SSH and Web security<br>5.3 Information Security Standards - ISO, IT Act, Copyright Act, Cyber Laws in India.<br>5.4 IT Act 2000 Provisions and late statements<br>5.5 Social issues, Hacking, precautions<br>5.6 Firewalls: Working and Design Principle, Packet Filter Firewall , Proxy Firewall | 08        | 18%         |
|    | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>45</b> | <b>100%</b> |

## SUGGESTED PRACTICAL EXERCISES: -

Suggested Course Practical List: The Suggested list of PRACTICALS is based on Networking systems & Communication.

| Sr. No. | Practical Outcomes (PrOs)                                                                                                                                                                               | Approx. Hrs. required |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 1.      | Perform and Verify Ring topology using Trainer Kit.                                                                                                                                                     | 02                    |
| 2.      | Study about OSI model network Layers.                                                                                                                                                                   | 02                    |
| 3.      | Prepare and Test Straight UTP Cable and Cross UTP Cable.                                                                                                                                                | 02                    |
| 4.      | Study and Test various Network devices available at Department/Institute. (Repeater, Hub, Switch, Bridge, Router and Gateway).                                                                          | 02                    |
| 5.      | Determine whether following IPv4 address are valid or invalid. If valid IPv4 addresses then find class, Network and Host ID of an IPv4 address. If invalid IPv4 address then write reason for the same. | 02                    |



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|                      |                                                                                                                   |           |
|----------------------|-------------------------------------------------------------------------------------------------------------------|-----------|
| 6.                   | Determine Class and Network Address for given IPv4 address and subnet mask.                                       | 02        |
| 7.                   | Subnet the IP address 216.21.5.0/24 into 30 hosts in each subnet.                                                 | 02        |
| 8.                   | Identify valid IPv6 addresses and if invalid IPv6 address then write reason for the same.                         | 02        |
| 9.                   | Study of firewall in providing network security.                                                                  | 02        |
| 10.                  | Run basic utilities and network commands: ipconfig, ping, tracert, netstat, pathping, route.                      | 02        |
| 11.                  | List different adapters in any computer/ laptop and configure network connection in your institute/ premises LAN. | 02        |
| 12.                  | Introduction to Network Simulator Tool Packet Tracer Simulator.                                                   | 02        |
| 13.                  | Building a Simple Network.                                                                                        | 02        |
| 14.                  | Using Wireshark to View Network Traffic.                                                                          | 02        |
| 15.                  | Building Ethernet Straight and Crossover Cable.                                                                   | 02        |
| 16.                  | Build a Simple Two Computers Network and Verify the Connectivity in Packet Tracer Simulator.                      | 02        |
| 17.                  | Configure and Verify the Basic Switch Settings by using 2960 Switch.                                              | 02        |
| 18.                  | Set Various Passwords on 1941 Router and Verify those Passwords.                                                  | 02        |
| 19.                  | Configure and Verify the Basic Router Settings by using 1941 Router.                                              | 02        |
| 20.                  | Inter-virtual LAN Configuration using Legacy Inter- Virtual LAN Routing.                                          | 02        |
| 21.                  | Implement Spanning Tree Protocol using Three Switches.                                                            | 02        |
| 22.                  | Router as a Server and as a Client Configuration using DHCPv4 Protocol.                                           | 02        |
| <b>Total (Hours)</b> |                                                                                                                   | <b>44</b> |

**Note :-** 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.



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## 7. Notes: -

**I.** More Practical Exercises can be designed and offered by the concerned course teacher to develop the industry-relevant skills/outcomes to match the COs. The above table is only a representative list.

**II.** It is compulsory to prepare log book/continuous records of exercises. It is also required to get each exercise recorded in log book/continuous records, checked and duly dated signed by teacher. CA component of practical marks is dependent on continuous and timely evaluation of exercises.

**III.** Term work report must not include any photocopy/ies, printed manual/pages, litho, etc. It must be hand written / hand drawn by student only.

a. Brief details of industry visited.

b. Type, location, products, rough layout, human resource, etc., of industry.

c. Details, description and broad specifications of machineries/processes observed.

d. Safety norms and precautions observed.

e. Student's own observation on industrial environment, productivity concepts, quality consciousness and quality standards, cost effectiveness, culture and attitude.

f. Any other details/ observations asked by accompanying faculty.

**IV.** For practical ESE part, students are to be assessed for competencies achieved. They should be assigned the necessary data and should be given any one experience to perform. 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.

## References/Suggested Learning Resources:

### (a) Books:

| Sr. No | Title of Book                     | Author                                      | Publication                                            |
|--------|-----------------------------------|---------------------------------------------|--------------------------------------------------------|
| 1.     | Data Communication and Networking | Forouzen                                    | Tata McGraw Hill, Education New Delhi (Latest edition) |
| 2.     | Computer Networks                 | Tannebaum Andrew S<br>Wetherall<br>David J. | Pearson, New Delhi, 5th Edition, 2011                  |
| 3.     | Data and Computer Communication   | Stallings Williams                          | PHI Learning, New Delhi (Latest edition)               |
| 4.     | Data Communication Networks       | Sharma Sanjay                               | S.K. Kataria and Sons, New Delhi (Latest edition)      |



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**(a) Open-source software and website:**

- <https://www.netacad.com/courses/packet-tracer>
- <https://www.javatpoint.com/computer-network-architecture>
- <https://www.geeksforgeeks.org/>
- [https://www.cisco.com/c/en\\_in/products/security/what-is-network-security.html](https://www.cisco.com/c/en_in/products/security/what-is-network-security.html)

**Major Equipment / Instruments and Software Required**

|    | Equipment Name with Broad Specifications                                                                                                  |
|----|-------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Computer with latest configuration with network management software                                                                       |
| 2. | Network Devices Hub, Switch, Router, Network Access point                                                                                 |
| 3. | Simulator:- Cisco Packet Tracer <a href="https://www.netacad.com/courses/packet-tracer">https://www.netacad.com/courses/packet-tracer</a> |
| 4. | Simulator:- Wireshark – network packet analyzer                                                                                           |
| 5. | Network Cables Twisted Pair, Coaxial and Fiber Optics                                                                                     |
| 6. | Crimping Tool                                                                                                                             |
| 7. | Cable Tester                                                                                                                              |
| 8. | Network cable connector                                                                                                                   |

**Suggested Project List& 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 groups and prepare reports of each activity.

- a) Construct a Chart of Small Network
- b) Undertake micro-projects in teams.
- c) Prepare charts to explain types of Network.
- d) Students are encouraged to register themselves in various MOOCs such as: Swayam to further enhance their learning.
- e) 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.

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