Program Name	: Diploma in Information Technology
Program Code	: IF
Semester	: Fourth
Course Title	: Computer Networks
Course Code	: 22417

1. RATIONALE

To utilize the potential of Information and communication technology fully, all workplaces contain computers, and they are invariably interconnected. Apart from at home and in the office, computer networks are present in all domains of work. This demands increased need of skilled man power and well trained work force to create and maintain computer networks. This course introduce basic concept of networks, network classification, network topologies, network devices, Network communication models, concept of TCP/IP protocols, IP addressing to help the students to setup computer network and apply current Computer Network technology to maintain it.

2. COMPETENCY

The aim of this course is to help the student to attain the following *industry identified* competency through various teaching learning experiences:

- **Setup different types of computer networks.**

3. COURSE OUTCOMES (COs)

The theory, 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. Use basic concepts of networking for setting-up computer networks.
b. Setup a computer network for specific requirements.
c. Configure basic network services.
d. Configure the different TCP/IP services.
e. Implement subnetting for improved network address management.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
					Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.
**Legends: L**-*Lecture;* **T** – *Tutorial/Teacher Guided Theory Practice;* **P** - *Practical;* **C** – *Credit,* **ESE** - *End Semester Examination;* **PA** - *Progressive Assessment.*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.
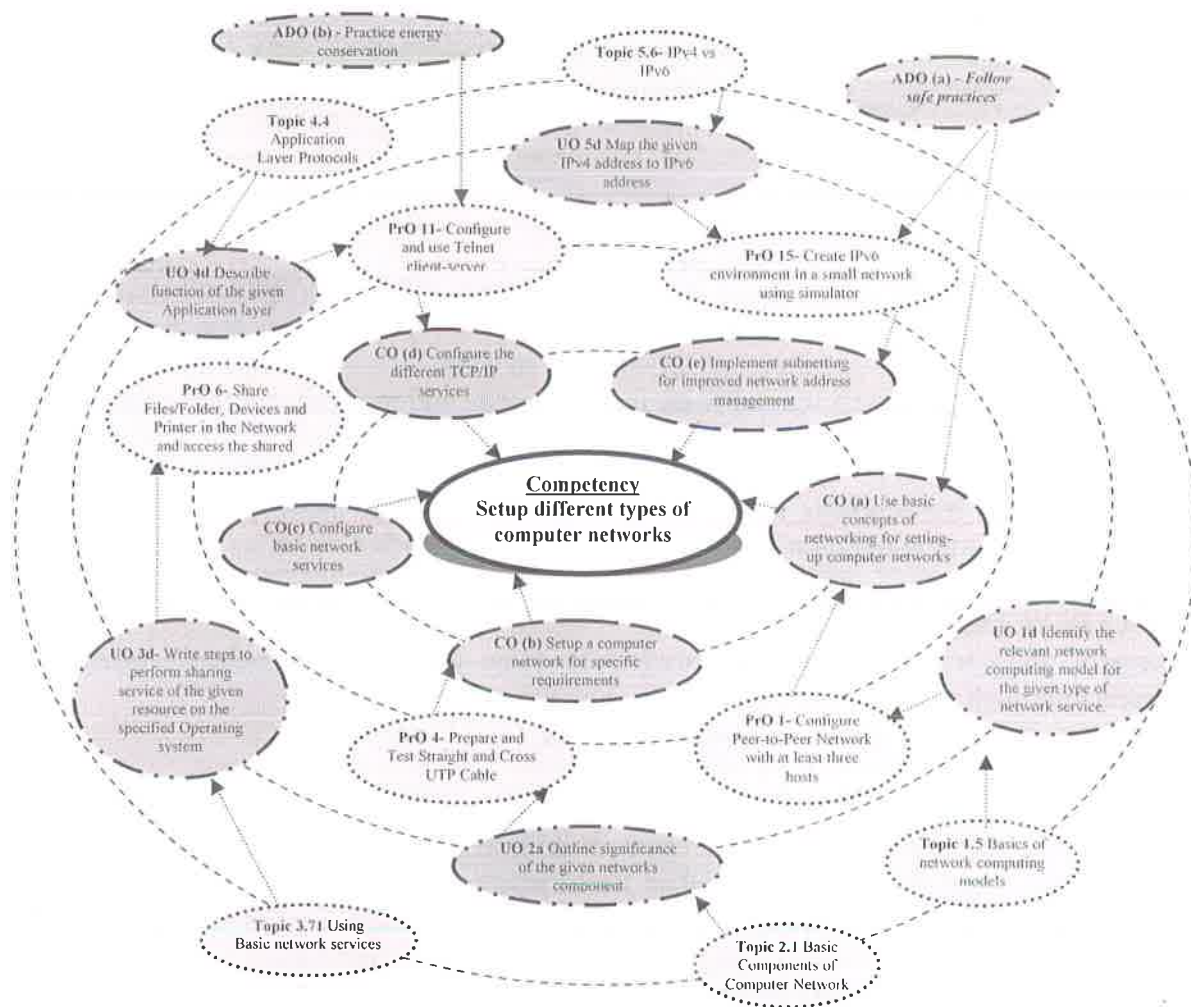
Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Configure Peer-to-Peer Network with at least three hosts.	I	02*
2.	Create a small physical network using compuers, Network connecting device and cables.	II	02*
3.	Draw the network layout with its topology for network set-up of your Laboratory .	II	02
4.	Prepare and Test Straight and Cross UTP Cable.	II	02
5.	Install and configure Network Interface Card and identify its MAC Address.	II	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
6.	Share Files/Folder, Devices and Printer in the Network and access the shared resource from the other node.	III	02*
7.	Run the following TCP/IP Commands with Options and record their output: Ping, ipconfig, Tracert, Netstat, Wireshark, ARP	III	02*
8.	Use Wireshark packet sniffer software and capture TCP, UDP, IP, ARP, ICMP, Telnet, FTP packets.	IV	02
9.	Setup FTP Client/ Server and Transfer the file using FTP.	IV	02*
10.	Install TCP/IP Protocols and configure Advanced features of TCP/IP Protocols like IP address, subnetmask, gateway, primary and secondary DNS.	IV	02*
11.	Configure and use Telnet client-server.	IV	02
12.	Configure and work with Remote desktop application available with Operating System.	IV	02
13.	Configure DHCP server.	IV	02*
14.	Create two subnets and impement it with calculated subnet masking.	IV	02*
15.	Create IPv6 environment in a small network using simulator (preferably open source based) Part-I	V	02*
16.	Create IPv6 environment in a small network using simulator (preferably open source based) Part-II	V	02*
	Total		32

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Completion of given task.	25
2	Correctness of the given task.	50
3	Answer to sample questions.	15
4	Submit report in time.	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

    a. Follow safety practices.
    b. Practice good housekeeping.
    c. Demonstrate working as a leader/a team member.
    d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs

according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:
- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Networked computers.	All
2	UTP Cable CAT 6, Crimping Tool, Punch Tool, Network Cable Tester, RJ45 Connectors and switch with minimum 8 ports.	02
3	Network Interface Card	05
4	Wireshark packet sniffer software.	10

8.   UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Fundamentals of Computer Network	1a. Outline benefits of the given computer network application. 1b. Classify Computer Network based on the given criteria. 1c. Describe the steps to share the given network resource on the specified Operating System . 1d. Select the relevant network computing model for the given type of network service with justification. 1e. Elaborate the given feature of NOS.	1.1 Needs, uses of Computer Network, Applications of Computer Network, Advantages/Benefits of Computer Network: Sharing of Information, Sharing Resources, Centralized management of resources, Backing up of data 1.2 Classification of Networks: Geographical Classification, Classification Based on Transmission Technology, Classification Based on Network Relationships 1.3 Basics of network computing models: per-to peer, client sever, distributed 1.4 Network Operating System (NOS): its types, features.
Unit-II Network Components and Topologies	2a. Outline the significance of the given networks component. 2b. Explain the function of the given network connecting device. 2c. Explain merits/demerits of the specified type of network topology. 2d. Write the cable/connector/ connecting device requirement to	2.1 Basic Components of Computer Network : cables, Host, Communication Subnet, NIC. 2.2 Network Devices and their role : Repeaters. Hub. Bridge. Switches. Router, and Gateway 2.3 Wireless Infrastructure components : Access point.Clients.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	implement the given network topology. 2e. Describe the procedure to set up the computer network for the given requriment	2.4 Network Topologies: Concept, Significance, Bus, Star, Ring, Tree, Mesh, Hybrid.
Unit– III Reference Models for Computer Networks.	3a. Describe the significance of the given design issue for layering in Protocol. 3b. Explain major functions of the given layer of OSI Reference Model. 3c. Explain major functions of the given layer of TCP/IP protocol suit. 3d. Write steps to perform sharing service of the given resource on the specified Operating system. 3e. Describe the procedure to configure the given type of computer network.	3.1 Protocol Hierarchies- Layered Approach 3.2 Interfaces, Services, Protocols and Packets 3.3 Design issues for layering. 3.4 OSI reference Model: Layers and their functions. 3.5 TCP/IP Protocol: Layers and their functions 3.6 OSI Model Vs. TCP/IP 3.7 Using Basic network services: File sharing, Print sharing, Device sharing
Unit– IV TCP/IP Protocol Suite	4a. Explain the salient fatures of the given Host–to-Network Layer Protocol. 4b. Explain the working of the given internet layer protocol. 4c. Identify the use of TCP or UDP at transport layer, based on functioning of the given application layer protocol. 4d. Describe function of the given Application layer protocol. 4e. Describe the procedure to configure the given type of TCP/IP services.	4.1 Host –to- Network Layer Protocols: SLIP, PPP 4.2 Internet Layer Protocols: IP, ARP, RARP, ICMP. 4.3 Transport Layer Protocols: TCP, UDP. 4.4 Application Layer Protocols: FTP, HTTP, SMTP, TELNET, DNS, BOOTP, DHCP
Unit –V IP Addressing	5a. Calculate address range of hosts on each subnet for the given IP address. 5b. Calculate subnet mask for the given subnet. 5c. Illustrate the method of multicast operation usig given IP address. 5d. Map the given IPv4 address to IPv6 address	5.1 Addressing: Physical Address, Logical Address, Prot Address, 5.2 IP Address: Concept, Notation, Addres Space 5.3 IPv4 Addressing: Classes, Subnet Mask, Subnetting, Supernetting. 5.4 Unicast, Multicast, Broadcast Address, Multicast operation . 5.5 IPv6 adress, basic structure 5.6 IPv4 vs IPv6

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

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	Fundamentals of Computer Network	08	04	06	04	14
II	Network Components and Topologies	12	06	04	06	16
III	Reference Models for Computer Networks.	10	04	08	04	16
IV	TCP/IP Protocol Suite	08	02	06	04	12
V	IP Addressing	10	02	04	06	12
	Total	**48**	**18**	**28**	**24**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note: *This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of 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 reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:
   a. Draw OSI Reference model viz a viz TCP/IP protocol stack on chart.
   b. Prepare chart showing wire color coding for making UTP cable and straight cable.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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. **'L' in item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
   c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
   d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
   e. Use animations to explain various theorems in circuit analysis.
   f. Guide student(s) in undertaking micro-projects.

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. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three.**
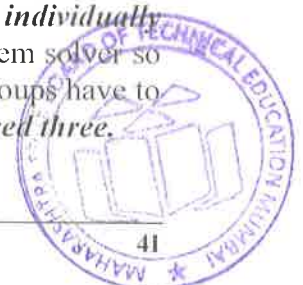
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

a. **Survey on Guided Transmission media:** Prepare a report on recent and widely used Guided media in industries depending on Cost, speed, efficiency, reliability.

b. **Survey on Unguided Transmission Media:** Prepare a report on recent and widely used Unguided media in industries depending on Cost, speed, efficiency, reliability.

c. **Present design of computer network for the institute spread across a campus with several buildings:** Elaborate/justify the Network for Inter building connectivity and within building. Present layout plan highlighting type of network selected, devices required, addressing used/servers used.

d. **Survey on Structured cabling with CAT(5/5e/6/6a..):** Prepare a report on structured cabling system. Elaborate its importance, components, devices (passive and/active) required with their broad specifications for structured cabling with UTP cables.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Computer Networks	Tanenbaum , Andrew S.	PHI Learning, New Delhi, ISBN-13: 978-0-13-212695-3
2	TCP/IP PROTOCOL SUITE	Forouzan, Behrouz A.	McGraw Hill, New Delhi, 2006, ISBN 978-0-07-337604-2
3	Data communications and networking.	Forouzan, Behrouz A.	McGraw Hill, New Delhi, 2006, ISBN : 9780-07-296775-3
4	Data Communication and Networks	Godbole, Achyut	McGraw Hill, New Delhi, 2006, ISBN : 0070472971
5	Computer Networking	T.M.Bansod	
6	Computer Network Top down approach	Korus	Pearson.

14. SOFTWARE/LEARNING WEBSITES

a. http://www.nptelvideos.in/2012/11/computer-networks.html
b. http://nptel.ac.in/courses/106105081/1
c. http://freevideolectures.com/Course/2276/Computer-Networks
d. https://www.youtube.com/playlist?list=PL5419FC33483A2563
e. http://nptel.ac.in/downloads/106105080/
f. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Computer%20networks/ New_index1.html
g. http://www.studytonight.com/computer-networks/
h. http://homepages.herts.ac.uk/~comqrgd/docs/network-notes/network-notes.pdf
i. http://studentstudyhub.com/wp-content/uploads/2013/12/CN-Full-Notes-Download-1st-Part.pdf