COMPUTER NETWORKS		Semester	V
Course Code	**BCS502**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/practical		

Course objectives:

This course will enable students to,

- Study the TCP/IP protocol suite, switching criteria and Medium Access Control protocols for reliable and noisy channels.
- Learn network layer services and IP versions.
- Discuss transport layer services and understand UDP and TCP protocols.
- Demonstrate the working of different concepts of networking layers and protocols.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters student's Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

MODULE-1

Introduction: Data Communications, Networks, Network Types, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer: Transmission media, Guided Media, Unguided Media: Wireless. Switching: Packet Switching and its types.
Textbook: Ch. 1.1 - 1.3, 2.1 - 2.3, 7.1 – 7.3, 8.3.

MODULE-2

Data Link Layer: Error Detection and Correction: Introduction, Block Coding, Cyclic Codes. Data link control: DLC Services: Framing, Flow Control, Error Control, Connectionless and Connection Oriented, Data link layer protocols, High Level Data Link Control. Media Access Control: Random Access, Controlled Access. Check Sum and Point to Point Protocol
Textbook: Ch. 10.1-10.4, 11.1 -11.4, 12.1 - 12.2

MODULE-3

Network Layer: Network layer Services, Packet Switching, IPv4 Address, IPv4 Datagram, IPv6 Datagram, Introduction to Routing Algorithms, Unicast Routing Protocols: DVR, LSR, PVR, Unicast Routing protocols: RIP, OSPF, BGP, Multicasting Routing-MOSPF
Textbook: Ch. 18.1, 18.2, 18.4, 22.2,20.1-20.3, 21.3.2

MODULE-4

Introduction to Transport Layer: Introduction, Transport-Layer Protocols: Introduction, User Datagram Protocol, Transmission Control Protocol: services, features, segments, TCP connections, flow control, Error control, Congestion control.
Textbook: Ch. 23.1- 23.2, 24.1-24.3.4, 24.3.6-24.3.9

MODULE-5

Introduction to Application Layer: Introduction, Client-Server Programming, Standard Client-Server Protocols: World Wide Web and HTTP, FTP, Electronic Mail, Domain Name System (DNS), TELNET, Secure Shell (SSH)

Textbook: Ch. 25.1-25.2, 26.1-26.6

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth, and find the number of packets dropped.
2	Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3	Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4	Develop a program for error detecting code using CRC-CCITT (16- bits).
5	Develop a program to implement a sliding window protocol in the data link layer.
6	Develop a program to find the shortest path between vertices using the Bellman-Ford and path vector routing algorithm.
7	Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
8	Develop a program on a datagram socket for client/server to display the messages on client side, typed at the server side.
9	Develop a program for a simple RSA algorithm to encrypt and decrypt the data.
10	Develop a program for congestion control using a leaky bucket algorithm.

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:
- **Explain** the fundamentals of computer networks.
- **Apply** the concepts of computer networks to demonstrate the working of various layers and protocols in communication network.
- **Analyze** the principles of protocol layering in modern communication systems.
- **Demonstrate** various Routing protocols and their services using tools such as Cisco packet tracer.

Note: For the Simulation experiments modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude using NS2 or NS3. Installation procedure of the required software must be demonstrated, carried out in groups, and documented in the report. Non simulation programs can be implemented using Java.

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE

(Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

● IPCC means practical portion integrated with the theory of the course.

● CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.

● 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

● Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.

● The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

● **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.

● On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.

● The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.

● The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**

● Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.

● The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scoredby the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:
Textbook:

1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, Tata McGraw-

Hill,2013.

Reference Books:

1. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2019.
2. Nader F. Mir: Computer and Communication Networks, 2nd Edition, Pearson Education, 2015.
3. William Stallings, Data and Computer Communication 10th Edition, Pearson Education, Inc., 2014.

Web links and Video Lectures (e-Resources):

1. https://www.digimat.in/nptel/courses/video/106105183/L01.html
2. http://www.digimat.in/nptel/courses/video/106105081/L25.html
3. https://nptel.ac.in/courses/10610

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Implementation of various protocols using open source simulation tools. (5 marks)
- Simulation of Personal area network, Home area network, achieve QoS etc. (5 marks)