**Suggested Learning Resources:**

**Textbooks**

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman," Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson.
2. Alfred V.Aho, Monica S.Lam,Ravi Sethi, Jeffrey D. Ullman, " Compilers Principles, Techniques and Tools", Second Edition,Perason.

**Reference:**

1. Elain Rich, "Automata,Computability and complexity", 1st Edition, Pearson Education,2018.
2. K.L.P Mishra, N Chandrashekaran , 3rd Edition , 'Theory of Computer Science",PHI,2012. 3.

Peter Linz, "An introduction to Formal Languages and Automata ", 3rd Edition, Narosa Publishers,1998.

4. K Muneeswaran, "Compiler Design", Oxford University Press 2013.

**Weblinks and Video Lectures (e-Resources):**

1. https://nptel.ac.in/courses/106/106/106106049/#
2. https://nptel.ac.in/courses/106/104/106104123/ 3.

https://www.jflap.org/

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

Group Activities, quizzes, Puzzles and presentations

HOD's Signature
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Dept. Of Information Science & Engineering
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**V Semester**

| COMPUTER NETWORKS | | | |
|---|---|---|---|
| Course Code: | 21CS52 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40T + 20P | Total Marks | 100 |
| Credits | 04 | Exam Hours | 03 |

**Course Objectives:**

CLO 1. Fundamentals of data communication networks.
CLO 2. Software and hardware interfaces
CLO 3. Application of various physical components and protocols
CLO 4. Communication challenges and remedies in the networks.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which 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 students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

**Module-1**

**Introduction to networks**: Network hardware, Network software, Reference models,

**Physical Layer:** Guided transmission media, Wireless transmission

**Textbook 1: Ch.1.2 to 1.4, Ch.2.2 to 2.3**

***Laboratory Component:***

**1.** Implement Three nodes point – to – point network with duplex links between them for different topologies. 1Set the queue size, vary the bandwidth, and find the number of packets dropped for various iterations.

| **Teaching-Learning Process** | Chalk and board, Problem based learning, Demonstration |
|---|---|

**Module-2**

**The Data link layer:** Design issues of DLL, Error detection and correction, Elementary data link protocols, Sliding window protocols.

**The medium access control sublayer:** The channel allocation problem, Multiple access protocols.

**Textbook 1: Ch.3.1 to 3.4, Ch.4.1 and 4.2**

***Laboratory Component:***

1. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the throughput with respect to transmission of packets
2. Write a program for error detecting code using CRC-CCITT (16- bits).

| **Teaching-Learning Process** | Chalk and board, Problem based learning, Demonstration |
|---|---|

**Module-3**

**The Network Layer:**
Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, QoS.

**Textbook 1: Ch 5.1 to 5.4**

***Laboratory Component:***

1. 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 in the network.
2. Write a program to find the shortest path between vertices using bellman-ford algorithm.

| **Teaching-Learning Process** | Chalk and board, Problem based learning, Demonstration |
|---|---|

**Module-4**

**The Transport Layer:** The Transport Service, Elements of transport protocols, Congestion control, The internet transport protocols.

**Textbook 1: Ch 6.1 to 6.4 and 6.5.1 to 6.5.7**

***Laboratory Component:***

1. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
2. Write a program for congestion control using leaky bucket algorithm.

| **Teaching-Learning Process** | Chalk and board, Problem based learning, Demonstration |
|---|---|

**Module-5**

**Application Layer:** Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service.

**Textbook 2: Ch 2.1 to 2.4**

| **Teaching-Learning Process** | Chalk and board, Problem based learning, Demonstration |
|---|---|

**Course Outcomes (Course Skill Set)**

At the end of the course the student will be able to:

CO 1. Learn the basic needs of communication system.
CO 2. Interpret the communication challenges and its solution.
CO 3. Identify and organize the communication system network components CO
4. Design communication networks for user requirements.

**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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and 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 **Continuous Internal Evaluation:**

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5$^{th}$ week of the semester
2. Second test at the end of the 10$^{th}$ week of the semester
3. Third test at the end of the 15$^{th}$ week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4$^{th}$ week of the semester
5. Second assignment at the end of 9$^{th}$ week of the semester

Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to **20 marks**.

- Rubrics for each Experiment taken average for all Lab components – 15 Marks.
- Viva-Voce– 5 Marks (more emphasized on demonstration topics)

The sum of three tests, two assignments, and practical sessions will be out of 100 marks and will be **scaled down to 50 marks**
(to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).
**CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

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

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 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.

The students have to answer 5 full questions, selecting one full question from each module

**Suggested Learning Resources:**

**Textbooks:**

1. Computer-Networks- Andrew S. Tanenbaum and David J. Wetherall, Pearson Education, 5thEdition. (www.pearsonhighered.com/tanenbaum)
2. Computer Networking A Top-Down Approach -James F. Kurose and Keith W. RossPearson Education 7th Edition.

**Reference Books:**

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill,Indian Edition
2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER

**Weblinks 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/106105081
4. VTU e-Shikshana Program

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning** Simulation of Personal area network, Home area network, achieve QoS etc.

**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. 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

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