**Shyama Prasad Mukherji College**

**Teaching Plan**

**July-2022 - December 2022**

**Course and Year:** B.Sc (H) Computer Science 2nd Year

**Semester:** III

**Taught individually or shared:** Individual

**Paper:** Computer Networks (32341303)

**Faculty:** Manish Kumar Singh

**No. of Classes** (per week)**:** 4 Lectures, 4 Practicals

**Paper Objective:**

This course covers the concepts of data communication and computer networks. It comprises the study of the standard models for the layered protocol architecture to communicate between autonomous computers in a network and also the main features and issues of communication protocols for different layers. Topics covered include introduction to OSI and TCP/IP models also.

**Paper Learning Outcomes:**

On successful completion of the course, the student will be able to:

1. Describe the hardware, software components of a network and their interrelations.

2. Compare OSI and TCP/IP network models.

3. Describe, analyze and compare different data link, network, and transport layer protocols.

4. Design/implement data link and network layer protocols in a simulated networking

environment.

| **Paper Structure & Readings** |
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| **Name of the Unit**  Unit 1 Introduction  Unit 2 Network Architecture Models  Unit 3 Physical Layer  Unit 4 Data Link MAC Layer  Unit 5 Network layer  UNIT 6 Transport and Application Layer  UNIT 7 Protocols |
| **Readings prescribed in the syllabus for each unit**  *Unit 1 Introduction*  Forouzan, B. A. (2017). *Data Communication and Networking*. McGraw-Hill Education  *Unit 2 Network Architecture Models*  Forouzan, B. A. (2017). *Data Communication and Networking*. McGraw-Hill Education  *Unit 3 Physical Layer*  Forouzan, B. A. (2017). *Data Communication and Networking*. McGraw-Hill Education  *Unit 4 Data Link MAC Layer*  Tanenbaum, A.S. & Wethrall, D.J. (2012). *Computer Networks*. Pearson Education  *Unit 5 Network layer*  Tanenbaum, A.S. & Wethrall, D.J. (2012). *Computer Networks*. Pearson Education  *UNIT 6 Transport and Application Layer*  Tanenbaum, A.S. & Wethrall, D.J. (2012). *Computer Networks*. Pearson Education  *UNIT 7 Protocols*  Tanenbaum, A.S. & Wethrall, D.J. (2012). *Computer Networks*. Pearson Education |
| **Readings, e- references to be given to students but not prescribed in syllabus (if any) for each unit-** Apart from topics covered in syllabus, these links will help to study the applications of topics covered in curriculum and how they connect and relate to other subjects in the course.   1. Kozierok, C.M. The TCP/IP Guide, free online resource. (2005.). Retrieved from http://www.tcpipguide.com/free/index.htm 2. Kurose, J. F., & Ross, K. W. (2017). Computer Networking: A Top-Down Approach. Pearson Education India 3. Stallings, W. (2017). Data and Computer Communications. 10th edition. Pearson Education India. 4. <https://www.youtube.com/watch?v=VwN91x5i25g&list=PLBlnK6fEyqRgMCUAG0XRw78UA8qnv6jEx> 5. <https://www.youtube.com/watch?v=3DZLItfbqtQ&list=PL32DBC269EF768F74> 6. <https://www.youtube.com/watch?v=g8iY36onLeM&list=PLWPirh4EWFpHJrW1D9UB24wsbM3zx7QMx> 7. <https://www.youtube.com/watch?v=sP1e4LdIMc&list=PLks8W396lro58gvpKXIiPdGvqptoomLA3> 8. <https://www.youtube.com/watch?v=UXMIxCYZu8o&list=PLEbnTDJUr_IegfoqO4iPnPYQui46QqT0j> 9. <https://www.youtube.com/watch?v=n2D1o-aM-2s&list=PLh94XVT4dq02frQRRZBHzvj2hwuhzSByN> |
| **No of classes required to complete the unit (approx.):**  Unit 1 4  Unit 2 5  Unit 3 6  Unit 4 20  Unit 5 14  UNIT 6 8  UNIT 7 3 |

**Detailed Teaching/Lesson Plan**

| Week | Topics to be covered |
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| 1 | OBJECTIVE:   * To provide answers to the following questions to pupils: what is Computer Network and why do we need it, what are the various Computer Networks available and how simply it can be configured. * To further explain the concept of Internet and how it is different from Intranet |
| KEY TOPICS:  Introduction to Computer Networks: Network definition, types of computer networks, Internet, intranet, network topologies, and network classifications. |
| EVALUATION:  TWO separate Assignments on the Topic of INTRODUCTION TO DATA COMMUNICATION, NETWORK TOPOLOGIES, and NETWORK MISCELLANEOUS FUNDAMENTAL TOPICS |
| 2 | OBJECTIVE:   * To explain the various metrics for determining the NETWORK PERFORMANCE * To discuss the various issues observed in achieving an effective COMPUTER NETWORK |
| KEY TOPICS:  Network Performance issues and concepts: Putting network performance in perspective, balancing network performance with key non-performance characteristics. Performance measurements: speed, bandwidth, throughput and latency; simplex, half duplex and full duplex operation; Quality of service. |
| EVALUATION:  One Assignments on the Topic of NETWORK PERFORMANCE & ISSUES |
| 3 | OBJECTIVE:   * To provide the details regarding need for Network Model while setting Computer Network * To provide overview of OSI Model * To Provide overview of TCP/IP Reference Model |
|  | KEY TOPICS:  Network Architecture Models: Layered Approach, OSI Reference Model, TCP/IP Reference Model. |
|  | EVALUATION:  Two separate assignments on the topics – OSI MODEL, and TCP/IP REFERENCE MODEL |
| 4, 5 | OBJECTIVE:   * To discuss the various Network devices used on frequent basis in the area of Computer Networks * To provide details of Data and Signals at Physical Layer * To explain the concept of Digital Transmission and various encoding techniques used at Physical Layer * To explain the concept of Analog Transmission and the need of constellation diagram. * To describe how to utilize link bandwidth through Multiplexing |
| KEY TOPICS:  Network devices: hubs, switches, bridges, routers, gateways. Physical Layer: Analog signal, digital signal. Physical Layer: digital modulation techniques (ASK, PSK, QAM), encoding techniques, frequency division multiplexing, time division multiplexing. |
| EVALUATION:   * Four separate assignments on the topics – DATA & SIGNALS, DIGITAL TRANSMISSION, ANALOG TRANSMISSION, and MULTIPLEXING * 50 Marks Online Test on the topics taught so far |
| 6 | OBJECTIVE:   * To explain the concept of Switching and types in Computer Networks * To provide the overview of Key Data Link Layer concerns – Services, Framing and Flow Control |
| KEY TOPICS:  Physical Layer: switching techniques- Circuit, packet and message switching, guided transmission media, wireless transmission, satellite communication.  Data Link Layer: data link layer services, framing and flow control. |
| EVALUATION:  Two separate assignments on the topics – SWITCHING IN COMPUTER NETWORKS, and DATA LINK LAYER. |
| 7, 8 | OBJECTIVE:   * To discuss the need of error detection and correction in Computer Networks * To explain the ERROR DETECION MECHANISMS used at Data Link Layer * To explain the ERROR CORRECTION MECHANISM used at Data Link Layer * To simulate CRC Error Detection Mechanism on System through C++ Programming in Lab * To simulate HAMMING CODE Error Correction Mechanism on System through C++ Programming in Lab |
| KEY TOPICS:  Data Link Layer: error-detection and correction techniques error recovery protocols (stop and wait (for noiseless and noisy environment)). |
| EVALUATION:   * Two separate assignments on the topics – ERROR DETECTION MECHANISMS, and ERROR CORRECTION MECHANISMS * 4 Labs for the simulation of each topics through C++ Language - ERROR DETECTION MECHANISMS, and ERROR CORRECTION MECHANISMS |
| 9, 10, 11 | OBJECTIVE:   * To discuss the need of error recovery protocols in Computer Networks. * To explain the DLL Protocols needed for Noiseless channel * To explain the DLL Protocols needed for Noisy channel * To simulate STOP-AND-WAIT ARQ Protocol on System through C++ Programming in Lab * To simulate GO-BACK-N ARQ Protocol on System through C++ Programming in Lab * To simulate SELECTIVE REPEAT ARQ Protocol on System through C++ Programming in Lab * To explain the concept of Point-to-Point Protocol in DLL. |
| KEY TOPICS:  Data Link Layer Protocols: For Noiseless Channel, For Noisy Channel (Stop-and-Wait ARQ, go back n ARQ, selective repeat ARQ), point-to- point protocol. |
| EVALUATION:   * One complete assignment covering the key topics * 4 Labs for the simulation of each topics through C++ Language - STOP-AND-WAIT ARQ Protocol, GO-BACK-N ARQ Protocol, and SELECTIVE REPEAT ARQ Protocol. |
| 12 | OBJECTIVE:   * To explain the concept of Routing Algorithms of Network Layer * To describe the concept of IP Addressing in Network Layer * To simulate IP Addressing on System through C++ Programming * To discuss various Network Layer Protocols |
| KEY TOPICS:  Network layer: Routing- distance vector and link state routing, Network Layer Protocols- ARP, IPV4, ICMP, IPV6. |
| EVALUATION:   * One complete Assignment on the key topics of Network Layer * 4 Labs for the simulation of IP Addressing through IP Address * 50 Marks Online Test on the topics taught b/w Week-6 to 11 |
| 13 | OBJECTIVE:   * To explain the fundamentals functionalities of Transport Layer including Process to Process Delivery, Connection related understanding, Ports based services. * To explain the TCP Protocols including UDP and TCP/IP. |
| KEY TOPICS:  Transport Layer: Process to process Delivery- client server paradigm, connectionless versus connection-oriented service, reliable versus unreliable; user datagram Protocol- well known ports, user datagram.  Transport Layer: UDP Operation, use of UDP, TCP/IP protocol - well known ports, TCP Service, features. |
| EVALUATION:   * One complete Assignment on the key topics of Transport Layer |
| 14 | OBJECTIVE:   * To explain the concept of Connection Establishment and Flow Control Mechanism in Transport Layer * To explain the key services of Application Layer and various Protocols, specifically DNS, WWW, HTTP * To describe the concept of Uniform Resource Locator |
| KEY TOPICS:  Transport Layer: TCP connection establishment and release, Flow Control.  Application Layer: Domain name space, Distribution of Name space, DNS in the Internet, Resolution. WWW and HTTP, Architecture- Client server model,  Uniform Resource Locator, HTTP-Transaction, HTTP operational model and client server communication, HTTP message format. |
| EVALUATION:  Two separate Assignments on the topics – MISCELLANEOUS CONCEPTS OF TRANSPORT LAYER, and APPLICATION LAYER |
| 15 | OBJECTIVE:   * To revisit the topics discussed so far in the form of Semantic Net. * To take over the doubts (if any) of pupil * To provide mentorship to pupil how to appear for Computer Network Paper related Exam |
| EVALUATION:  A 75 marks mock test of Computer Network Paper. |

| **Teaching Learning Process**   * Use of Projector for Clear Visibility and Collar Mic for Proper audio during classroom teaching * Teaching Methodology: Interactive sessions, Class discussions * Use of Google Classroom to provide quiz, study material and other resources related to each Lecture. Moreover, this platform will be used to provide and assess assignments. |
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| **Assessment Methods**  Tests, assignments, quizzes and presentations. |