



| Savitribai Phule Pune University, Pune<br>Second Year Artificial Intelligence & Machine Learning (2020 Course)<br><b>218543: Computer Networks</b>   |   |  |
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| Teaching Scheme:   | Credit Scheme:                                | Examination Scheme:                                |
| Theory (TH) : 03 hrs/week  | 03  | Mid_Semester : 30 Marks<br>End_Semester : 70 Marks |
| <b>Prerequisite Courses</b> , if any: Basics of Communications   |   |  |
| <b>Companion Course</b> , if any:  |   |  |
| <b>Course Objectives:</b> <ol style="list-style-type: none"> <li>1. To understand the fundamentals of communication system.</li> <li>2. To understand the basics of internetworking.</li> <li>3. To understand services and protocols used at Physical, Data Link, Network, Transport and Application Layer</li> </ol>   |   |  |
| <b>Course Outcomes:</b><br>On completion of the course, students will be able to–<br><b>CO1:</b> Understand data/signal transmission over communication media.<br><b>CO2:</b> Understand basics of computer networking and <b>compare</b> functions of OSI and TCP/IP model using concepts of communication theory.<br><b>CO3:</b> <b>Analyze</b> data link layer services, different access techniques, and Ethernet standards.<br><b>CO4:</b> Understand the network layer services, <b>apply</b> skills of subnetting, supernetting and routing mechanisms.<br><b>CO5:</b> <b>Illustrate</b> services and protocols used at transport layer.<br><b>CO6:</b> Understand and learn the different application layer protocols. |   |  |
| COURSE CONTENTS  |   |  |
| Unit I   | Basics of data communication                  | (06 hrs )  |
| <b>Signals:</b> Types of Signals, A/D, D/A, A/A, D/D Signal Conversion Methods, Bandwidth Utilization and Data Rate Limits, Multiplexing Techniques.<br><b>Modulation:</b> Introduction, Need for Modulation, Electromagnetic Spectrum and typical Applications.<br><b>Noise:</b> Types of noise, Shannon Hartley Theorem, Channel capacity, Nyquist and Shannon Theorem, Bandwidth S/N trade off.   |   |  |
| Mapping of Course Outcomes for Unit I  | CO1   |  |
| Unit II  | Introduction to basics of Computer Networking | (06 hrs)   |

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| <b>Computer network fundamentals</b><br><b>Networking Reference Models:</b> ISO OSI Model, TCP/IP Protocol Suite.<br><b>Addressing :</b> Physical addressing, Logical addressing, Port addressing and other addressing<br><b>Types of network:</b> LAN, WAN, MAN, PAN.<br><b>Network architecture:</b> Peer to Peer network architecture, Server client network architecture.<br><b>Network Topologies:</b> Bus Topology, Star Topology, Ring Topology, Mesh Topology, and Hybrid Topology with advantages and disadvantages.<br><b>Types of cable connection:</b> Straight through connection, Cross over Connection.<br><b>Guided Media:</b> Twisted Pair Cable, Coaxial Cable and Fiber-Optic Cable.<br><b>Unguided Media:</b> Wireless, Radio Waves, Microwaves and Infrared, Wireless frequency spectrum.<br><b>Network connecting devices:</b> Router, Switch, bridge, hub, repeaters, and its comparisons |                 |          |
| Mapping of Course Outcomes for Unit II   | CO2             |          |
| Unit III   | Data Link Layer | (06 hrs) |
| <b>Data Link Layer Services</b><br><b>Error Detection and Correction:</b> Introduction, Error Detection, Error Correction.<br><b>Linear Block Codes:</b> Hamming code, Hamming Distance, parity check code.<br><b>Cyclic Codes:</b> CRC (Polynomials), Advantages of Cyclic Codes.<br><b>Checksum:</b> One's Complement, Internet Checksum.<br><b>Framing:</b> fixed-size framing, variable size framing.<br><b>Flow control:</b> flow control protocols.<br><b>Noiseless channels:</b> simplest protocol, stop-and-wait protocol.<br><b>Noisy channels:</b> stop-and-wait Automatic Repeat Request (ARQ), go-back-n ARQ, Selective repeat ARQ.<br><b>Random Access Techniques:</b> CSMA, CSMA/CD, CSMA/CA<br><b>Ethernet: IEEE Standards:</b> 802.3, 802.4, 802.5, 802.6 Comparisons of Standard Ethernet, Fast Ethernet, Gigabit Ethernet.   |                 |          |
| Mapping of Course Outcomes for Unit III  | CO3             |          |
| Unit IV  | Network Layer   | (06 hrs) |
| <b>Network Layer Services</b><br><b>IPv4 Addresses:</b> Classful and Classless Addressing, Subnet Mask, Subnetting, Supernetting, Delivery and Forwarding of IP Packet, IPv4 header and Fragmentation, private IPv4 addresses, Public IPv4 addresses, NAT.<br><b>IPv6 addresses:</b> Header, Types of IPv6 addresses<br><b>Structure of Router</b><br><b>Network layer protocols:</b> ARP, RARP, DHCP, ICMPv4.<br><b>Routing:</b> Metric, Routing Tables, Static routing, dynamic routing, Default Routing.<br><b>Unicast Routing Protocols :</b> Distance vector routing, Link State routing, Path vector routing<br><b>Interior Gateway Routing Protocols:</b> RIP, EIGRP, OSPF<br><b>Exterior Gateway Routing Protocol:</b> BGP   |                 |          |
| Mapping of Course Outcomes for Unit IV   | CO4             |          |

| Unit V  | Transport Layer   | (06 hrs) |
|---|-------------------|----------|
| <b>Transport Layer Services, Transport Layer Protocols.</b><br><b>UDP:</b> UDP header, Services, Applications.<br><b>TCP:</b> Services, Features, Segment, TCP Header, TCP Connection, Window in TCP, TCP Timers, Options, TCP Package.<br><b>Applications:</b> SCTP: Features, Services, Packet Format<br><b>Flow control protocols</b><br><b>Congestion Control protocols:</b> Congestion Control Algorithms, Leaky Bucket, Token Bucket and QoS.<br><b>Socket:</b> TCP and UDP Socket, Applications. |                   |          |
| Mapping of Course Outcomes for Unit V   | CO5               |          |
| Unit VI   | Application Layer | (06 hrs) |
| <b>Application layer services :</b><br>Client Server Paradigm, Peer to Peer Paradigm, Communication using TCP and UDP services.<br><b>Application Layer Protocols:</b> DNS, FTP, TFTP, HTTP, SMTP, POP, IMAP, MIME.<br><b>Network Management:</b> SNMP.   |                   |          |
| Mapping of Course Outcomes for Unit VI  | CO6               |          |
| <b>Text Books:</b>  |                   |          |
| 1. Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.<br><br>2. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3.   |                   |          |
| <b>Reference Books:</b>   |                   |          |
| 1. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-1.<br><br>2. Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education, ISBN: 978-1-25-906475-3, 5th Edition.<br><br>3. Mayank Dave, Computer Network, Cengage Learning, ISBN: 978-81-315-0986-9.   |                   |          |