**ANNEXURE – 16**

**Nirma University**

**Institute of Technology**

**Computer Engineering Department**

**Course Policy Document**

**B. Tech. Computer Engineering**

**Semester: V, Academic Year: 2020-21, Term: Odd**

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| **Course Code & Name** | **:** | 2CS502 |
| **Credit Details** | **:** | 3-0-2-4 (L-T-P-C) |
| **Course Co-ordinator** | **:** | Dr. Zunnun Narmawala (Also a course faculty) |
| **Contact No. & Email** | **:** | 07971652525, zunnun.narmawala@nirmauni.ac.in |
| **Office** | **:** | PG007 |
| **Visiting Hours** | **:** | 8:45 AM – 4:00 PM |
| **Course Blog** | **:** | <http://ce503zan.wordpress.com> |
| **Course Faculty** | **:** | Dr. Vijay Ukani  Prof. Umesh Bodkhe |
| **Contact No. & Email** | **:** | vijay.ukani@nirmauni.ac.in  [umesh.bodkhe@nirmauni.ac.in](mailto:umesh.bodkhe@nirmauni.ac.in) |
| **Office** | **:** |  |
| **Visiting Hours** | **:** | 8:45 AM to 4:00 PM |

**Introduction to Course:**

The entire world has become very small thanks to evolution in telecommunication and networking. We use large number of applications for communication. E-mail, Whatsapp and Facebook are few of those. As a student of Computer Engineering, one must know internal details of how applications/devices communicate with each other. The objective of this course is exactly the same.  This course discusses issues and protocols involved in packet transfer over a network or Internet.

**Course Learning Outcomes:**

At the end of the course, students will be able to -

1. Comprehend the functionality of different layers of computer network architectures
2. Analyse protocols related to various network architecture layers
3. Design computer network configurations
4. Simulate various protocols for different types of networks.

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| **Syllabus** | **Teaching Hours** |
| **Unit I**  **Introduction:** Use of Computer Networks, Connecting devices, Networks and its types, network standards. Network Hardware, Network Software, OSI and TCP/IP Reference Model. | **04** |
| **Unit II**  **Data Link Layer:** Introduction and link layer services, Two sublayers, link layer addressing, data link layer protocols, multiple-access protocols: Random-access Protocols, Controlled-access Protocols, Channelization protocols, Ethernet protocols and types of Ethernet, Data Link Layer Switching. | **15** |
| **Unit III**  **Network Layer:** Design Issues, packet switching, network layer performance, Routing Algorithms: Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Broadcast, multicast, anycast routing; Congestion Control Algorithms, Quality of Service, Internetworking, Example protocols: IPv4 and IPv6, classfull addressing, classless addressing, subnetting, IP Datagram Format, Fragmentation, NAT. | **14** |
| **Unit IV:**  **Transport Layer:** Transport Service, transport layer protocols for flow control, Elements of Transport Protocols, Congestion Control, Example protocols: UDP, TCP. | **9** |
| **Unit V**  **Application Layer:** The Domain Name System, Electronic Mail, World Wide Web, HTTP, FTP, Content delivery. | **3** |
| **(\*)Self-Study:**  The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents. | |
| **Laboratory Work:**  Laboratory work will be based on the above syllabus with minimum 10 experiments to be incorporated. | |

**Suggested Readings^:**

1. Andrew S. Tanenbaum, Computer Networks, PHI Publication
2. Behrouz Forouzan, Data Communication Networking, TMH Publication
3. Behrouz Forouzan, TCP/IP Protocol suite, TMH Publication
4. William Stallings, Data and Computer Communication, Pearson
5. Jim Kurose, Computer Networking: A top down approach, Pearson

L=Lecture, T=Tutorial, P=Practical, C=Credit

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| **Practical No** | **Aim of the practical** | **No. of Hours** | **Mapped CLO** |
| 1 | Basics of network commands: ping, ipconfig, netstat, traceroute, nslookup, finger, fping, and Arp | 2 | 1 |
| 2 | Explore Packet capture tool (Wireshark) to capture and analyze various types of network packets | 2 | 1,2 |
| 3 | Data Link Layer (Frame Generation): Write a program to read a stream of data from data file to create frames by implementing bit stuffing and character stuffing. | 4 | 2 |
| 4 | Implement Selective Repeat Sliding Window Protocol. | 4 | 2 |
| 5 | Configure Virtual LAN using Packet Tracer. | 2 | 4 |
| 6 | Configure Wirless LAN using Packet Tracer. | 2 | 4 |
| 7 | Implementation of Subnetting: Design multiple subnets using Packet Tracer with suitable number of hosts. Make a plan to assign static IP addressing across all subnet to understand Subnetting. | 2 | 2,3,4 |
| 8 | Configure static routing, RIP and OSPF using Packet Tracer. | 4 | 2,3,4 |
| 9 | Implement Leaky Bucket mechanism. | 4 | 3 |
| 10 | Develop File Transfer application using TCP and UDP socket programming. | 4 | 3 |
|  | Total | 30 |  |
|  | **Additional Experiment** |  |  |
| 11 | Explore Network Simulator (NS2) |  | 4 |
| 12 | Demonstrate Configuration of Network Address Translation (NAT) and Port Address Translation (PAT) using Packet Tracer simulation. |  | 4 |

**Laboratory details: (List of Experiments, Schedule, assessment policy)**

**Assessment Policy:** Practical evaluation will be based on following criteria:

* Plagiarism
* Implementation
* Output
* Timeliness

**Lesson Plan**

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| **Lecture**  **No.** | **Topics** | **Mapping with CLO** |
| 1 | Introduction to the course, reading materials and evaluation methods | 1 |
| **UNIT 1 – Introduction (03 Lectures)** | | |
| 2 | Network Hardware : Personal Area Networks, Local Area  Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks  Network Software: Protocol Hierarchies, Design Issues of  Layers, Connection Oriented v/s Connectionless services, Service Primitives | 1 |
| 3 | OSI Reference Model : Description of all 7 layers  TCP/IP Reference Model, Comparison of OSI and TCP/IP | 1 |
| 4 | Example Networks: Internet, Cellular Networks, Wireless LANs, RFID and Sensor Networks  Network Standardization, Revision of First Unit of Syllabus | 1 |
| **UNIT 2 – Data Link Layer (07 Lectures)** | | |
| 5 | Data Link Layer Design Issues: Services Provided to Network Layer, Framing, Error Control, Flow Control | 1 |
| 6 | Elementary Data Link Protocols | 1,2 |
| 7 | Simplex Stop and Wait for Noiseless and Noisy Channels | 1,2 |
| 8 | Sliding Window Protocols: One bit | 1,2 |
| 9 | Go back N, Selective Repeat | 1,2 |
| 10 | Example Data Link Protocols: Packet over SONET, ADSL | 1,2 |
| 11 | Protocol Verification Models | 1,2 |
| **UNIT 3 – Medium Access Control Sublayer (08 Lectures)** | | |
| 12 | 1. Channel Allocation Problem: Static and Dynamic   Channel Allocation   1. Multiple Access Protocols: ALOHA, CSMA | 1,2 |
| 13 | Collision-Free Protocols, Limited Contention Protocols, Wireless LAN Protocols | 1,2 |
| 14 | Ethernet: Classical Ethernet Physical Layer, Ethernet MAC sublayer protocol | 1,2 |
| 15 | Ethernet Performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet | 1,2 |
| 16 | Wireless LANS: 802.11 standard architecture, protocol stack | 1,2 |
| 17 | MAC protocol, Frame structure | 1,2 |
| 18 | Data Link Layer Switching: Use of bridges, Learning bridges, spanning tree bridges, | 3 |
| 19 | Hubs, Switches, Routers, gateways, Virtual LANs | 3 |
|  |  |  |
| **UNIT 4: Network Layer (14 Lectures)** | | |
| 20 | Network Layer Design Issues: Store and Forward Concept,  Services, Comparison of Virtual Circuit and Datagram subnet | 3 |
| 21 | Shortest Path Routing, flooding | 2, 3 |
| 22 | Distance Vector Routing: Principle, count to infinity problem and it’s solutions | 2, 3 |
| 23 | Link State Routing: Working Principle | 2, 3 |
| 24 | Broadcast, Multicast and Anycast routing | 2, 3 |
| 25 | Congestion Control Algorithms: Traffic-aware routing, admission control, traffic throttling, load shedding | 2, 3 |
| 26 | Quality of Service: Application Requirements, Traffic shaping, packet scheduling | 2, 3 |
| 27 | Admission Control, Integrated Services, Differentiated Services | 2, 3 |
| 28 | Internetworking: Tunnelling, Internetwork Routing, Packet fragmentation | 2, 3 |
| 29 | IPv4 header, Classes of IP addresses | 2, 3 |
| 30 | Creation of subnets, classless addressing, | 2, 3 |
| 31 | Classless addressing, sub-netting in classless addressing, CIDR | 2, 3 |
| 32 | Concept of Network Address Translation, IPv6 header | 2, 3 |
| 33 | Other Network Layer Protocols: ICMP, IGMP, ARP, RARP | 2, 3 |
|  |  |  |
| **UNIT 5: Transport Layer (09 Lectures)** | | |
| 34 | Transport Service: Services provides, Service primitives, sockets, an example of socket programing | 2, 3 |
| 35 | Elements of Transport Protocols: Addressing, Connection establishment and Release, Error Control | 2, 3 |
| 36 | Flow Control, Multiplexing, Crash Recovery, Congestion Control: Desirable bandwidth allocation | 3,4 |
| 37 | Regulating the sending rate, wireless issues | 3, 4 |
| 38 | Connectionless Protocol: UDP header, Remote Procedure call, Real-Time transport Protocol | 2, 3 |
| 39 | Connection-oriented Protocol: Introduction to TCP, TCP header | 2, 3 |
| 40 | TCP connection establishment and release, TCP Error Control | 2, 3 |
| 41 | TCP congestion control : slow start, congestion avoidance | 2, 3 |
| 42 | Performance Issues: Performance problems, performance measurement, host design for fast networks, fast segment processing, header compression | 4 |
| **\*UNIT 6: Application Layer (03 Lectures)** | | |
| 43 | Domain Name System: Name space, Domain Resource Records, Name Servers | 3,4 |
| 44 | Electronic Mail: Architecture and Services, User Agent, Message Formats, Message Transfer, Final Delivery | 3,4 |
| 45 | Word Wide Web: Architecture, static web pages, dynamic web pages, HTTP, Mobile web, Web Search | 3,4 |
|  | Total | 45 |

**Course Assessment Schemes:**

Continuous Evaluation: Class Test/ (3 Quizzes each of 10 Marks), Sessional Exam, Lab Work Evaluation

Semester End Evaluation: LPW Viva Voce, Semester End Examination (SEE)

**Component wise Continuous Evaluation & Semester End Examination weightage:**

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| --- | --- | --- | --- | --- | --- | --- |
| **Assessment scheme** | **CE** | | | **LPW** | | **SEE** |
| **Component weightage** | 0.4 | | | 0.2 | | 0.4 |
|  | 3 Quizzes each of 10 Marks  30% | 2 Special/ Innovative  Assignments each of 15 Marks  30% | Comprehensive Assessment  40% | Continuous Evaluation  75% | Viva Voce  25% |  |

**Teaching-learning methodology:**

* Lectures: PPT, Online Teaching
* Laboratory: Network design, Network programming, Simulation
* Tutorial: Problem solving
* University campus network demonstration

**Active learning techniques:**

* One-minute paper (Clearest/Muddiest point), What I liked the most that helped me in learning

**Types of Special/Innovative Assignments, Term Papers, mini Projects etc.**

* One Term Paper
* One Design Problem

**Course Material:**

Following materials are available on course website: <https://sites.google.com/a/nirmauni.ac.in/ce503-computernetworks/>

* Course Policy
* PPTs, Notes, other Material
* [Assignments, Tutorials](https://sites.google.com/a/nirmauni.ac.in/3ec1218-testing-and-verification-of-vlsi-design/home/academic-docs/j-assignments-tutorials), [Lab Manuals](https://sites.google.com/a/nirmauni.ac.in/3ec1218-testing-and-verification-of-vlsi-design/home/academic-docs/l-laboratory-manuals)
* Question bank
* [Web-links](https://sites.google.com/a/nirmauni.ac.in/3ec1218-testing-and-verification-of-vlsi-design/home/academic-docs/m-course-related-important-web-links), [Blogs](https://sites.google.com/a/nirmauni.ac.in/3ec1218-testing-and-verification-of-vlsi-design/home/academic-docs/n-course-related-own-blog-and-other-such-blogs), [Video Lectures](https://sites.google.com/a/nirmauni.ac.in/3ec1218-testing-and-verification-of-vlsi-design/home/academic-docs/o-video-lectures-if-available-like-nptel-mooc-etc), [Journals](https://sites.google.com/a/nirmauni.ac.in/3ec1218-testing-and-verification-of-vlsi-design/home/academic-docs/p-list-of-international-national-journals-related-to-the-course)
* [Animations /Simulations](https://sites.google.com/a/nirmauni.ac.in/3ec1218-testing-and-verification-of-vlsi-design/home/academic-docs/x-animations-simulations-to-explain-the-complex-principles), [Softwares](https://sites.google.com/a/nirmauni.ac.in/3ec1218-testing-and-verification-of-vlsi-design/home/academic-docs/y-useful-softwares)
* [Advanced topics](https://sites.google.com/a/nirmauni.ac.in/3ec1218-testing-and-verification-of-vlsi-design/home/academic-docs/q-list-of-advanced-topics-seminar-topics-related-to-the-course)
* Industries/[Organizations](https://sites.google.com/a/nirmauni.ac.in/3ec1218-testing-and-verification-of-vlsi-design/home/academic-docs/r-list-of-world-leading-industries-organizations-working-on-the-course-related-areas)

**Course Outcome Attainment:**

* Use of formal evaluation components of continuous evaluation, laboratory work, semester end examination
* Informal feedback during course conduction
* Surveys & Peer observation