**COURSE DESCRIPTION FORM**

**INSTITUTION**  FAST-NUCES

**PROGRAM (S) TO BE EVALUATED** Computer Science

1. **Course Description**

| **Course Code** | CS 3001 | | | |
| --- | --- | --- | --- | --- |
| **Course Title** | Computer Networks | | | |
| **Credit Hours** | 03 | | | |
| **Prerequisites by Course(s) and Topics** | CS2001-Data Structures | | | |
| **Assessment Instruments with Weights** (homework, quizzes, midterms, final, programming assignments, lab work, etc.) | Quiz (3): 10%  Assignments (3): 10%  Mid1: 15%  Mid2: 15%  Final: 50% | | | |
| **Course Coordinator** | Dr. Farrukh Salim Shaikh | | | |
| **URL (if any)** |  | | | |
| **Current Catalog Description** | The learning and skill-based objectives of this course resolve around the following questions:   * How does the global network infrastructure work and what are the design principles on which it is based? * In what ways are these design principles compromised in practice? * How should Internet applications be written, so they can obtain the best possible performance both for themselves and for others using the infrastructure? * How do we ensure that it will work well in the future in the face of rapidly growing scale and heterogeneity?   The course will focus on the design & undergraduate level analysis of large-scale networked systems and tool (Wireshark, packet tracer) based implementation and evaluation of small-scale networked systems in the Lab. | | | |
| **Textbook** (or **Laboratory Manual** for Laboratory Courses) | J. F. Kurose and K. W. Ross --- **Computer Networking: A Top-Down Approach, 8th Edition** | | | |
| **Reference Material** | A. S. Tannenbaum and D. J. Wetherall --- **Computer Networks, 6th Edition** | | | |
| **Course Goals** | | **A. Course Learning Outcomes (CLOs)** | | | | | | | --- | --- | --- | --- | --- | --- | | **No.** | **Course Learning Outcomes (CLO)** | **Domain** | **Taxonomy Level** | **PLO** | **Tools** | | 01 | Describe and evaluate the protocols, services and functions provided by each layer in the Internet protocol stack. | Cognitive | C2 (Describe) | 1 | Q, M, F | | 02 | Analyze the architectural principles of computer networking and compare different approaches to organizing networks. | Cognitive | C4 (Analyze) | 2 | Q, M, F | | 03 | Apply network protocol and communication services for client/server and other application layouts. | Cognitive | C3 (Apply) | 3,5 | A, M, F | | *Tool: A = Assignment, Q = Quiz, M = Mid-term, F=Final (End-term)* | | | | | |  | **B. Program Learning Outcomes** | | | | | | --- | --- | --- | --- | --- | | **PLO 1** | Computing Knowledge | Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems. |  | | **PLO 2** | Problem Analysis | Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences. |  | | **PLO 3** | Design / Develop Solutions | Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. |  | | **PLO 4** | Investig  -ation & Experi  -mentation | Conduct investigation of complex computing problems using research-based knowledge and research-based methods |  | | **PLO 5** | Modern Tool Usage | Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems. |  | | **PLO 6** | Society Respon  -sibility | Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems. |  | | **PLO 7** | Environ  -ment and Sustain  -ability | Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems |  | | **PLO 8** | Ethics | Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice. |  | | **PLO 9** | Individual and Team Work | Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings. |  | | **PLO 10** | Commu-nication | Communicate effectively on complex computing activities with the computing community and with society at large. |  | | **PLO 11** | Project Manage-  ment and Finance | Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team. |  | | **PLO 12** | Life Long Learning | Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes. |  |  | **C. Relation between CLOs and PLOs**  (CLO: Course Learning Outcome, PLOs: Program Learning Outcomes) | | | | | | | | | | | | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | | **PLOs** | | | | | | | | | | | | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | | **CLOs** | 1 |  |  |  |  |  |  |  |  |  |  |  |  | | 2 |  |  |  |  |  |  |  |  |  |  |  |  | | 3 |  |  |  |  |  |  |  |  |  |  |  |  | | | | |
| **Topics Covered in the Course, with Number of Lectures on Each Topic** (assume 15-week instruction and one-hour lectures) | | Week | Duration | Topics Covered | CLOs | | --- | --- | --- | --- | | 1. | L1 = 1 hour  L2 = 1 hour  L3 = 1 hour | L1: 1.1 - Introduction, Course  L2: 1.2 - Network Edge,  1.3 - Network Core (Tiers of ISPs, Backbones)  L3: 1.4 - Delay, Loss and Throughput | 1 | | 2. | L1 = 1 hour  L2 = 1 hour  L3 = 1 hour | L1: 1.5 - Protocol Layers, Service Model  L2: 1.6 - Network Under Attacks  1.7 - History  L3: 2.1 - Principles of network Applications | 1 | | 3. | L1 = 1 hour  L2 = 1 hour  L3 = 1 hour | L1: 2.2 - Web and HTTP  L2: 2.3 - Electronic Mail  L3: 2.4 - DNS—The Internet’s Directory Service | 1,2 | | 4. | L1 = 1 hour  L2 = 1 hour  L3 = 1 hour | L1: 2.5 – P2P Distributions  L2: 3.1 - Transport Layer service  L3: 3.2 - Multiplexing and De-multiplexing | 1,2,3 | | 5. | L1 = 1 hour  L2-L3 = 2 hours | L1: 3.3 – Connectionless Transport UDP  L2: 3.4 – Principles of Reliable data transport  L3: 3.4 – Principles of Reliable data transport | 1,2,3 | | **6.** | **1 Hour**  L1 = 1 hour  L2 = 1 hour | **Midterm # 1**  L1: 3.5 Connection Oriented Transport: TCP  L2: 3.5 Connection Oriented Transport: TCP |  | | 7. | L1-L2 = 2 hours  L3 = 1 hour | L1: 3.6 Principles of Congestion Control  L2: 3.6 Principles of Congestion Control  L3: Exam Review | 1,2 | | 8. | L1-L2 = 2 hours  L3 = 1 hour | L1: 3.7 - TCP Congestion Control  L2: 3.7 - TCP Congestion Control  L3: 3.7 - TCP Congestion Control | 1,3 | | 9. | L1 = 1 hour  L2 = 1 hour  L3 = 1 hour | L1: 4.1 – Network Layer- Data Plane Introduction  L2: 4.1 – Network Layer- Data Plane Introduction  L3: 4.2 – What’s Inside a Router | 1,2 | | 10. | L1-L3 = 3 hours | L1: 4.3 – Internet Protocol  L2: 4.3 – Internet Protocol  L3: 4.3 – Internet Protocol | 1,2,3 | | **11.** | **1 Hour**  L1 = 1 hour  L2 = 1 hour | **Midterm # 2**  L1: 4.4 - Generalized Forwarding and SDN  L2: 4.5 - Middle Boxes |  | | 12. | L1 = 1 hour  L2 = 1 hour  L3 = 1 hour | L1: 5.1 - Network Layer-Control Plane Overview  L2: 5.2 - Routing Algorithms  5.3 - Intra-AS routing in the Internet: OSPF  L3: Exam Review | 1,2,3 | | 13. | L1-L2 = 2 hours  L3 = 1 hour | L1: 5.4 - Routing Among the ISPs: BGP  L2: 5.4 - Routing Among the ISPs: BGP  L3: 5.5 - The SDN Control Plane | 1,2,3 | | 14. | L1 = 1 hour  L2-L3 = 2 hours | L1: 6.1 - Introduction to Link layer  L2: 6.2 - Error-Detection & Correction Techniques  L3: 6.2 - Error-Detection & Correction Techniques | 1,2 | | 15. | L1-3 = 3 hours | L1: 6.3 – Multiple Access Links and Protocols:  6.3.1 - Channel Partitioning Protocols  L2: 6.3.2 - Random Access Protocols  L3: 6.3.3 - Taking-Turns Protocols | 1,2 | | 16. | 3 hours | Course wrap-up | 1,2,3 | | | | |
| **Laboratory Projects/Experiments Done in the Course** | Project (in course Lab part) focused on the application of network fundamentals and practices to develop efficient networking solutions and applications. | | | |
| **Programming Assignments Done in the Course** | Socket Programming | | | |
| **Class Time Spent on** (in credit hours) | **Theory** | **Problem Analysis** | **Solution Design** | **Social and Ethical Issues** |
| 40% | 30% | 30% | 0% |
| **Oral and Written Communications** |  | | | |

Instructor Name: \_\_\_\_\_

Instructor Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_