**COURSE DESCRIPTION FORM**

**INSTITUTION**  FAST-NUCES

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

1. **Course Description**

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| --- | --- | --- | --- | --- |
| **Course Code** | CS 3001 | | | |
| **Course Title** | Computer Networks | | | |
| **Credit Hours** | **3 + 1** | | | |
| **Prerequisites by Course(s) and Topics** | CS2001-Data Structures | | | |
| **Assessment Instruments with Weights** (homework, quizzes, midterms, final, programming assignments, lab work, etc.) | Quiz (2): 6%  Assignments (2): 6%  Project (1): 8% (Proposal, Demo Presentation, Report)  Mid-1: 15%  Mid-2: 15%  End-term (Final): 50% | | | |
| **Course Coordinator** | **Dr-Ing. Farrukh Salim Shaikh (**[**farrukh.salim@nu.edu.pk**](mailto:farrukh.salim@nu.edu.pk)**)** | | | |
| **Class Teacher** | **Dr.-Ing. Farrukh Salim Shaikh (**[**farrukh.salim@nu.edu.pk**](mailto:farrukh.salim@nu.edu.pk)**)** | | | |
| **URL (if any)** | **Google Classrooms**:   1. <https://classroom.google.com/c/Nzc0MTk3OTEzMDkx> **(BCS-5A)** 2. <https://classroom.google.com/c/Nzc0MTk3OTIxMDg3> **(BCS-5K)** | | | |
| **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, 9th Edition**  Wireshark, Packet Tracer, and GNS3 Labs (mostly by the lab instructors) | | | |
| **Reference Material** | A. S. Tannenbaum and D. J. Wetherall --- **Computer Networks, 6th Edition**  B. A. Forouzan --- **Data Communications & Networking with TCP/IP Protocol Suite, 6th Edition**  W. Stallings --- **Data and Computer Communications, 10th Edition** | | | |
| **Course Goals** | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **A. Course Learning Outcomes (CLOs)** | | | | | | | **No.** | **Course Learning Outcomes (CLO)** | **Domain** | **Taxonomy Level** | **PLO** | **Tools** | | 01 | Describe utilization of network protocol concepts vis-a-vis OSI and TCP/IP stack. (2) (2) | Cognitive | C2 (Describe) | 2 | Q, A, M, F | | 02 | Demonstrate the basics of network concepts using state-of-the-art network tools.(3) (2) | Cognitive | C3 (Apply) | 2 | Q, A, M, F | | 03 | Demonstrate operations of various classical routing and switching protocol via simulators.(3) (4) | Cognitive | C3 (Apply) | 4 | Q, A, M, P, F | | 04 | Apply Socket Programming (client/server) to solve various real world problems, including ensuring of data integrity (3) (4) | Cognitive | C3 (Apply) | 4 | Q, A, M, P, F | | *Tool: A = Assignment, Q = Quiz, P = Project, M = Mid-term, F=Final (End-term)* | | | | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | **B. Graduating Attributes -GAs (Program Learning Outcomes – PLOs)** | | | | | | **1** | Academic Education | Completion of an accredited program of study designed to prepare graduates as computing professionals |  | | **2** | Knowledge for Solving Computing Problems | Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements |  | | **3** | Problem Analysis | Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines |  | | **4** | Design/ Development of Solutions | Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations |  | | **5** | Modern Tool Usage | Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations |  | | **6** | Individual and Team Work | Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings |  | | **7** | Communication | Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions |  | | **8** | Computing Professionalism and Society | Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice |  | | **9** | Ethics | Understand and commit to professional ethics, responsibilities, and norms of professional computing practice |  | | **10** | Life-long Learning | Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **C. Relation between CLOs and Gas (PLOs)**  (CLO: Course Learning Outcome, PLOs: Program Learning Outcomes) | | | | | | | | | | | | | |  | | **Graduating Attributes- GAs or PLOs** | | | | | | | | | | | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | | **CLOs** | 1 |  |  |  |  |  |  |  |  |  |  | | 2 |  |  |  |  |  |  |  |  |  |  | | 3 |  |  |  |  |  |  |  |  |  |  | | 4 |  |  |  |  |  |  |  |  |  |  | | | | |
| **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 | 1.1 - Introduction, Course  1.2 - Network Edge,  1.3 - Network Core (Tiers of ISPs, Backbones) | 1 | | 2. | L1 = 1 hour  L2 = 1 hour  L3 = 1 hour | 1.4 - Delay, Loss and Throughput  1.5 - Protocol Layers, Service Model,  1.6 - Network Under Attacks  2.1 - Principles of network Applications  2.2 - Web and HTTP | 1 | | 3. | L1 = 1 hour  L2 = 1 hour  L3 = 1 hour | 2.2 - Web and HTTP  2.3 - Electronic Mail`  2.4 - DNS—The Internet’s Directory Service  ***(Assignment 1 will be assigned in the 3rd week)*** | 1,2 | | 4. | L1 = 1 hour  L2 = 1 hour  **1 Hour** | 2.4 - DNS—The Internet’s Directory Service  3.1 - Transport Layer service  3.2 - Multiplexing and De-multiplexing  **Quiz 1** | 1,2,3 | | 5. | L1 = 1 hour  L2-L3 = 2 hours | 3.3 - Connectionless Transport UDP  3.4 - Principles of Reliable data transport | 1,2,3 | | **6.** | **1 Hour**  L1 = 1 hour | **Midterm # 1**  3.4 – Principles of Reliable data transport  ***(Assignment 2 will be assigned in the 6th week)*** | 1,2 | | 7. | L1 = 1 hour  L2 = 1 hour  L3 = 1 hour | 3.5 - Connection Oriented Transport: TCP  3.5.2 TCP Segment Structure  3.5.3 Round-Trip Time Estimation and Timeout  3.5.4 Reliable Data Transfer  3.5.5 Flow Control  3.5.6 TCP Connection Management  ***(Project will be announced on the 7th week)*** | 1,2 | | 8. | L1-L2 = 2 hours  **1 Hour** | 3.7 - TCP Congestion Control  **Quiz 2, Exam Review** | 1,3 | | 9. | L1 = 1 hour  L2 = 1 hour  L3 = 1 hour | 4.1 - Network Layer- Data Plane Introduction  4.2.1 - Destination-Based Forwarding  4.3.1 - Internet Protocol (IPv4 Datagram Format)  4.3.2 - IPv4 Addressing | 1,2 | | 10. | L1 = 1 hour  L2 = 1 hour  L3: 1 hour | 4.3.2 - IPv4 Addressing  Class C Subnetting  Variable Length Subnet Mask (VLSM)  4.3.3 - Network Address Translation (NAT)  4.3.4 - IPv6  4.4 - Generalized Forwarding and SDN | 1,2,3 | | **11.** | **1 Hour**  L1 = 1 hour | **Midterm # 2**  5.1 - Network Layer-Control Plane Overview  5.2 - Routing Algorithms (Link State) | 1,2 | | 12. | L1-L2 = 2 hours  L3 = 1 hour | 5.2 - Routing Algorithms (Distance Vector)  5.3 - Intra-AS routing in the Internet: OSPF  5.4 - Routing Among the ISPs: BGP | 1,2,3 | | 13. | L1-L2 = 2 hours  **1 Hour** | 5.4 - Routing Among the ISPs: BGP  5.5 The SDN Control Plane  **Quiz 3, Exam Review** | 1,2,3 | | 14. | L1 = 1 hour  L2-L3 = 2 hours | 6.1 - Introduction to Link layer  6.2 - Error-Detection & Correction Techniques  6.3 – Multiple Access Links and Protocols | 1,2 | | 15. | L1-L2 = 2 hours  L3 = 1 hour | 6.4 Switched Local Area Networks  6.6 - Data Center Networking | 1,2 | | 16. | 3 hours | Course wrap-up | 1,2,3 | | | | |
| **Laboratory Projects/Experiments Done in the Course** | Project is 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** |  | | | |

* No ReQuizz and Late Assignment submission
* Usage of generative artificial intelligence (AI) such as ChatGPT or Microsoft Copilot for producing assessment submissions etc. should be mentioned clearly with reference.

Instructor Name: \_Farrukh Salim Shaikh\_\_\_\_

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

Date**: August 18, 2025**\_