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| <b>Course:</b>                  | <b>Communication Networks – 0903426 (3 Cr. – Elective Course)</b>  |
| <b>Instructor:</b>              | Prof. Mohammed Hawa<br><i>Office: E306, Telephone: 06/5355000 ext 22857, Email: hawa@ju.edu.jo</i><br><i>Office Hours: will be posted soon</i>   |
| <b>Course website:</b>          | <a href="http://www.hawa.work/426">http://www.hawa.work/426</a>  |
| <b>Catalog description:</b>     | Introduction to communication networks and the OSI model. Circuit switching and packet switching. Physical layer and transmission media. Asynchronous and synchronous transmission. Local loop access technologies. Data Link Layer Principles. IEEE 802.x Medium Access Control (MAC) protocols: LANs, MANs, WANs and PANs. The concept of internetworking and the Internet Protocol (IP). IP Specifications and supporting protocols (ARP, DHCP, ICMP, etc). Routing and switching in IP networks. Repeaters, Switches, Hubs, Bridges, Routers and Gateways. UDP and TCP transport layers. Internet applications.  |
| <b>Prerequisites by course:</b> | <b>EE 0953421 – Communications I</b> (pre-requisite).  |
| <b>Prerequisites by topic:</b>  | Students are assumed to have a background in the following topics: <ul style="list-style-type: none"><li>• Digital baseband coding and digital modulation.</li><li>• Basics of computer hardware and software.</li></ul>   |
| <b>Textbook:</b>                | <b><i>Computer Networks</i> by Andrew S. Tanenbaum, Nick Feamster and David J. Wetherall, Pearson, 6th Edition, 2021.</b>  |
| <b>References:</b>              | <ul style="list-style-type: none"><li>• <i>Computer Networks: A Systems Approach</i> by Larry L. Peterson and Bruce S. Davie, Morgan Kaufmann, 6th edition, 2021.</li><li>• <i>Computer Networking: A Top-Down Approach</i> by James F. Kurose and Keith W. Ross, Pearson, 8th edition, 2022.</li><li>• <i>Computer Networks and Internets</i> by Douglas E. Comer, Pearson, 6th edition, 2014.</li><li>• <i>Internetworking with TCP/IP Vol. 1: Principles, Protocols, and Architecture</i> by Douglas E. Comer, Pearson, 6th Edition, 2013.</li><li>• <i>Data and Computer Communications</i> by William Stallings, Pearson, 10th edition, 2013.</li><li>• <i>Introduction to Computer Networks and Cybersecurity</i> by Chwan-Hwa (John) Wu and J. David Irwin, CRC Press, 1st edition, 2013.</li><li>• <i>Hacking for Dummies</i> by Kevin Beaver, Wiley, 7th edition, 2022.</li></ul> |
| <b>Schedule:</b>                | 16 Weeks, 42 lectures (50 minutes each) plus exams.  |
| <b>Course goals:</b>            | The overall objective is to introduce the student to the basics of computer networks and the OSI model. This course emphasizes: <ul style="list-style-type: none"><li>• The concepts and design guidelines of computer networks.</li><li>• The framework for implementing network protocols (Layering &amp; OSI model).</li><li>• Modern trends and latest implementations of networks and internetwork protocols.</li></ul>   |

## Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

|   |        |
|---|--------|
| Upon successful completion of this course, a student will:  | [SO]   |
| 1. Become familiar with the basic principles of computer networking and be able to evaluate network performance metrics such as throughput, delay, and loss.      | [1]    |
| 2. Be able to describe network architectures, the OSI reference model, framing, MAC protocols, internetworking and encapsulation.                                 | [1]    |
| 3. Understand the design philosophies for various popular networking protocols, such as CSMA/CD, WiMAX, FTTH, IPv4, IPv6, ICMP, DHCP, UDP, TCP and Wireless LANs. | [1, 7] |
| 4. Be able to use IP addressing and apply sub-netting techniques.   | [1]    |
| 5. Recognize the need to keep up with changing network technology and emerging network security issues.   | [7]    |

## Course topics:

|   | Hrs |
|---|-----|
| 1. Introduction to Communication Networks. Circuit vs. Message vs. Packet vs. Virtual-Circuit Switching. Growth of the Internet.  | 1   |
| 2. Network Protocols and Layering: OSI Model, Protocols, Encapsulation, TCP/IP Protocol Stack.  | 3   |
| 3. The Physical Layer and Transmission Media. FLAG Network. Asynchronous and Synchronous Transmission.  | 1   |
| 4. Local Loop, Internet Access and Leased Lines: xDSL, Cable Modems, Broadband Wireless Access (BWA), Power Line Communications, PDH, SDH/SONET.  | 5   |
| 5. Data Link Layer Basics: Framing and Error Detection.   | 2   |
| 6. Local Area Networks (LANs): Ethernet and Ethernet MAC Protocol (CSMA/CD).  | 1   |
| 7. Ethernet Addressing and Frame Formats.   | 2   |
| 8. <b>First Exam</b>  | 1   |
| 9. Switched Ethernet and Collision Domains.   | 2   |
| 10. Self-Learning Bridges and the Spanning Tree Protocol (STP). VLANs.  | 2   |
| 11. Ethernet Wiring and Ethernet Standards (Fast Ethernet, 1 GbE and 10 GbE).   | 3   |
| 12. Concept of Internetworking and the Internet Protocol (IP).  | 1   |
| 13. IP Packet Format and IP Packet Fragmentation. IP Addressing (Classful and Classless), and Subnetting.   | 4   |
| 14. IP Datagram Forwarding and ICMP Protocol.   | 2   |
| 15. <b>Midterm Exam.</b>  | 1   |
| 16. Address Resolution and ARP. DHCP, Private IP Addresses and NAT.   | 3   |
| 17. Introduction to Internet Routing: OSPF, RIP and BGP.  | 1   |
| 18. UDP and TCP Transport Layers: Automatic Repeat Request (ARQ) and the TCP Sliding Window Algorithm. Introduction to Congestion Control in TCP.                                       | 4   |
| 19. Wireless LANs: IEEE 802.11 Wi-Fi.   | 1   |
| 20. Metropolitan Area Networks (MANs): DOCSIS and IEEE 802.16 (Wi-MAX). Personal Area Networks (PANs): Bluetooth, Wireless USB and UWB. Wide Area Networks (WANs): ATM and Frame Relay. | 2   |

**Ground rules:** **Attendance is required** and highly encouraged. To that end, attendance will be taken every lecture. Eating and drinking are **not** allowed during class, and cell phones must be set to silent mode. All exams (including the final exam) should be considered **cumulative**. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

**Assessments:** Exams, Quizzes, Projects, and Assignments.

### Assessment & grading policy:

|              |      |              |       |
|--------------|------|--------------|-------|
| Assignments  | 0 %  | Quizzes      | 0 %   |
| First Exam   | 20 % | Projects     | 0 %   |
| Midterm Exam | 30 % | Lab Reports  | 0 %   |
| Final Exam   | 50 % | Presentation | 0 %   |
|              |      | Total        | 100 % |

**Last Updated:** October 2023