MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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| **Module Information**  **معلومات المادة الدراسية** | | | | | | | | |
| **Module Title** | Advanced Computer Networks | | | | | **Module Delivery** | | |
| **Module Type** | Core | | | | | * **☒ Theory** * **☐Lecture** * **☒ Lab** * **☒ Tutorial** * **☒ Practical** * **☐ Seminar** | | |
| **Module Code** | **ADCN222** | | | | |
| **ECTS Credits** | 7 | | | | |
| **SWL (hr/sem)** | 175 | | | | |
| **Module Level** | | | UGx11 2 | **Semester of Delivery** | | | | 2 |
| **Administering Department** | | | Type Dept. Code | **College** | Type College Code | | | |
| **Module Leader** | Dr. Saman Hameed Amin | | | **e-mail** | 120108@uotechnology.edu.iq | | | |
| **Module Leader’s Acad. Title** | | | Lecturer | **Module Leader’s Qualification** | | | | Ph.D. |
| **Module Tutor** | **None** | | | **e-mail** | **None** | | | |
| **Peer Reviewer Name** | | 1. Dr. Dhari Ali 2. Dr. Ammar Abdul Ameer | | **e-mail** | 1. [Dhari.a.mahmood@uotechnology.edu.iq](mailto:Dhari.a.mahmood@uotechnology.edu.iq)   2. [120016@uotechnology.edu.iq](mailto:120016@uotechnology.edu.iq) | | | |
| **Scientific Committee Approval Date** | | / /2024 | | **Version Number** | | | 1.0 | |

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| **Relation with other Modules**  **العلاقة مع المواد الدراسية الأخرى** | | | |
| **Prerequisite module** | Computer Networks Fundamentals | **Semester** | 1 |
| **Co-requisites module** | None | **Semester** |  |

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| **Module Aims, Learning Outcomes and Indicative Contents**  **أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** | |
| **Module Objectives**  **أهداف المادة الدراسية** | 1. Understand Advanced Link Layer Mechanisms and Random-Access Techniques 2. Comprehend Collision Detection and Avoidance 3. Analyze Routing Algorithms and Understand Internet Structure 4. Explore IPv6 Networks and Understand and configure NDP and L2TP in IPv6 networks. 5. Implement and analyze QoS mechanisms 6. Analyze transport layer protocol behavior, including connection establishment and flow control. 7. Understand and configure VLANs |
| **Module Learning Outcomes**  **مخرجات التعلم للمادة الدراسية** | 1. Design and simulate advanced network topologies using GNS3. 2. Capture and analyze network traffic using Wireshark to diagnose and troubleshoot network issues. 3. Implement and configure various routing protocols and understand their operational mechanisms. 4. Understand the principles of IPv6, configure IPv6 networks, and analyze IPv6 traffic. 5. Implement and analyze link layer protocols and their error control mechanisms. 6. Demonstrate proficiency in configuring and troubleshooting transport layer protocols. 7. Understand and apply concepts related to VLANs and optical networks in practical scenarios. 8. Integrate and apply advanced networking concepts to solve complex networking problems. |
| **Indicative Contents**  **المحتويات الإرشادية** | Introduction to the Link Layer, Framing techniques, Flow control methods, Error detection and correction, Overview of random-access protocols, Pure Aloha and Slotted Aloha concepts and operations, Performance analysis and comparison, Carrier Sense Multiple Access (CSMA) protocols, CSMA with Collision Detection (CSMA/CD), CSMA with Collision Avoidance (CSMA/CA), Differences between wired and wireless implementations. [SSWL=18 hrs]    Basics of routing and switching, Connection-oriented vs. connectionless networks, Introduction to routing tables and path selection, Network Performance analysis, Overview of routing algorithms, Distance-Vector Routing, Link-State Routing, Path-Vector Routing. [SSWL=18 hrs]    Internet Structure and Routing Information Protocol, Open Shortest Path First (OSPF),  OSPF protocol principles, OSPF areas and hierarchical design, OSPF message types and operations, Border Gateway Protocol concepts and operations, BGP path selection and policy, BGP message types and peering. [SSWL=24 hrs]  IPv6 Networks, IPv6 address configuration, Neighbor Discovery Protocol, Tunneling Protocol, IPv6 QoS, Quality of Service (QoS) in IPv6 networks. [SSWL=12 hrs]  Transport Layer Protocols, TCP and UDP principles and differences, TCP connection establishment and teardown, Flow control, congestion control, and reliability in TCP, Connection Establishment, Flow Control, Congestion Control. [SSWL=12 hrs]  Virtual LANs, VLAN concepts and configuration, VLAN setup on switches. [SSWL=6 hrs] |

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| **Learning and Teaching Strategies**  **استراتيجيات التعلم والتعليم** | |
| **Strategies** | 1. **Lectures**: Instructors will deliver in-class lectures to introduce and explain key networking concepts, architectures, and protocols. These presentations will cover theoretical foundations and practical applications. 2. **Interactive** Discussions: Students will be encouraged to participate in discussions that foster critical thinking and problem-solving skills. These discussions will revolve around case studies, hypothetical scenarios, and current events in networking. 3. **Hands-on Laboratory** Work: Practical lab sessions will allow students to apply theoretical knowledge by working with networking hardware and simulation software. This includes setting up networks, configuring routers and switches, and analyzing network traffic with tools like Wireshark and Cisco Packet tracer. 4. **Group Projects**: Students will collaborate on projects that involve designing and implementing network solutions for simulated environments. This promotes teamwork and the practical application of learned concepts, including network planning, security measures, and troubleshooting. 5. **Simulations and Virtual Labs**: Utilizing advanced simulation tools and virtual lab environments to provide students with hands-on experience, especially when physical resources or access to actual networking equipment is limited. 6. **Use of Visuals and Multimedia**: Integration of visual aids such as diagrams, flowcharts, and multimedia content to enhance understanding of complex network structures and data flow mechanisms. 7. **Assessment and Feedback**: Regular assessments through quizzes, tests, and exams to gauge students' understanding and mastery of course content. Feedback will be provided systematically to guide students' learning processes and adjustments. 8. **Practice and Revision Sessions**: Dedicated sessions for practice and revision will be available to reinforce learning, address students’ questions, and prepare them adequately for assessments. |

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| **Student Workload (SWL)**  **الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا** | | | |
| **Structured SWL (h/sem)**  **الحمل الدراسي المنتظم للطالب خلال الفصل** | **93** | **Structured SWL (h/w)**  **الحمل الدراسي المنتظم للطالب أسبوعيا** | **7** |
| **Unstructured SWL (h/sem)**  **الحمل الدراسي غير المنتظم للطالب خلال الفصل** | **82** | **Unstructured SWL (h/w)**  **الحمل الدراسي غير المنتظم للطالب أسبوعيا** | **6** |
| **Total SWL (h/sem)**  **الحمل الدراسي الكلي للطالب خلال الفصل** | **175** | | |

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| **Module Evaluation**  **تقييم المادة الدراسية** | | | | | |
| **As** | | **Time/Number** | **Weight (Marks)** | **Week Due** | **Relevant Learning Outcome** |
| **Formative assessment** | **Quizzes** | 2 | 10% (10) | 5 and 10 | LO #1- #5 and #6 - #11 |
| **Assignments** | 2 | 10% (10) | 3 and 12 | LO #2 and #5, #7, #11 |
| **Projects / Lab.** | 1 | 10% (10) | Continuous | All |
| **Report** | 1 | 10% (10) | 13 | LO #5 - #12 |
| **Summative assessment** | **Midterm Exam** | 2hr | 10% (10) | 8 | LO #1 - #10 |
| **Final Exam** | 3hr | 50% (50) | 16 | All |
| **Total assessment** | | | 100% (100 Marks) |  |  |

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| **Delivery Plan (Weekly Syllabus)**  **المنهاج الاسبوعي النظري** | |
| **Week** | **Material Covered** |
| **Week 1** | Link Layer (Framing, flow, and error control) |
| **Week 2** | Random access techniques (Pure Aloha, Slotted Aloha) |
| **Week 3** | CSMA/CD, CSMA/CA |
| **Week 4** | Introduction to Routing Protocols (Network layer routing and switching, Connection-oriented vs. connectionless networks) |
| **Week 5** | Modern Network Performance Parameters (Throughput, Latency, Jitter,  Packet Loss) |
| **Week 6** | Routing algorithms: Distance-Vector, Link-State, Path-Vector |
| **Week 7** | Internet structure and Routing Information Protocol (RIP) |
| **Week 8** | Open Shortest Path First (OSPF) |
| **Week 9** | Mid-term Exam + Dijkstra's algorithm |
| **Week 10** | Border Gateway Protocol Version 4 (BGP4) |
| **Week 11** | IPv6 Networks (IPv6 addresses, interface identifiers, and multicast addresses, Addressing IPv4/IPv6 translators) |
| **Week 12** | Neighbor Discovery Protocol (NDP), Layer 2 Tunneling Protocol (L2TP), IPv6 QoS |
| **Week 13** | Transport Layer Protocols (TCP, UDP, and network design, Internet checksum) |
| **Week 14** | Connection establishment, flow control vs. congestion control, Congestion collapse, window-based congestion control, fairness |
| **Week 15** | Virtual LANs |
| **Week 16** | **Preparatory week before the final Exam** |

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| **Delivery Plan (Weekly Lab. Syllabus)**  **المنهاج الاسبوعي للمختبر** | |
| **Week** | **Material Covered** |
| **Week 1** | Lab 1: Link Layer (Framing, Flow, and Error Control) |
| **Week 2** | Lab 2: Random Access Techniques (Pure Aloha, Slotted Aloha) |
| **Week 3** | Lab 3: CSMA/CD, CSMA/CA |
| **Week 4** | Lab 4: Introduction to Routing Protocols |
| **Week 5** | Lab 5: Routing Algorithms (Distance-Vector, Link-State, Path-Vector) |
| **Week 6** | Lab 6: Internet Structure and Routing Information Protocol (RIP) |
| **Week 7** | Lab 7: Open Shortest Path First (OSPF) |
| **Week 8** | Lab 8: Mid-term Exam |
| **Week 9** | Lab 9: Border Gateway Protocol Version 4 (BGP4) |
| **Week 10** | Lab 10: IPv6 Networks |
| **Week 11** | Lab 11: Neighbor Discovery Protocol (NDP), L2TP, IPv6 QoS |
| **Week 12** | Lab 12: Transport Layer Protocols (TCP, UDP) |
| **Week 13** | Lab 13: Connection Establishment, Flow Control, Congestion Control |
| **Week 14** | Lab 14: Virtual LANs |

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| **Learning and Teaching Resources**  **مصادر التعلم والتدريس** | | |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | 1. Computer Networking: A Top-Down Approach" by James Kurose and Keith Ross 2. Networking Essentials: A CompTIA Network by Jeffrey S. Beasley and Piyasat Nilkaew 3. Data Communications and Networking by Behrouz a. Forouzan |  |
| **Recommended Texts** | 1. Data and Computer Communications" by William Stallings | Yes |
| **Websites** | Cisco Networking Academy (https://www.netacad.com) | |

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| **Grading Scheme**  **مخطط الدرجات** | | | | |
| **Group** | **Grade** | **التقدير** | **Marks %** | **Definition** |
| **Success Group**  **(50 - 100)** | **A -** Excellent | **امتياز** | 90 - 100 | Outstanding Performance |
| **B -** Very Good | **جيد جدا** | 80 - 89 | Above average with some errors |
| **C -** Good | **جيد** | 70 - 79 | Sound work with notable errors |
| **D -** Satisfactory | **متوسط** | 60 - 69 | Fair but with major shortcomings |
| **E -** Sufficient | **مقبول** | 50 - 59 | Work meets minimum criteria |
| **Fail Group**  **(0 – 49)** | **FX –** Fail | **راسب (قيد المعالجة)** | (45-49) | More work required but credit awarded |
| **F –** Fail | **راسب** | (0-44) | Considerable amount of work required |
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| **Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. | | | | |