Module (Course Syllabus) Catalogue

2024-2025

College/ Institute	**Erbil Technical Engineering**		
Department	**Information Systems Engineering**		
Module Name	**Future Network Architecture**		
Module Code			
Degree	**Technical Diploma** ☐ **Bachler** ☐ **High Diploma** ☐ **Master** ■ **PhD** ☐		
Semester	Second		
Qualification	**PhD**		
Scientific Title	**Lecturer**		
ECTS (Credits)	**8**		
Module type	**Prerequisite** ☐ **Core** x **Assist.** ☐		
Weekly hours	**3**	**Total Workload=(162) hrs**	
Weekly hours (Theory)	**(3)hr Class**	**(36)Total hrs Workload**	
Weekly hours (Practical)	**( )hr Class**	**()Total hrs Workload**	
Number of Weeks	**15 Week**		
Lecturer (Theory)	**Dr. Diana Hussein**		
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Lecturer (Practical)			
E-Mail & Mobile NO.			

Websites	https://moodle.epu.edu.iq/course/view.php?id=3293

Course Book

Course Description	This course provides an in-depth understanding of Software-Defined Networking (SDN), a revolutionary approach to managing and controlling networks through software. Students will learn the principles, architecture, and design of SDN, including its application in modern networking environments. Topics will cover SDN's separation of the control and data planes, network virtualization, and how SDN enables programmability and flexibility in managing complex networks. Through theoretical lessons and hands-on exercises, students will gain practical experience with SDN tools, protocols (e.g., OpenFlow), and real-world applications in cloud computing and data centers. Cloud Computing has become a cornerstone of modern IT infrastructure, enabling businesses and individuals to leverage on-demand computational resources over the internet. This course will provide students with a comprehensive understanding of cloud computing technologies, deployment models, service models, and the architecture that enables cloud environments. Students will learn about infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS), and software-as-a-service (SaaS), as well as key cloud technologies like virtualization, containerization, and serverless computing. Through case studies and practical exercises, students will explore the applications and challenges of cloud computing in both private and public clouds.
Course objectives	1) To introduce the fundamental concepts of SDN and its architecture. 2) To explore the key components and protocols used in SDN, such as OpenFlow. 3) To understand the separation of the control and data planes in network architecture. 4) To investigate network programmability, automation, and the role of SDN in modern networking. 5) To examine SDN's integration with cloud computing and virtualization technologies. 6) To provide hands-on experience with SDN software platforms and tools. 7) To explore security and scalability challenges in SDN environments. 8) To discuss the practical applications of SDN in data centers, telecommunications, and enterprise networks. 9) To explore the importance of SDN in Internet of Things (IoT) environments, focusing on how SDN can provide network flexibility, scalability, and centralized management to handle the large volumes of devices and data in IoT networks. This includes discussing SDN's role in improving network performance, security, and resource allocation in IoT ecosystems 10) To introduce the fundamental concepts of cloud computing and its key

	characteristics. 11) To understand the different service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid clouds). 12) To examine the importance of cloud computing in Internet of Things (IoT) environments, focusing on how cloud platforms provide scalable storage, processing power, and data analytics capabilities to support the massive amounts of data generated by IoT devices.
Student's obligation	Students take active role in their learning process during their study period at the university. They are accountable for their academic success through making their own choice and take actions that lead them toward their educations goals. Student responsibilities could be expressed by the following points: 1- Attend and participate in classes and labs prepared and on time. You are responsible for what you miss- "I was absent" is not an excuse for not understanding the material or not being prepared for an assessment.

	2- Demonstrate academic integrity and honesty. No matter how much stress you are under, it is expected that you will do your work with integrity and honesty. The consequences of violating the academic integrity are very serious and could lead to expulsion or suspension from the college. A- Plagiarism: trust your own ideas and conduct the work by yourself. Don't copy ideas or data without citing the source. It is not allowed to get someone do your work on your behalf. B- Cheating is not allowed: You are not allowed to copy answers from another student or ask another student to do your own work. Results' fabrication is not permitted too. Changing graded exams and submit them for a regrading is not allowed. C- Don't facilitate copying your answers, whether in an exam, project, or any sort of test to another student. 3- Do the home works, practice problems, re-solve all the examples and problems that were given in the class, submit your assignments\exercise problems on time with great attention to quality of work and intellectual property right (avoiding plagiarism). 4- Turn off your cell phone and put it away before class starts so you can focus on the class discussion and not cause a distraction for others. 5- Communicate in a careful and respectful manner with your instructors, colleagues, and other members of the college. 6- Respect diverse ideas and opinions. You will be exposed to a variety of viewpoints, values and opinions in the class that will differ from your own. All students in this class should feel comfortable expressing their viewpoints and concerns. You are an important part of creating an atmosphere that makes this possible. 7- Dedicate sufficient time to conduct self-study for the college work.
Required Learning Materials	You can expect your instructors to: • Attend every class period and arrive to class on time. • Learning tools will be data shows, lecture hand-outs and ppt. presentations, whiteboard explanation. • Online tools such as the university Moodle for submitting the reports and communicating with students. • Come to class with a good attitude.

Evaluation	**Task**		**Weight (Marks)**	**Due Week**	**Relevant Learning Outcome**
	Paper Review				
	Assignments	Homework			
		Class Activity		continuous	
		Report	30	13	
		Seminar			
		Essay			
		Project Presentation		14,15	

	Quiz	10	Expected any time	
	Lab.			
	Theory Midterm Practical Midterm	10	8	
	Final Exam(theory) Final Exam (Practical)	50	15	
	Total	100		
Course References:	1- W. Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud. London, U.K.: Pearson Educ., 2015.			

Course topics (Theory)	Week	Learning Outcome
Forwarding and Routing at the network layer Virtual circuits and datagram networks	1	students will be able to distinguish between forwarding and routing, explaining how each process handles the movement of data packets through a network. Understand how forwarding refers to the actual process of moving packets between routers, while routing involves determining the optimal path for data transmission. Discuss real-world applications where virtual circuit networks (e.g., ATM, Frame Relay) or datagram networks (e.g., IP) are used and their respective advantages in different networking scenarios.

Detailed description of what is inside a router IP addressing Routing algorithms	2, 3	students will be able to explain the key components of a router, including the control plane, data plane, and forwarding plane. Understand the purpose of IP addressing in identifying devices on a network and enabling routing. Differentiate between IPv4 and IPv6 addressing, including the structure and notation of IP addresses. Learn how to break down an IP address into its network and host portions, and explain subnetting and subnet masks. Understand the function of routing algorithms in determining the optimal path for data transmission in a network. Compare and contrast distance-vector algorithms (e.g., RIP) and link-state algorithms (e.g., OSPF), and explain their key characteristics, advantages, and limitations. Discuss path vector algorithms (e.g., BGP) and their role in inter-domain routing.
SDN: Background and Motivation	4	Students will recognize the limitations of traditional networking models and explain how they led to the development of SDN. Students will be able to Identify the motivation behind SDN that explain the key challenges in traditional networking (e.g., lack of flexibility, manual configuration, scalability issues) that SDN aims to address.

SDN Data Plane and OpenFlow	5, 6	Students will grasp both the theoretical and practical aspects of SDN's data plane and OpenFlow, allowing them to understand how SDN functions at the device level and how OpenFlow enables programmability.
SDN Control Plane	7, 8, 9	students will be able to explain the function of the control plane in SDN and how it is responsible for network-wide decision-making, including routing and forwarding policies. students will be able to identify the key components and architecture of an SDN controller and its role in managing and controlling the data plane devices.
SDN Application Plane	10, 11, 12	students will be able to describe the application plane's position in the SDN architecture and how it interacts with the control plane to enable application-specific functionalities. Recognize the variety of applications that run on the SDN application plane, including traffic engineering, network monitoring, security, and load balancing. Explore how SDN applications drive innovation in fields like IoT, data centers, and cloud computing by enabling highly customizable, dynamic, and automated network management.

Cloud Computing	13, 14, 15	students will be able to understand the core concepts of cloud computing, including its definition, characteristics, and essential features like on-demand self-service, resource pooling, and scalability. Differentiate between the primary cloud service models: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS), and understand their use cases.

Practical Topics	**Week**	**Learning Outcome**

Questions Example Design
Extra notes:
Signature