

Subject Description Form

Subject Code	EIE589
Subject Title	Wireless Data Network
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	The students are expected to have some basic knowledge about IP networks.
Objectives	<ol style="list-style-type: none"> 1. To introduce the fundamental issues, concepts, and design principles in wireless data networks and systems. 2. To understand the key concepts towards 4G and 5G Wireless and the convergence of cellular network and the Internet. 3. To introduce Low-Power Wide-Area Networks for Internet of Things (IoT). 4. To understand software defined network and network function virtualization.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <p>(1) Professional/academic knowledge and skills</p> <ol style="list-style-type: none"> a. Understand network topology, layered architecture and protocols of current and emerging wireless data network systems and their standards. <p>(2) Attributes for all-roundedness</p> <ol style="list-style-type: none"> b. Communicate effectively. c. Think critically and creatively. d. Assimilate new technological development in related field.
Subject Synopsis/ Indicative Syllabus	<ol style="list-style-type: none"> 1. Convergence of cellular network and the Internet <ol style="list-style-type: none"> 1.1. Network edge: wireless technologies 1.2. Network core: the Internet structure 1.3. Layered Internet protocol stack 2. Data plane on network layer <ol style="list-style-type: none"> 2.1. Overview of the data plane and the control plane on network layer 2.2. What is inside a router 2.3. Generalized Forwarding 3. Control plane on network layer <ol style="list-style-type: none"> 3.1. IPv4 and IPv6 addresses 3.2. Routing protocols 3.3. Software-defined networking 4. Modern wireless networks <ol style="list-style-type: none"> 4.1. Elements of 4G LTE architecture 4.2. Elements of 5G NR architecture 4.3. Elements of WiFi architecture 4.4. Low-power wide-area networks for Internet of Things (IoT) 5. Physical-layer techniques <ol style="list-style-type: none"> 5.1. Fundamentals of physical layer 5.2. Bandwidth utilization

	<p>5.3. Error detection & correction</p> <p>5.4. Channel coding</p> <p>5.5. Data link control and media access control</p>
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Teaching/Learning Methodology	<p>Internet and wireless networks are taught with emphasis on fundamental understanding of the architecture, components, and protocols. The fundamentals of Internet are taught with network-layer and physical-layer techniques, such as IPv4 versus IPv6 protocols, routing protocols, software-defined networking, error detection & correction, channel coding, data link control and media access control, etc. The latest developments towards 5G Wireless standards are explained. These examples will help students not only to learn the theoretical material but also to understand the practical issues. The students will be able to understand the challenges associated with the latest generations of wireless networks and get an insight into new techniques under development.</p>				
	Teaching/Learning Methodology		Intended Subject Learning Outcomes		
		a	b	c	d
	Lecture	✓			
	Tutorial	✓		✓	
Case study	✓	✓	✓	✓	

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks		% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
				a	b	c	d
	1. Midterm test		30%	✓	✓	✓	✓
	2. Assignments		10%	✓	✓	✓	✓
	3. Case study		10%	✓	✓	✓	✓
	3. Final examination		50%	✓	✓	✓	✓
	Total		100%				
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Assignments let students review the taught materials, do further reading for deeper learning and apply the learnt materials to solving circuit design problems.</p> <p>Case study requires students to do further reading, search for information, keep abreast of current development, run simulation and write a report.</p>							

Student Study Effort Expected	Class contact:		
	▪ Lecture/Tutorial		33 Hrs.
	▪ Case study – presentations and discussions		6 Hrs.
	Other student study effort:		
	▪ Further reading, doing homework /assignments		72 Hrs.
	Total student study effort		

Reading List and References

1. “Computer Networking: A Top-Down Approach”, 8th ed., J. F. Kurose and K. W. Ross, Pearson, 2020
2. “5G System Design”, Wan Lei, Anthony C.K. Soong, Liu Jianghua, Wu Yong, Brian Classon, Weimin Xiao, David Mazzaresse, Zhao Yang, Tony Saboorian, Springer, 2020
3. “5G Mobile Communications”, Wei Xiang, Kan Zheng, Xuemin (Sherman) Shen, Springer, 2017
4. “Wireless Communications: Principles, Theory and Methodology”, Keith Q.T. Zhang, Wiley, 2016
5. “Data Communications and Networking”, Behrouz A. Forouzan, McGraw-Hill, 2013
6. “Introduction to Wireless and Mobile Systems”, D.P. Agrawal and Q. Zeng, Cengage Learning, 2016
7. “Optical Communications in the 5G Era”, Xiang Liu, Elsevier, 2022
8. 3GPP standards: <http://www.3gpp.org>
9. IETF rfc in IPv6 and transition from IPv4 to IPv6:
<http://tools.ietf.org/html/rfcxxxx>

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