

Appendix A

Schedule Plan of “Summer School for Coding Theory & Signal Processing in 5G Era” 6 Days, 30 July – 4 August 2018

Day	Time	Program	Learning Outcome	Contents
MONDAY, 30 July 2018	08:30 – 09:00	REGISTRATION		
	09:00 – 09:30	Summer School Opening from Telkom University Rector		
	09:30 – 10:00	COFFEE BREAK		
	10:00 – 12:00	Lecture on: “Basic Coding Theory for 5G Technology and Research Opportunities” part 1 (2 hours)	Total hours: 5 hours <ul style="list-style-type: none"> Participants understood the principle of error correction coding in communications Participants understood Polar codes and LDPC codes. Participants understood the random access for IoT with network coding. Participants can demonstrate how the coding works. 	Total hours: 5 hours <ol style="list-style-type: none"> Channel coding theorem Basic of Polar codes Basic of LDPC codes Basic of Turbo processing Coded random access for IoT
	12:00 – 13:30	LUNCH BREAK		
	13:30 – 15:00	Lecture on: “Basic Coding Theory for 5G Technology and Research Opportunities” part 2 (1.5 hours)		
	15:00 – 15:30	COFFEE BREAK		
15:30 – 17:00	“Basic Coding Theory for 5G Technology and Research Opportunities” part 3 (1.5 hours)			
TUESDAY 31 July 2018	08:30 – 09:00	REGISTRATION		
	09.00 – 10.15	Lecture on: “MIMO Communications: Fundamental Limits and Applications” Part 1 (1:15 hours)	Total hours: 5:30 hours <ul style="list-style-type: none"> To demonstrate knowledge and understanding of fundamentals of multiple-input multiple-output (MIMO) communications 	Total hours: 5.5 hours <ol style="list-style-type: none"> Fundamentals of MIMO communications Capacity and Multiplexing Architectures of MIMO systems
	10:15 – 10:45	COFFEE BREAK		
	10:45 – 12:00	Lecture on:		

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		"MIMO Communications: Fundamental Limits and Applications" Part 2 (1:15 hours)	<ul style="list-style-type: none"> To develop a critical thinking in understanding the MIMO principles of MIMO and evaluating its potential through the capacity analysis of MIMO systems. To understand and synthesize the potential direction of MIMO research for 5G networks and beyond 	<ol style="list-style-type: none"> Diversity and Multiplexing Tradeoff in MIMO systems Massive MIMO case study for 5G and beyond: Challenges and opportunities.
	12:00 – 13:30	LUNCH BREAK		
	13.30 – 15:00	Lecture on: "MIMO Communications: Fundamental Limits and Applications" Part 3 (1:30 hours)		
	15:00 – 15:30	COFFEE BREAK		
	15:30 – 17:00	Lecture on: "MIMO Communications: Fundamental Limits and Applications" Part 4 (1:30 hours)		
WEDNESDAY, 1 August 2018	08:30 – 09:00	REGISTRATION		
	09.00 – 10.00	Lecture on: "Coding and detection for fiber-optic channels" Part 1 (1 hour)	Total hours: 5:15 hours This course of lectures will provide: <ul style="list-style-type: none"> Optical communication channel characteristics in general (multi-mode, single-mode fibers, different dispersion effects, incoherent/coherent communications, historic perspective), LDPC channel coding (in particular spatially coupled codes), using, e.g., EXIT chart techniques 	<ol style="list-style-type: none"> Optical communication channel and modulation formats- a brief history of optical communications <ul style="list-style-type: none"> multi-mode/gradient fiber and mode dispersion single-mode fiber and chromatic dispersion optical amplifiers Schoedinger equation and non-linear effects Soliton pulses and split-step Fourier transform incoherent (intensity-based) communications external modulation using the Mach-Zehnder Modulator pulse shaping coherent communications 2x4 90-degree hybrid polarization multiplex Channel coding for optical communications
	10:00 – 10:15	COFFEE BREAK		
	10:15 – 12:00	Lecture on: "Coding and detection for fiber-optic channels" Part 2 (1:15 hours)		
	11:30 – 13:30	LUNCH BREAK & PRAY		
	13:30 – 15:00	Lecture on: "Coding and detection for fiber-optic channels" Part 3 (1:30 hours)		
	15:00 – 15:30	COFFEE BREAK		
	15:30 – 17:00	Lecture on: "Coding and detection for fiber-optic channels" Part 4 (1:30 hours)		

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				<ul style="list-style-type: none"> LDPC codes encoding and decoding degree profile design for early convergence using EXIT charts connection to density evolution "interleaver" (H matrix) design for low error floors combination of detection (modulation) front-ends and decoding spatially coupled LDPC codes and wavelike convergence constellation shaping techniques
THURSDAY,	08:30 – 09:00	REGISTRATION		
2 AUGUST 2018	09.00 – 10.15	Lecture on: "Ultra Reliable Wireless Ad-Hoc Networks for 5G and IoT/M2M Applications" (1:15 hours)	Total hours: 5 hours <ul style="list-style-type: none"> Understanding the major application or use-case of Ultra Reliable Wireless Ad-Hoc Networks for 5G and IoT/M2M Understanding technical requirements and international standardization of Ultra Reliable Wireless Ad-Hoc Networks for 5G and IoT/M2M Understanding the regulatory and business model of Ultra Reliable Wireless Ad-Hoc Networks for 5G and IoT/M2M 	Total hours: 5 hours Ultra Reliable Wireless Ad-Hoc Networks for 5G and IoT/M2M Applications, including: <ol style="list-style-type: none"> Major Applications or Use-Cases, Technical Requirement International Standardization Regulatory Science, and Business Model Research Opportunities
	10:15 – 10:45	COFFEE BREAK		
	10:45 – 12:00	Lecture on: "Ultra Reliable Wireless Ad-Hoc Networks for 5G and IoT/M2M Applications" (1:15 hours)	Total hours: 5 hours	
	12:00 – 13:30	LUNCH BREAK & PRAY		
	13:30 – 15:00	Lecture on: "Ultra Reliable Wireless Ad-Hoc Networks for 5G and IoT/M2M Applications" (1:30 hours)		
	15.00 – 15.30	COFFEE BREAK		

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	15:30 – 17:00	Lecture on: “Ultra Reliable Wireless Ad-Hoc Networks for 5G and IoT/M2M Applications” (1:30 hours)		
FRIDAY, 3 August 2018	08:30 – 09:00	REGISTRATION		
	09:00 – 10:15	Lecture on: “Best Practice on 5G Business Regulation & Standardization: Lesson Learned from Japan”	Total hours: 2 hours This course of lectures will provide Best Practice on 5G Business Regulation & Standardization: Lesson Learned from Japan	
	10:15 – 10:45	COFFEE BREAK		
	10:45 – 11:30	Lecture on: “Best Practice on 5G Business Regulation & Standardization: Lesson Learned from Japan”		
	11:30 – 13:30	LUNCH BREAK & PRAY		
	13:30 – 15:00	POSTER SESSION AND RESEARCH CONSULTATION	Improving research methods and results from the expert feedback	
	15.00 – 15.30	COFFEE BREAK		
	15.30 – 17.00	POSTER SESSION AND RESEARCH CONSULTATION		
SATURDAY, 4 August 2018	08.00 – 17.00	FULL DAY EXCURSION To Tea / Coffee Garden, Tangkuban Parahu, and Saung Angklung Udjo in Bandung Paris van Java	Total hours: 9 hours <ul style="list-style-type: none"> • Cultural Visit 	

Facilities for participants : Lunch & Break, seminar kit, certificate

Facilities for lecturer: hotel, international flight & local transportation, cultural visit in Bandung & Bali (optional)