High Intensity Training (HIT) Programs on 5G Wireless Technologies

5G Multi-User and Massive MIMO 25th to 27th September, 2020

5G Broadband mmWave MIMO-OFDM 2nd to 4th October, 2020

5G Cooperative and NOMA Communication 9th to 11th October, 2020

Organized by Prof. Aditya K. Jagannatham, EE Department, IIT Kanpur

Important Information for the short course at IIT Kanpur

Welcome to this short course at IIT Kanpur! We are delighted to have you as a participant. Please go through some essential information in this document. Please note that this course will be conducted online via zoom.

Contact Information

Staff below can be contact for training related support.

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Important notes:

1. Only hard copy of lecture material will be provided. Due to IPR related concerns, soft copies will not be provided. This will be sent by post/ courier as and when normal services resume either before or after the course.
2. Recording of lectures, uploading/ distribution of video or audio lectures or course notes is NOT permitted.
3. Participants have to ensure connectivity for the duration of the course. Recorded video lectures will NOT be available.
4. All participants MUST keep their video feed ON during the training program to monitor attendance and participation.

Tentative Schedule

The tentative schedule for the duration of the short course is also available online at:
http://www.iitk.ac.in/mwn/5GHIT/programme.html

P1: Schedule for HIT Program on 5G Multi-User and Massive MIMO 25th to 27th September, 2020

Test Day: September 23rd , 2020 (WEDNESDAY)	
12:00 PM -12:30 PM	Zoom Test Session
DAY 1: September 25th , 2020 (FRIDAY)	
09:00 AM - 0:15 AM	5G and IoT: A Gentle Introduction
10:15 AM - 10:45 AM	Break
10:45 AM - 12:15 PM	Introduction to Massive MIMO Technology and Architecture UL/ DL
12:15 PM - 2:00 PM	Break
02:00 PM - 03:15 PM	Problem solving session on Massive MIMO and Multi-user MIMO
03:15 PM - 03:45 PM	Break
03:45 PM - 05:15 PM	Multi-user MIMO Techniques for 5G: Precoding and Combining
DAY 2: September 26th , 2020 (SATURDAY)	
09:00 AM - 10:15 AM	Beamforming Strategies and Performance of Massive MIMO Cellular Networks
10:15 AM - 10:45 AM	Break
10:45 AM - 12:15 PM	Channel Estimation for Massive MIMO and Performance with Imperfect CSI
12:15 PM - 2:00 PM	Break
02:00 PM - 03:15 PM	MATLAB Project on Massive MIMO System Implementation with Perfect and Imperfect CSI, ZF and MF Receivers, Power Scaling
03:15 PM - 03:45 PM	Break
03:45 PM - 05:15 PM	Broadband Massive MIMO-OFDM Technology, Channel Estimation and Performance
DAY 3: September 27th , 2020 (SUNDAY)	
09:00 AM - 10:15 AM	Spatial Modulation (SM), Space Shift Keying (SSK) and Generalized Spatial Modulation (GSM) for massive MIMO
10:15 AM - 10:45 AM	Break
10:45 AM - 12:15 PM	Expert Guest Lecture on 5G: Dr. Tanumay Datta, Engineer, Staff, Qualcomm
12:15 PM - 2:00 PM	Break
02:00 PM - 03:15 PM	MATLAB Project on Spatial Modulation Techniques for Massive MIMO
03:15 PM - 03:45 PM	Break
03:45 PM - 05:15 PM	Multi-cell Massive MIMO and Pilot Contamination

P2: Schedule for HIT Program on 5G Broadband mmWave MIMO-OFDM 2nd to 4th October, 2020

Test Day: September 30th , 2020 (WEDNESDAY)	
12:00 PM - 12:30 PM	Zoom Test Session
DAY 1: October 2nd , 2020 (FRIDAY)	
09:00 AM - 10:15 AM	Overview and Goals of 5G
10:15 AM - 10:45 AM	Break
10:45 AM - 12:15 PM	Introduction to mmWave MIMO Technology, Hybrid Signal Processing Architectures
12:15 PM - 02:00 PM	Break
02:00 PM - 03:15 PM	Tutorial and Problem solving session on MIMO Precoding and mmWave MIMO
03:15 PM - 03:45 PM	Break
03:45 PM - 05:15 PM	Multi-antenna Beamforming and MIMO Precoding
DAY 2: October 3rd, 2020 (SATURDAY)	
09:00 AM - 10:15 AM	mmWave MIMO Channel Modeling, Beam Training for mmWave MIMO, Optimal Training
10:15 AM - 10:45 AM	Break
10:45 AM - 12:15 PM	Hybrid Transceiver Design for mmWave MIMO Systems
12:15 PM - 2:00 PM	Break
02:00 PM - 03:15 PM	Hands-on MATLAB Project on mmWave MIMO Channel Modeling and Estimation
03:15 PM - 03:45 PM	Break
03:45 PM - 05:15 PM	Introduction to mmWave MIMO OFDM Technology
DAY 3: October 4th, 2020 (SUNDAY)	
09:00 AM - 10:15 AM	Channel Estimation for mmWave MIMO-OFDM Systems
10:15 AM - 10:45 AM	Break
10:45 AM - 12:15 PM	Expert Guest Lecture on 5G: Dr. Bama Muthuramalingam, Staff Engineer, Qualcomm
12:15 PM - 2:00 PM	Break
02:00 PM - 03:15 PM	MATLAB Project on Hybrid Transceiver Design for mmWave MIMO
03:15 PM - 03:45 PM	Break
03:45 PM - 05:15 PM	Transceiver Design for Broandband mmWave MIMO-OFDM systems

P3: Schedule for HIT Program on 5G Cooperative and NOMA Communication 9th to 11th October, 2020

Test Day: October 7th , 2020 (WEDNESDAY)	
12:00 PM - 12:30 PM	Zoom Test Session
DAY 1: October 9th , 2020 (FRIDAY)	
09:00 AM - 10:15 AM	5G Technologies and Specifications
10:15 AM - 10:30 AM	Break
10:30 AM - 11:30 AM	Introduction to Non-Orthogonal Multiple Access (NOMA)
11:30 AM - 02:00 PM	Break
02:00 PM - 03:15 PM	Tutorial and Problem Solving Session - BER/ Diversity, Outage Performance, NOMA and Cooperative communication
03:15 PM - 03:45 PM	Break
03:45 PM - 05:15 PM	Beamforming, BER and Diversity of Wireless Communication
DAY 2: October 10th, 2020 (SATURDAY)	
09:00 AM - 10:15 AM	Fixed NOMA Wireless Systems, Performance Analysis for UL and DL
10:15 AM - 10:30 AM	Break
10:30 AM - 11:30 AM	Cooperative communication Protocols, and Selective DF Performance Analysis
11:30 AM - 02:00 PM	Break
02:00 PM - 03:15 PM	MATLAB Project on Cooperative Communication, MIMO Cooperation
03:15 PM - 03:45 PM	Break
03:45 PM - 05:15 PM	Cooperative MIMO and Multi-relay Communication Systems
DAY 3: October 11th , 2020 (SUNDAY)	
09:00 AM - 10:15 AM	Ordered NOMA Systems and Performance Analysis, NOMA Optimization
10:15 AM - 10:30 AM	Break
10:30 AM - 11:30 AM	Expert Guest Lecture on 5G: Dr. Shashidhar Vummintala, Director Engineering, Qualcomm
11:30 AM - 02:00 PM	Break
02:00 PM - 03:15 PM	MATLAB Project on NOMA Systems, Fixed NOMA, Ordered NOMA, Optimal Power Allocation
03:15 PM - 03:45 PM	Break
03:45 PM - 05:15 PM	AF and Fixed DF Cooperative wireless communication