



SHORT TERM COURSE ON 5G Wireless Communications

(Starts on 09/09/2024)

Sponsored by:
Scheme for Promotion of
Academic and Research
Collaboration (SPARC)

Organized by:
Department of Electronics and
Communication Engineering,
NIT Tiruchirappalli, India

Collaboration with:
National Research Tomsk
Polytechnic University,
Russia

About SPARC:

Scheme for Promotion of Academic and Research Collaboration (SPARC) is a Ministry of Education, Government of India initiative to improve research ecosystem in India. It supports national premier educational institutions by facilitating academic and research collaborations between Indian institutions and best institutions in the world from 28 selected nations to jointly solve problems of national and/or international relevance. The scheme proposes to enable productive academic co-operation by supporting the visits and long-term stay of top international faculty/researchers in Indian institutions to pursue teaching and research, visits by Indian students for training and experimentation in premier laboratories worldwide, and joint development of niche courses, world-class books and monographs, translatable patents, demonstrable technologies or action research outcomes and products.

About TPU- Russia:

The Tomsk Polytechnic University (TPU), Russia is ranked at 576 in QS world university ranking and is ranked as 9th in RAEX-100 Rating of the best universities in Russia. TPU is the first engineering school in Russia's Far East to open doors in 1896. Today TPU is one of Russia's leading public research universities with focus on applied science and technology. TPU is a research university with a strong tradition of excellence in the areas of physics, applied engineering, and electronics engineering. Recently, we added nanotechnologies and alternative energy to our research portfolio. Tomsk Polytechnic's annual research budget of \$30 million ranks second among technical and engineering schools in the country. Roughly 10% of funding comes from outside Russia; we rank second to none in this category.

Key Resource Person:

Prof. DUSHANTHA NALIN K JAYAKODY,



Prof. Dush N. K. Jayakody is a Senior Member IEEE, Fellow, IET, and received the Ph. D. degree in Electronics and Communications Engineering, from the University College Dublin, Ireland in 2014. He received his MSc degree in Electronics and Communications Engineering from

Eastern Mediterranean University, Turkey. He was ranked as the top 2% scientist in the world in 2021, 2022 and 2023 by the Stanford Elsevier list. In 2021, he received the Sri Lankan Presidential Award for his outstanding research performance among many other awards

and recognitions. Since 2022, he is a Professor at the Lusófona University, Portugal. He is currently serving as the Vice Chair of IEEE ComSoc. He held visiting and/or sabbatical positions at the Center for Telecommunications Research, University of Sydney, Australia in 2015, and Texas A&M University in 2018, He was a visiting professor at the University of Jyväskylä, Finland both in 2019 and 2022 within the framework of the Academy of Finland. He also served as a visiting professor at the University of Juiz de Fora in Brazil in 2019. From 2019-2022, he has been a SPARC Professor at the Department of Electronics and Communication Engineering, National Institute of Tiruchirappalli, India, within the framework of the Ministry of Human Resources in India. From 2014 - 2016, he was a Postdoc Research Fellow at University of Tartu, Estonia and University of Bergen, Norway. From 2016-2021, he was a Professor at the School of Computer Science & Robotics, National Research Tomsk Polytechnic University (TPU) Russia. From 2019-2021, he served as the Dean, School of Postgraduate Studies & Research at Sri Lanka Technological Campus, Sri Lanka and then from 2021-2022 as the Director Postgraduate, Research and Impact at the Research at Sri Lanka Technological Campus, Sri Lanka. From 2021-2022, he was with the Department of Engineering & Computer Science/Autónoma TechLab, Universidade Autónoma de Lisboa, Portugal. He is supervised over 8 PhD students and many master and over 50 undergraduate students and 5 Postdoc researchers. In his career, so far, he has attracted nearly 6M \$ research funding from many international grant agencies and has published over 230 international peer reviewed journal and conference papers and books.

Eligibility:

The programme is open to UG (final year), PG, Ph.D. Scholars, and professionals (faculty and staff) of Electronics and Communication Engineering and allied disciplines of National Institute of Technology, Tiruchirappalli.

Course Coordinators:

Dr. P. Muthuchidambaranathan, Professor, ECE Dept.

Dr. P. Maheswaran, Assistant Professor, ECE Dept.

Last date of Registration 07.09.2024

For any clarifications, please contact:

Mr. E. G. Hariganesh, Mobile: 9788303279

Ms. Deepika Rajpoot, Mobile: 9411813484

Mrs. Yoga Sheeba, Mobile: 9344234038

Course Outline

Name of course: 5G Wireless Communications
Instructor: Prof. Dushantha Nalin K. Jayakody
Discipline: Electronics & Communication Engineering/Telecommunications Engineering
Lecture hours: 20 hrs
Target Audience: UG final year students, Postgraduate students, PhD candidates, research scientists, and professionals (faculty and staff) of NIT Trichy working in this or allied area.

Intended Learning Outcomes:

Deep Understanding of Advanced 5G Technologies: Gain an in-depth knowledge of the latest 5G technologies

- **ILO 1:** Demonstrate a comprehensive understanding of advanced concepts in 5G wireless communication systems, including system parameters, requirements, and mathematical optimization techniques.
- **ILO 2:** Critically analyse and design Ultra-Reliable and Low Latency Communication (URLLC) systems, with an emphasis on latency analysis, multi-access edge computing, and robust communication strategies.
- **ILO 3:** Evaluate and apply various 5G multiple access schemes, channel coding, and modulation techniques to optimize the performance and reliability of 5G networks.
- **ILO 4:** Design and implement Enhanced Mobile Broadband (EMbb) communication systems, with a focus on massive MIMO and the underlying principles that drive high-capacity, high-speed wireless communication.

Module Content:

Week 1: Advanced Concepts in 5G

- 5G Wireless Communication System Parameters and Requirements
- Mathematical Optimization Techniques for Wireless Communications

Week 2: Ultra-Reliable and Low Latency Communication Systems

- Design Approaches of URLLC Systems
- Latency Analysis
- Multi-Access Edge Computing

Week 3: 5G Multiple Access Schemes & Channel coding

- 5G Multiple Access Techniques
- 5G Channel Coding and Modulation

Week 4: Enhanced Mobile Broadband Communication Systems (EMbb)

- Design of EMbb
- Massive MIMO

Assessment and Evaluation:

- Active participation in lectures and discussions.
- Group project focused on designing an advanced 5G application or solution.
- Individual research proposal on a 5G/6G-related topic.

Short term course certificate will be given after the successful completion of the course.

Learning Resources:

- Advanced textbooks, research papers, technical reports, and online courses.
- X. Huang and J. A. Zhang, "5G Mobile Communications: Concepts and Technologies," CRC Press, 2020.
- M. Shafi, A. F. Molisch, P. J. Smith, T. Haustein, P. Zhu, and P. De Silva, "5G: A Tutorial Overview of Standards, Trials, Challenges, Deployment, and Practice," IEEE Press, 2019.
- Y. Cai, R. Q. Hu, Y. Qian, and G. Yu, "5G and Beyond Wireless Systems: PHY Layer Perspective," Springer, 2020.
- F. Hu, "5G Development and Applications," Springer, 2021.
- K. I. Pedersen, F. Frederiksen, P. Mogensen, and P. E. Mogensen, "5G NR: The Next Generation Wireless Access Technology," Academic Press, 2020.

Course Registration:

<https://forms.gle/NY7GHschVS7M9xPC7>

SPARC Project Code – 3524, UAV Assisted and Reconfigurable Intelligent Surface Supported B5G Communication