The proliferation of smartphones and tablets has led to a tremendous increase in mobile data traffic. Further, the large number of devices and appliance are expected to connect wirelessly to the internet in the emerging Internet of Things (IoT) applications and machine-to-machine (M2M) communication. In order to support the exponential growth of existing mobile traffic and the emergence of new wireless applications and services, researchers and worldwide standardization bodies are proposing with new wireless standards almost every decade. Fifth-generation (5G) wireless network is about to be launched with new state-of-the-art technologies like Massive MIMO, mmWave communication, FBMC and NB-IoT with the intent of “Everyone, Everywhere, Always Connected”. Hence it is necessary for communication engineers, students and researchers to understand the fundamentals of emerging wireless technologies to be employed in the rapidly growing wireless industry. Aim of the course is to introduce various mobile technologies from 2G to 4G and beyond and different wireless channel modeling and their performance analysis. Additionally, provide hands-on practical experience using MATLAB to analyze the various digital wireless communication sub-modules.

**COURSE OBJECTIVES**

- To present comprehensive overview of modern wireless communication from 2G to 4G and beyond and related wireless technologies.
- To understand the performance analysis of wireless systems in different channel impairments.
- To understand the various state-of-the-art technologies on 5G like Massive MIMO, mmWave communication, GFDM, OFDM, OTFS, FBMC, Cognitive Radio and NB-IoT.
- To provide practical hands on lab exercises using MATLAB for illustrating wireless channel modelling and various sub modules of wireless communication system.
- To provide useful tips for research paper writing and typesetting using Latex from invited speakers.

**Invited Expert Speakers**

Prof. Sarat Kumar Patra, Director, IIIT Vadodara  
Prof. Himansu Mishra, IIT, Dhanbad  
Prof. Tony Jacob. IIT, Guwahati

**TEQIP-III sponsored Short Term Course on**  
“Modern Wireless Communication: Towards 5G”  
25th SEP-29th SEP 2019

Co-ordinators:  
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### ABOUT NIT ROURKELA:
National Institute of Technology (NIT), Rourkela was founded as Regional Engineering College, Rourkela in 1961. It is a prestigious Institute with a reputation for excellence at both undergraduate and postgraduate levels, fostering the spirit of national integration among the students, a close interaction with industry and a strong emphasis on research, both basic and applied. Its been consistently ranked within TOP 20 engineering institutes for 4 consecutive years as per MHRD’s NIRF, Govt. of India. The city of Rourkela is a bustling industrial town, cosmopolitan by nature and is well connected to all parts of the country by road and rail. It is en-route Howrah-Mumbai main line of South-Eastern Railway. Nesting amidst greenery on all sides, NIT campus is approximately 7km from Rourkela railway station. The nearest airports are Jharsguda, Ranchi, Kolkata and Bhubaneswar.

### INTENDED AUDIENCE:
- B.Tech/M.Tech students undertaking projects and career option in wireless communication industry
- Ph.D. scholars pursuing research in next generation wireless technologies
- Faculties of Electronics, Electrical and Computer Science & Engineering departments
- Engineers from Wireless Industry and R&D Organizations

### REGISTRATION AND FEES:

<table>
<thead>
<tr>
<th>Registration Type</th>
<th>Fees</th>
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</thead>
<tbody>
<tr>
<td>Student (UG/PG/Ph.D.)</td>
<td>₹ 1000</td>
</tr>
<tr>
<td>Faculty member</td>
<td>₹ 1500</td>
</tr>
<tr>
<td>Industry participants</td>
<td>₹ 2000</td>
</tr>
</tbody>
</table>

### MODE OF PAYMENT:
Interested participants can pay the registration fee via online banking followed by sending an email to the coordinator and filling the online registration link. The banking details are given below. Alternatively, they could also pay via Demand Draft drawn in favour of Director, NIT Rourkela and send it by post to the coordinator.

- **Account Name:** Director NIT Rourkela
- **Account number:** 37537622247
- **IFSC Code:** SBIN0002109
- **Bank name:** SBI, NIT Campus.

Registration link: [https://forms.gle/WvNCgpYqJGhQNJTB6](https://forms.gle/WvNCgpYqJGhQNJTB6)

# Registration includes Accommodation, Course kit, study material, breakfast and lunch on all five days. Accommodation will be provided in student hostels.
# Special request for accommodation in the institute guest house will be charged as per actual.

### MAILING ADDRESS:
Mail: hiremaths@nitrkl.ac.in

### COURSE OUTLINE:
**25th SEP 2019:**
- Introduction to wireless communication: Covering 1G to 5G evolution and Technical Challenges in wireless communication
- Cellular concept in 2G, 3G and 4G
- MATLAB based simulation on cellular concepts

**26th SEP 2019:**
- Wireless Propagation: Propagation mechanisms, large scale and small scale channel impairments
- channel modelling for large scale and small scale fading
- Channel equalization
- Capacity of wireless Channels
- MATLAB based simulation on small scale and large scale impairments

**27th SEP 2019:**
- 5G system overview: New Radio concept
- NOMA and NB-IoT
- Cognitive radio and application of machine learning to wireless communication
- Invited talk
- MATLAB tutorial Lab session

**28th SEP 2019:**
- Diversity
- Multicarrier communication: OFDM
- OFDM in LTE, WLAN,
- MIMO wireless communication
- OTFS vs OFDM in 5G
- Invited talk
- MATLAB tutorial Lab session

**29th SEP 2019:**
- Massive MIMO
- Millimeter wave Communication,
- FDD, D2D and Visible Light Communications
- Invited talk
- MATLAB tutorial Lab session