All about Wireless Power Transfer- Antenna, Circuit, Device, and Applications

Overview

A Wireless Power Transfer (WPT) is the 4th application of radio waves/fields after wireless communication, remote sensing, and heating. The WPT is roughly classified with a coupled (near field) WPT and a radiative (far field) WPT. The radiative WPT via microwaves can be applied for battery-free IoT (Internet-of-Things) sensors, wireless charger for mobiles, wireless powered flying drone, and Solar Power Satellite (SPS)/Space Based Solar Power (SBSP). The WPT is recently considered as a game changing technology. We can realize the new world "electricity like the air" with the WPT, in which the electricity is most important for our life, but we cannot mind where they are like the air. The WPT can contribute to the decrease of CO2, especially in the SPS/SBSP, but also in battery-free sensors with new power management systems. The radiative WPT is based on conventional radio wave theory/technology from the different viewpoint as "energy". In the proposed GIAN Course, the audience can learn all about WPT, which involves antenna, circuit, device, and applications.

Course Objectives

The GIAN Course is both for working professionals and young engineers including students, who want to learn the WPT, and for senior engineers, who want to consider new applications of the WPT including commercial applications. After attending the GIAN Course, they can start the WPT research and development in each technology, antenna, circuit, device, and applications, which they are interested in.

Course Information	**Duration:** 25-29 August 2025 **Place:** Department of ECE, NIT Silchar, Assam, India **Total Contact Hours:** 13 Lecture Sessions and 02 Sessions (Tutorial + Hands on) in 5 days **GIAN Course Examination:** 29 August 2025
Course Outlines	Review and Recent R&D of Radiative Wireless Power Transfer, Review and Recent R&D of Solar Power Satellite SPS, Theory and Technology of Antenna and Propagation for WPT**,** Microwave Power Transfer Applications in Bioelectromagnetic, Target Detecting Technologies, Power Combiner and Power Splitter for WPT Applications, Theory and Technology of Amplifier Design for WPT, Energy Storage for WPT Applications, Theory and Technology of Rectenna – Rectifying Antenna for WPT. Problem Solving Session with Examples and Hands-On Session.
Teaching Faculty	**Prof. Naoki Shinohara:** 11 Lecture Sessions + 1 Tutorial Session **Dr. Taimoor Khan:** 2 Lecture Sessions + 1 Tutorial Session
Who can attend…..	• Electronics engineers or research scientists from R&D organizations/ laboratories, interested in working in the area of wireless power transfer (WPT) system, microwave, antennas and allied domains. • Faculty members from academic institutions/universities interested in learning how to do research on WPT systems or subsystems.

	• Engineer and researcher from manufacturing, service and government organizations including R&D laboratories. • Student (B.Tech./M.Tech./MSc./Ph.D.), researchers and faculty members in all areas of engineering working on wireless power transfer, microwave, antennas and allied domains.
Fee Details	The participation fees for taking the course is as follows: a. Participants from abroad: **USD 250** b. Participants from Industry/Research Organizations: **Rs. 5000/-** c. Participants from Academic Institutions: *i. Faculty member:* ***Rs. 2000/-*** *ii. External Students:* ***Rs. 500/-*** *iii. Internal PG and Ph.D. Students:* ***Rs. 500/-*** *iv. Internal UG Students:* ***Nil*** **Note:** • The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment, 24 hr free internet facility. • The participants may be provided with accommodation (single/sharing) on payment basis. • Valid Identity card/bonafide letter is mandatory from the students.
Registration Guidelines	**1.** Pay the requisite course fee (see above) through SBI Collect. You may use the adjacent QR Code. Select: **GIAN COURSE NIT SILCHAR_2412366_Taimoor Khan.** Note down the payment reference number. You will need this in the next step. **2.** Fill out the registration form using the link: https://forms.gle/eosH2mw9Wo69LGtQ6 and await the Course Coordinator's confirmation within the next couple of days. **3.** The deadline for registration is 24 August 2025. Seats will be filled on a first-come-first-get basis. **N.B: Please retain original receipt/one photocopy of the payment confirmation for on-spot submission.** **Course Coordinator:** Dr. Taimoor Khan Associate Professor Dept of Electronics and Communication Engineering, National Institute of Technology Silchar, **Silchar, Assam, India, E-mail: ktaimoor@ece.nits.ac.in**

The Faculty (Experts)

Naoki Shinohara received the B.E. degree in electronic engineering, the M.E. and Ph.D (Eng.) degrees in electrical engineering from Kyoto University, Japan, in 1991, 1993 and 1996, respectively. He was a research associate in Kyoto University from 1996. From 2010, he has been a professor in Kyoto University. He has been engaged in research on Solar Power Station/Satellite and Microwave Power Transmission system. He is a Fellow of IEEE and URSI, IEEE MTT-S elected AdCom member (2022-2027), IEEE MTT-S Technical Committee 25 (Wireless Power Transfer and Conversion) former chair and member, IEEE MTT-S Standard Committee chair, IEEE MTT-S MGA (Member Geographic Activities) Region 10 regional coordinator, IEEE WPT Initiative member, IEEE Wireless Power Transfer Conference & Expo founder and Steering committee member, URSI commission D (Electronics and Photonics) former chair, the first chair and technical committee member on IEICE Wireless Power Transfer in Japan, Japan Society of Electromagnetic Wave Energy Applications former president and adviser, Space Solar Power Systems Society president, and was IEEE MTT-S Distinguish Microwave Lecturer (2016-18). He was the recipient of the 2023 IEEE Journal of Microwaves Best Paper Award, the 2022 Award of Minister of Education, Culture, Sports, Science and Technology in Japan, and the 2023 IEICE Achievement Award in Japan. His supervised students were the recipient of 100 awards from 2011 to 2024. He has been author of over 140 reviewed journal papers, over 110 keynotes and invited speakers in international conferences, and over 100 the other invited speakers including 55 DMLs. He has collaborated with totally over 150 companies for the WPT and microwave applications in 30 years. He is the co-inventor of 35 patents and 20 submitting patents. He has worked to harmonize academia and industry of the WPT. He organizes Wireless Power Transfer Consortium for Practical Applications (WiPoT), and Wireless Power Management Consortium (WPMc) in Japan as a chair from 2013 with over 40 companies to establish the WPT market and to encourage the WPT business. His books are “Wireless Power Transfer via Radiowaves” (ISTE Ltd. and John Wiley & Sons, Inc., 2014), “Recent Wireless Power Transfer Technologies Via Radio Waves (ed.)”, (River Publishers, 2018), “Far-Field Wireless Power Transfer and Energy Harvesting”, (Artech House, 2022), “Theory and Technology of Wireless Power Transfer: Inductive, Radio, Optical, and Supersonic Power Transfer” (CRC Press, 2024), and “Wireless Power Transfer: Theory, Technology, and Applications (2nd Edition) (ed.)” (IET, 2018 and 2014), and some English, Japanese, and Chinese translated text books of WPT.

Dr. Taimoor Khan received his Ph.D. in Electronics and Communication Engineering from NIT Patna in 2014. He joined NIT Silchar the same year as an Assistant Professor and is currently an Associate Professor in the Department of Electronics and Communication Engineering. He has also served as a Visiting Researcher at Queen’s University, Canada (2019) and Visiting Assistant Professor at the Asian Institute of Technology, Thailand (2016). Before NIT Silchar, he worked in various institutions for over 14 years, including more than three years at Delhi Technological University. At NIT Silchar, he has held key administrative roles such as Head of ECE (2013–2014), Associate Dean (2021–2024), and Associate Warden (2019–2022). Currently, he is Member Secretary of DPMC, Programme Coordinator of M.Tech. (RFTC), and Lab Incharge of the Advanced Antenna and RF Lab. His research interests include RF Energy Harvesting, Wireless Power Transfer, UWB Antennas, EBG Structures, Dielectric Resonators, and AI/ML for Electromagnetics. He has guided eight Ph.D. theses and authored 90 journal papers, 73 conference papers, 3 patents, and 6 books. He has completed six funded projects and is currently executing three international collaborations under SPARC and VAJRA with Queen’s University (Canada) and California State University, Northridge (USA). Dr. Khan is a Fellow of IEI, IETE, and ATMS; Senior Member of IEEE, IEEE AP Society, IEEE MTT Society, URSI Belgium; and Life Member of ACES. He serves as Associate Editor of IET Electronics Letters and IJRFMCAD (Hindawi-Wiley), and as Editorial Board Member of Nature Scientific Reports. He is the recipient of the ISTE Syed Sajid Ali Award (2022) and the IETE Prof. SVC Aiya Memorial Award (2020). Dr. Khan is the Founder of IEEE MTT Society SBC at NIT Silchar (2019), Founder Chair of IEEE Silchar Subsection (2021), Founder General Chair of IEEE Silchar Subsection Conference, SILCON-2022, General Chair of SILCON-2023 and Organizing Chair of SILCON-2024, Founder Chair of IEEE Kolkata Section APS Chapter-Silchar (2023). Also, he served as an IEEE AP-S Chapter Activity Committee Member (2022), IEEE AP-S Paper Awards Subcommittee Member (2022), IEEE AP-S Chapter Award Committee Member (2022) and Immediate Past Chair, IEEE Silchar Subsection for the year 2023 and 2024 and 2024 and IEEE APS Best Paper Award Subcommittee (2023-2025). Presently he is serving as a Chair of IEEE Kolkata Section APS Chapter-Silchar, Faculty Advisor of IEEE MTTS Student Branch Chapter, IEEE APS Paper Award Committee Member, IEEE APS Education Committee Member and IEEE MTTS Education Committee Member, IEEE MTT-S Student Ambassador, and IEEE R10 ACEI Entrepreneurship Ambassador, all for the year 2025.

About Silchar

Silchar is the second largest town in the state of Assam. It was the kingdom of the Kachchari Kings from 1755 to 1830. It was annexed to the British East India Company in 1833. The city has now attained a cosmopolitan status with inhabitants from all over India although Bengali speaking people constitute the majority. It is an educational and business hub in North East India next to Guwahati. Aesthetically the campus is very beautiful with greenery and wetlands.

About NIT Silchar

In the late fifties, the Government of India decided to establish Regional Engineering Colleges (RECs) under the Quality Technical Education Policy – one each in every major state – with the prime objective of imparting quality technical education throughout the country and to foster national integration. These Regional Engineering Colleges were established as joint ventures of the Government of India and the respective State Governments. Assam is considered as the flag bearer of Northeast India and so in the year 1967 the 15th REC was officially established in Silchar. The first batch of students were admitted in 1977 in the BE program in 3 branches of engineering namely, Civil Engineering, Mechanical Engineering, and Electrical Engineering with a total intake of 60 students in each branch. The REC Silchar was upgraded to National Institute of Technology, Silchar with the status of Deemed University on 28th June 2002. The institute has been taken over by the Government of India and subsequently made into a fully funded Central Government Autonomous Institution. The institute has remodeled its curriculum and academic activities in line with that of the IITs. With its Deemed University status, the institute started awarding degrees from the year 2002 and the first convocation of the institute was held on 16 February 2004. The Government of India declared the Institute as an Institute of National Importance by enacting the National Institutes of Technology Act 2007.

How to reach NIT Silchar

The city is well connected by Road, Train and Air. There are direct flights from Kolkata and Guwahati and trains from New Delhi, Kolkata, Guwahati, and Agartala. Daily bus services are available from Agartala, Guwahati, Aizawl, and Imphal. The Institute is located around 35 kms from the Silchar airport, 10 kms from the Silchar railway station, 14 kms from ISBT Silchar, and 8 kms from the heart of the Silchar town. Prepaid taxi and auto services are available from Silchar.

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GIAN COURSE SCHEDULE
[25-29 August 2025]

DAY 1: MONDAY (25 August 2025) **Registration:** 9:00 AM-10.00 AM **Inaugural:** 10:00 AM-11:00 AM **High Tea:** 11:00 AM-11:30 AM ***Lecture-1*** **(Naoki Shinohara): 11.30 AM-12.30 PM** ***Topic:*** *Review and Recent R&D of Radiative Wireless Power Transfer* ***Lecture-2*** **(Naoki Shinohara)*: 02.00 PM-03.00 PM*** ***Topic:*** *Review and Recent R&D of Solar Power Satellite SPS* **Tea Break:** 03:00 PM-03:10 PM **Lecture-3 (Naoki Shinohara): 03.10 PM-04.10 PM** **Topic:** *Theory and Technology of Antenna and Propagation for WPT (Part #1)*	**DAY 2: TUESDAY (26 August 2025)** ***Lecture-4*** **(Taimoor Khan)*: 10.00 AM-11.00 AM*** ***Topic:*** *Microwave Power Transfer Applications in Bioelectromagnetic* **Tea Break:** 11:00 AM-11:10 AM ***Lecture-5*** **(Naoki Shinohara)*: 11.10 AM-12.10 PM*** ***Topic:*** *Theory and Technology of Antenna and Propagation for WPT (Part #2)* ***Lecuture-6*** **(Naoki Shinohara)*: 02:00 PM-03.00 PM*** ***Topic:*** *Target Detecting Technologies (Part #1)* **Tea Break:** 03:00 PM-03:10 PM **Lecture-7 (Naoki Shinohara): 03:10 PM-04.10 PM** **Topic:** *Target Detecting Technologies* (Part #2)
DAY 3: WEDNESDAY (27 August 2025) ***Lecture-8:*** **(Taimoor Khan) 10.00 AM-11.00 AM** ***Topic:*** *Power Combiner and Power Splitter for WPT Applications* **Tea Break:** 11:00 AM-11:10 AM **Lecture-9: (Naoki Shinohara) 11.10 AM-12.10 PM** ***Topic:*** *Theory and Technology of Amplifier Design for WPT (Part #1)* ***Lecture-10:*** **(Naoki Shinohara) 02:00 PM-03.00 PM** ***Topic:*** *Theory and Technology of Amplifier Design for WPT (Part #2)* **Tea Break:** 03:00 PM-03:10 PM ***Tutorial-1:*** **(Taimoor Khan) 03:10 PM-05.10 PM** ***Topic:*** *Problem Solving Session with Examples and Hands-On Session*	**DAY 4: THURSDAY (28 August 2025)** ***Lecture-11:*** **(Naoki Shinohara) 10.00 AM-11.00 AM** ***Topic:*** *Energy Storage for WPT Applications* **Tea Break:** 11:00 AM-11:10 AM ***Lecture-12:*** **(Naoki Shinohara) 11.10 AM-12.10 PM** ***Topic:*** *Theory and Technology of Rectenna – Rectifying Antenna for WPT* ***Tutorial-2:*** **(Naoki Shinohara) 02:00 PM-04.00 PM** ***Topic:*** *Problem Solving Session with Examples and Hands-On Session* **Tea Break:** 04:00 PM-04:10 PM
DAY 5: FRIDAY (29 August 2025) ***Lecture-13:*** **(Naoki Shinohara) 10:00 AM-11.00 AM** *Concluding Remarks and Future Scope* **Tea Break:** 11:00 AM-11:10 AM ***GIAN Course Examination (MCQ):*** **11.30 AM-12.30 PM** ***Examination Result Announcement and Discussion:*** 03:00 PM-03:30 PM **Valedictory:** 04:00 PM-05:00 PM **High Tea:** 05:00 PM-05:30 PM	

(Dr. Taimoor Khan)
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