

ADVANCES IN NEUROTECHNOLOGIES FOR BUILDING THE BRAIN-MACHINE INTERFACES

Overview

Advances in neurotechnologies are leading to novel diagnostic and therapeutic instrumentation. New generation of implantable devices now provide therapeutic solutions for restoring sensory and motor loss as well as to treat disorders of the central nervous system and other autonomic functions. Most significant advances have been in the area of cochlear, retinal prosthesis, and deep brain stimulation to treat neurological disorders such as Parkinson's and epilepsy. Recent research and development frontiers are implantable devices for interfacing to nerves to restore motor or sensory function and for treating dysfunction of bladder, respiration, cardiovascular autonomic system and immune function. The building blocks of the neurotechnologies are micro/nano sensors and electrodes, low power high performance electronic circuits, and wireless data and powering capabilities. The final frontier in the field is to build brain machine interface technologies for paralyzed and locked in patients.

In this course, we shall study medical Instrumentation focusing on neurotechnologies, frontiers of neuroengineering, Brain Machine Interface, Introduction of cochlear and retinal prosthesis, Motor or sensory functions, and embedded technologies for biomedical applications. Course participants will learn these topics through lectures and hands-on tutorials. Also applications of implantable devices and assignments will be shared to stimulate research motivation of participants.

The primary objectives of the course are as follows:

- Focus on current and future trends in fast emerging neuro-technologies with high potential impact in improving healthcare.
- Exploring applications of neuro-technologies to enhance the knowledge of participants.
- Providing therapeutic solutions for restoring sensory and motor loss as well as to treat disorders of the central nervous system and other autonomic functions.
- Enhancing the research capability of cochlear, retinal prosthesis, and deep brain stimulation to treat neurological disorders such as Parkinson's and epilepsy.
- The final frontier in the field is to build brain machine interface technologies for paralyzed and locked in patients.

LECTURE-WISE COURSE PLAN: (FEBRUARY 25 - MARCH 1, 2017)

Day-1 (Saturday, February 25)

Time (Hours)	Activity
08:30 -09:30	Registration
09:30 - 11:00	Inauguration and Key note (GIAN address) by Prof. Nitish V Thakor, USA Neuroengineering: Brain, Mind and Machine
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11:00 - 11:30	High Tea
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11:30 – 12:30	Lecture-1 Speaker 1: Prof. Nitish V Thakor, USA Introductory Neuroscience: Nervous System and Disorders
12:30 – 13:30	Lecture-2 Speaker 1: Prof. Nitish V Thakor, USA Foundations of Neurotechnologies: Neurosensors, Neurodevices
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13:30 - 14:30	Lunch
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14:30 - 15:30	Lecture-3 Speaker 2: Prof. VR Singh, NPL New Delhi
15:30 - 16:30	Lecture-4 Speaker 3: Prof. Munna Khan, JMI New Delhi

Day-2 (Sunday, February 26)

09:15 - 10:15	Lecture-5 Speaker 1: Prof. Nitish V Thakor, USA Neuromorphic Engineering
10:15 - 11:15	Lecture-6 Speaker 1: Prof. Nitish V Thakor, USA Neuroprosthesis and Neurorobotics
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11:15 - 11:30	Tea
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11:30 - 12:30	Lecture-7 Speaker 4: Prof. Vinay Goyal, AIIMS New Delhi
12:30 - 13:30	Lecture-8 Speaker 5: Prof. K.K. Deepak, AIIMS New Delhi
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13:30 - 14:30	Lunch
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14:30 - 15:30	Lecture-9 Speaker 6: Prof. Prof. AS Siddiqui, JMI New Delhi
15:30 - 16:30	Interactive sessions and group discussions about possible projects by Prof. Nitish V Thakor, USA

Day-3 (Monday, February 27)

09:15 - 10:15 Lecture-10 Speaker 1: Prof. Nitish V Thakor, USA
 Building Implantable Neurotechnologies: Solutions to Clinical Disorders
10:15 - 11:15 Lecture-11 Speaker 1: Prof. Nitish V Thakor, USA
 Building Brain Machine Interfaces: Methods and Applications

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11:15 - 11:30 Tea Break

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11:30 - 12:30 Lecture-12 Speaker 7: Prof. Ashok K Salhan DRDO Delhi
12:30 - 13:30 Lecture-13 Speaker 8: Prof. MR Khan, JMI New Delhi

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13:30 - 14:30 Lunch Break

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14:30 - 15:30 Lecture-14 Speaker 1: Prof. Nitish V Thakor, USA
 Introductions to Neurosciences
15:30 - 16:30 Visit to BMI Labs at JMI New Delhi by Prof Munna Khan

Day-4 (Tuesday, February 28)

09:15 - 10:00 Lecture-15 Speaker 1: Prof. Nitish V Thakor, USA
 NeuroChip: Cellular Neuroengineering
10:00 – 10:45 Lecture-16 Speaker 1: Prof. Nitish V Thakor, USA
Cognitive Engineering: Probing the Mind
10:45 - 11:30 Lecture-17 Speaker 9: Prof. Sujoy Kumar Guha, IIT Kharagpur

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11:30 - 11:45 Tea

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11:45 - 12:30 Lecture-18 Speaker 10: Prof. Sneha Anand, IIT Delhi
12:30 - 13:15 Lecture-19 Speaker 1: Prof. Nitish V Thakor, USA
Clinical Neuroengineering (Brain monitoring and therapeutics) etc)

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13:15 - 14:15 Lunch

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14:15 - 15:15 Lecture-20 Speaker 11: Prof. Moinuddin, Jamia Hamdard New Delhi
15:15 - 16:30 Examination for Performance Evaluation of Participants

Day-5 (Wednesday, March 01)

09:00 - 9:45 Valedictory Adress by Prof. Nitish V Thakor, USA
9:45- 10:30 Valedictory Ceremony: Distribution of certificates by
 Prof. Nitish V Thakor, USA and PVC/ Dean JMI

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10:30 - 11:00 High Tea

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11:00 - 13:30 Visit to AIIMS Labs/ IIT Delhi Labs by Prof Munna Khan

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13:30 - 14:30 Lunch

Modules	<p>A: Duration: Feb25 – March 01, 2017</p> <p>B: Venue Department of Electrical Engineering, Jamia Millia Islamia (A Central University), New Delhi – 25, India</p> <p><i>Number of participants for the course will be limited to fifty.</i></p>
You Should Attend If...	<ul style="list-style-type: none"> ▪ You are an executive, engineer and researcher from industry and government organizations, including R&D laboratories interested in graph analytics and mining. ▪ You are a student at all levels (B.Tech/MSc/MTech/PhD) or Faculty from reputed academic institutions.
Fees	<p>The participation fees for taking the course is as follows:</p> <p>Participants from abroad : US \$500</p> <p>Industry/ Research Organizations:INR 10000</p> <p>Academic Institutions:</p> <ul style="list-style-type: none"> • Faculty members: Rs. 3000/- • Students: Rs. 1500/- <p>The above fee include all instructional materials, tutorials and assignments, laboratory equipment usage charges, 24 hour free internet facility. The participants will be provided accommodation on payment basis, subject to the availability.</p>

The Foreign Faculty



Nitish V. Thakor is a Professor of Biomedical Engineering at Johns Hopkins University in the USA as well as the Director the Singapore Institute for Neurotechnology (SINAPSE) at the National University of Singapore. Dr. Thakor's technical expertise is in the field of Neuroengineering, where he has pioneered many technologies for brain monitoring to prosthetic arms and neuroprosthesis. He is an author of more than 300 refereed journal papers, more than a dozen patents, and co-founder of 3 companies. He is currently the Editor in Chief of Medical and Biological Engineering and Computing, and was the Editor in Chief of IEEE TNSRE from 2005-2011. Dr. Thakor is a recipient of a Research Career Development Award from the National Institutes of Health and a Presidential Young Investigator Award from the National Science Foundation, and is a Fellow of the American Institute of Medical and Biological Engineering, IEEE, Founding Fellow of the Biomedical Engineering Society, and Fellow of International Federation of Medical and Biological Engineering. He is a recipient of the award of Technical Excellence in Neuroengineering from IEEE Engineering in Medicine and Biology Society, Distinguished Alumnus Award from Indian Institute of Technology, Bombay, India, and a Centennial Medal from the University of Wisconsin School of Engineering.

Course Co-ordinator

Your name: Prof. Munna Khan

Your department/Centre name: Electrical Engineering, F/O Engineering & Technology, Jamia Millia Islamia (A Central University) Jamia Nagar, New Delhi – 110025, India

Your Mobile: 91-9999806500

Your E-mail: mkhan4@jmi.ac.in

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Course Registration Link:

<http://www.gian.iitkgp.ac.in/GREGN>

The Course Coordinator



Dr. Munna Khan has been working as a Professor of Biomedical Engineering at Electrical Engineering Department (EED), Jamia Millia Islamia (JMI) Central University, New Delhi, India from 2011 to till date. Dr Khan worked as a Director in Professor Scale of Mewat Engineering College (Wakf), Palla, Nuh, Mewat, Haryana, India from 2009 to 2011 on government deputation. Earlier to Director, profile includes an Associate Professor, Senior Lecturer, Lecturer from 1992 to 2009 at EED, JMI and as an Assistant Professor from 2004 to 2005 at Department of Electronics and Communication Engineering, Indian Institute of Technology (IIT), Guwahati.

Dr Khan also worked as visiting Professor during May to June of 2012, 2011, 2009, 2007 and Assistant Professor during May to July 2004, 2005 at Wright State University, Dayton, OH, USA.

Dr Khan received his Ph.D. degree in Biomedical Engineering from IIT Delhi on Jan 04, 2002. He passed B. Tech. and M. Tech. in Electronics Engineering from Aligarh Muslim University, Aligarh in 1989 and 1993, respectively. Dr. Khan has held various administrative as well as academic positions and developed various laboratories with their manuals. He has delivered many expert lectures/ invited talks at International and National levels. He has completed three R & D projects from Defence Research and Development Organization (DRDO) and All India Council for Technical Education (AICTE), Government of India. He has published more than 140 research papers in International/National journals and conferences. Dr Khan guided seven Ph.D. thesis and 9 Ph.D. scholars are working under him.

Dr Khan has had various special assignments such as Research Consultant for R & D Project of US Air Force, Evaluation of R&D project of ICMR for Indo-UK program, and a reviewer for International/National journals. Prof Munna Khan is the recipient of:

1. **Young Investigator award, Space Medicine Branch of NASA** (ranked to one of the top 10% performer) during 74th Annual Scientific meeting of AsMA, USA, held on May 7, 2003.
2. **Associate Fellow Award** by Aerospace Medical Association, USA on May 15, 2012.

3. **Dogra Endowment Gold Medal Award** for best scientific research publication in the field of Biomedical Engineering from IIT Delhi on Aug 10, 2002.
4. **Career award for young teacher for the year 2004** from the AICTE, Govt. of India on Jan 19, 2004. This award carried a research grant of Indian Rupees 10,50,000/- (US \$ 25,000).
5. **Best presentation award** in QIP summer school from IIT Delhi on July 12, 2002.
6. **Best Paper Award** for Excellence in interdisciplinary research at AIME-2006, JMI Central University, New Delhi, India on Jan 21, 2006.
7. **Best Presentation Award** during conference by NIT Kurukshetra, India on Dec 30, 2007.
8. **Associate Fellow Award** by ISAM, Indian Air Force, India for recognition of knowledge & outstanding contribution in Aerospace Medicine on Sept. 25, 2014.
9. **Best Paper Awards** for Excellence in interdisciplinary research during ETEEE-2015.
10. **Best Paper Awards** for Excellence in interdisciplinary research during INDICON-2015.

11. **Consolation Award for IIT Guwahati** delivering presentation on assistive devices for handicaps from Ministry of Social Justice & Empowerment, Govt. of India on Oct 14, 2004.
12. **Award of Honour** from Indian Society of Aerospace Medicine, Indian Air Force for poster research paper presentation on Nov. 19, 2004.

Further details about Prof M Khan can be seen at his homepage:
http://jmi.ac.in/electrical/faculty-members/Dr_Munna_Khan-1959