



शिक्षा मंत्रालय
MINISTRY OF
EDUCATION



A 10-Day Gian Course

On

ROBOTIC HEAD

*Sensing and processing inside the head of a future
intelligent Robot*

(Course ID: 2412245)

8th February -17th February, 2025



International Faculty

Prof. Bhaskar Choubey, FIET, FRPS ASIS

Chair of Institute of Analogue Circuits and Image Sensors
Siegen, Germany

Prof. P. Muralidhar

Prof. P. Sreehari Rao

Department of Electronics and Communication Engineering
National institute of Technology Warangal
Telangana 506 004. India

Brochure

[Registration](#)



शिक्षा मंत्रालय
MINISTRY OF
EDUCATION



A 10-days GIAN course (ID: 2412245) on

The Robotic Head

Sensing and processing inside the head of a future intelligent Robot

8th February – 17th February, 2025

Department of Electronics and communication Engineering

National Institute of Technology Warangal India

1.1 OVERVIEW:

Classical design of processing systems, including modern day computers utilize a van Neuman architecture. Furthermore, they also assume presence of data from inexpensive sensors. However, the sheer diversity of sensors and the amount of data produced by them makes it challenging to build edge computing systems suitable for the design of a robotic head. The future design of a robotic head should include the sensors, the memory as well as processing systems together in a small area while consuming low power. Hence, both computing as well as electronic engineering need to appreciate sensory signals as well as modern AI techniques to process them.

The course will provide them with understanding of sensor signal processing as well as physical sensors, which are currently being built or have the potential of being built in the same technology we build chips for computation and memory. The students will first understand the concepts of physical measurements as well as various sources of errors. They will be able to analyse and differentiate between different types of sensors for the same physical phenomenon. They will also learn advanced AI and machine learning concepts to interface with these sensors. Finally, they will bring together physical sensors

1.2 OBJECTIVES:

The primary objectives of the course are as follows:

- The past, present and future of hardware-software co-design for Robotic heads
- Physical quantities and their measurement, Measurement Errors and Calibration standards
- Optical Sensors – Digital cameras and related deep learning
- Chemical sensors, mass sensors, pressure sensors, gas sensors, Microelectromechanical sensors
- Sensor interface circuits and their physical implementations
- Neural networks for sensory signal processing and Neural networks hardware design

1.3 LECTURE SCHEDULE:

Day	L/T	Faculty	Topic
Day 1:	L1	BC	Computing 4.0 – Historical perspectives and future possibilities
	L2	BC	The Robotic Head
	L3-4	BC	History of Selfie and Gazillion Megapixel camera
Day 2:	L5	BC	Designing the eye for a robot
	L6	BC	Noise in Imaging Systems
	T1-2	BC	Pixels design for an image sensor chip
Day 3:	L7	BC	The robot in dark - Low light Imaging
	L8	BC	The robot in light - Wide dynamic range imaging
	L9-10	BC	Architecture design of robotic imaging system
Day 4:	L11	BC	Sensor Properties for a robotic head
	L12	BC	Sensor signal conditioning for a robotic hear
	T2-2	BC	Numerical exercises on sensor signal conditioning
Day 5:	L13	BC	Robotic Skin – Measuring temperature
	L14	BC	Robotic Skin – Measuring heat profiles
	T3-2	BC	Numerical exercises on temperature sensing
Day 6:	L15	BC	Robotic nose – Chemical sensing
	L16	BC	Robotic nose – Gas Sensing
	L17-18	BC	Lumped parameters
Day 7:	L19	BC	Robotic nose – Micromechanical Sensors
	L20	BC	Robotic balance – Pressure sensors
	T4-2	PSR	Matlab exercises on mechanical sensors
Day 8:	L21	BC	Robotic tongue – ph Sensing
	L22	BC	Robotic brain – The neural Networks
	T5-2	PMD	FPGA based Neural network hardware
Day 9:	L23	BC	Robotic brain – Neural Networks for sensory processing
	L24	BC	Robotic brain – Hardware design for neural networks
	T6-2	PMD	GPU based Neural network coding
Day 10:	L25	BC	Robotic brain – Memristors and Neural networks
	L26	BC	Robotic Head – The future
	T7-2	PSR	Intelligent Power management for Integrated sensor circuits

L/T- Lecture/Tutorial: BC- Bhaskar Choubey; PSR-Patri Sree Hari Rao; PMD-P.Muralidhar

You should attend if you are ...	<ul style="list-style-type: none"> ▪ an academican/researcher/engineer from private/government organizations including R&D laboratories ▪ Student at all levels (BTech/MSc/MTech/PhD) or Faculty from reputed academic institutions and technical institutions/scientists from Industry. 				
Registration Fees & Process To Register Click here	Category	India	Abroad	Bank Details	
	Students & Scholars	INR1500/- (without grading) INR2000/- (with grading)	US \$100	Account Name	Director Research Account
				Account No.	62266262236
	Faculty & Scientists in R&D	INR 2500/-	US \$200	Bank	State Bank of India
				Branch	REC Warangal (NIT Campus)
				Branch Code	20149
	Industry/ Consultancy	INR 5000/-		IFSC	SBIN0020149
				MICR Code	506002030
				SWIFT Code	SBININBBH14
<p>Fee includes 18% GST, instructional materials, internet facility, working lunch and mid-session tea. NOTE: No Travelling allowance and paid shared accommodation inside the campus will be provided.</p> <p style="color: blue; font-style: italic;">Number of participants for the course will be limited to fifty (50).</p>					

1.4 LAST DATE OF REGISTRATION: 25TH JANUARY 2025

Intimation to Selected participants: 1st February 2025

For Registration please click the following link

<https://forms.gle/zAsqgxQ81cZXAUUYA>

1.4.1 About_NIT Warangal

National Institute of Technology Warangal (NITW) formerly known as RECW is the first among seventeen RECs set up in 1959. Over the years, the Institute has established itself as a premier Institution in imparting technical education of a very high standard, leading to B.Tech, M.Tech and Ph.D. programs in various specializations of Science and Engineering streams. There are 14 departments offering 8 UG and 31 PG programs besides doctoral programs. It is fully residential campus sprawling over 250 acres with excellent infrastructures. NITW campus is 2 km away from Kazipet railway station, 12 km away from Warangal railway station and 140 km from the state capital Hyderabad (Nearest Airport).

1.4.4 About Department

About the Department: The Department of Electronics and Communication Engineering has been one of the key departments of the institute since its inception in 1971. The department has expanded steadily over the last few decades and is one of India's leading academic and research institutions. The department supports R&D organizations and is actively engaged in providing solutions to industry problems as consultants. The department at NITW has an international reputation for excellence in teaching, research, and service. The department of ECE offers a broad range of programs that include undergraduate (B.Tech) and postgraduate (M.Tech) in Embedded and Machine Learning Systems, VLSI System Design, and Advanced Communication Systems and Research (PhD) programs.

1.4.2 About Resource Person



Prof. Bhaskar Choubey is the Chair of the Institute of Analog Circuits and Image Sensors, University of Siegen, in Germany. Before moving to Germany, he served as an Associate Professor in Universities of Oxford, Tutorial fellow of the Somerville College and lecturer in Glasgow University in U.K.

He obtained his doctorate from Oxford University as a Rhodes scholar from India. He received his bachelor's degree from the Regional Engineering College, Warangal, with a gold medal for the best outgoing student. He holds a visiting professorship in IIT Bhilai and has held visiting positions in the University of Sydney, Australia and Max Planck Institute of Brain Research in Germany. He has been elected as a fellow of the Institution of Engineering and Technology as well as Royal Photographic Society, both in UK. He received the IEEE Sensors Council GOLD Early Career Achievement Award and the Myril B. Reed Best Paper Award. He has served as the 2019 Chair for the IEEE Working Group on Information and Communication Technology (ICT) in Europe and is currently the chair of IEEE Circuits and Systems Society chapter in Germany. His research interests include CMOS image sensors, MEMS, digital cameras and Artificial Intelligence

<https://www.eti.uni-siegen.de/acis/people/bhaskarchoubey/>

1.4.3 About Coordinator



Prof. P. Muralidhar works at Department of Electronics and Communication Engineering, National Institute of Technology Warangal, Telangana India, in the field of Embedded and Machine Learning systems. His area of interest includes embedded systems Design, VLSI Architectures, FPGA Design and AI Hardware. He has involved in the joint publications, projects, GIAN courses and SPARC Projects in the field of VLSI Design along with the Prof. Patri Sreehari Rao

<https://erp.nitw.ac.in/ext/profile/ec-pmurali>

1.4.4 About Co Coordinator



Sreehari Rao Patri has been working as professor at the Department of Electronics and Communication Engineering, National Institute of Technology Warangal, Telangana India. For more than 25 years His areas of interest include analog and mixed signal IC design, power management IC design and communication systems. Prof Patri has been pursuing collaborative research with Prof Muralidhar in the niche areas leading to joint publications and projects.

<https://erp.nitw.ac.in/ext/profile/ec-patri>



Course Coordinators

**Prof. P. Muralidhar &
Prof. P. Sreehari Rao**

Department of Electronics and
Communication Engineering
National Institute of Technology Warangal.
Warangal 506 004.
Telangana India.

Phone: 8332969359

E-mail: pmurali@nitw.ac.in