



**Introductory Training Course on “Nanofabrication Technologies”**  
**Centre for Nano Science and Engineering**  
**Indian Institute of Science, Bangalore**  
**18<sup>th</sup> June 2018 – 6<sup>th</sup> July 2018**



**Program Schedule**

**18<sup>th</sup> June 2018, Monday**

<b>Time</b>	<b>Event</b>
09:30 AM - 11:00 AM	Introductory Session (CeNSE Seminar Hall)
11:00 AM - 1:00 PM	Lab Tour – Physics Dept.
1:00 PM – 2:00 PM	Lunch Break (3 <sup>rd</sup> floor = TF-08)
2:00 PM – 4:00 PM	Packaging Lab Tour

**19<sup>th</sup> June 2018, Tuesday**

<b>Time</b>	<b>Event</b>
09:30 AM - 10:15 AM	NNFC Safety Training by Dr. Savitha P (1 <sup>st</sup> Floor Multimedia Classroom = FF-11)
10:15 AM - 11:15 AM	Introduction MNCF by Dr. Vijay Mishra
11:15 AM - 11:45 PM	Introduction to Thin Films
11:45 AM - 12:30 PM	Introduction to Lithography and 2D design lay out
12:30 PM - 1.00 PM	Introduction to Dry Etch

**1:00 PM - 2.00 PM: Lunch Break (3<sup>rd</sup> floor = TF-08)**

<b>Time</b>	<b>Event</b>
2:00 PM - 2:30 PM	Introduction to Furnaces and Wet Etch (1 <sup>st</sup> Floor Multimedia Classroom = FF-11)
2:30 PM – 3:00 PM	PV Module Introduction Siva
3:00 PM - 3:30 PM	MEMS Cantilever Module Introduction Sabiha
3:30 PM - 4:00 PM	MOS Cap Module Introduction Pavithra
4:00 PM – 5:00 PM	Fabrication of MEMS Cantilever (Video-Demonstration) Fabrication of PV (Video-Demonstration)



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Date/Day	Time	Event	Speakers	Topic
<b>20 June 2018, Wednesday</b>	9.30 - 10.00	<b>Introduction</b>	<b>The Chairman, CeNSE</b>	Overview of CeNSE Academic and Research activities
	10.00 - 10.30	Tea Break		
	10.30 - 11.30	<b>Lecture 1</b>	<b>Dr. Savitha P</b>	Introduction and Capabilities of NNfC
	11.30 - 12.15	<b>Lecture 2</b>	<b>Dr. Suresha S J</b>	Introduction to MNCF Capabilities
	12.15 - 13.00	<b>Lecture 3</b>	<b>Dr. Viswas S Nair (INUP User)</b>	Embedded ring fabricated using silica etch mask
	13.00 - 14.00	Lunch Break (Third floor = TF-08)		
	14.00 - 14.45	<b>Lecture 4</b>	<b>Dr. Vijayaraghavan</b>	Cleanroom Case Studies
	14.45 - 15.30	<b>Lecture 5</b>	<b>Ms. Suma BN</b>	FIB
	15.30 - 16.00	Tea Break		
	16.00 - 17.00	<b>Lecture 6</b>	<b>Prof. S A Shivashankar</b>	Nanomaterials
17.00 - 18.00	Hi Tea	<b>Poster Session - Group 1 &amp; Interaction with Faculty (Third floor = TF-08)</b> <b>Clean Room and MNCF Tour - Group 2</b>		
<b>21 June 2018, Thursday</b>	9.00 - 10.00		<b>Prof. Rudra Pratap</b>	MEMS Sensors
	10.00 - 11.00	<b>Lecture 7</b>	<b>Prof. V Venkataraman</b>	Microfluidics for Biological Applications
	11.00 - 11.30	Tea Break		
	11.30 - 12.30	<b>Lecture 8</b>	<b>Prof. R Muralidharan (Ex. Director SSPL)</b>	
	12.30 - 13.15	<b>Lecture 9</b>	<b>Mr. Varadharaja P</b>	XPS
	13.15 - 14.00	Lunch Break (Third floor = TF-08)		
	14.00 - 15.00	<b>Lecture 10</b>	<b>Prof. Ambarish Ghosh</b>	Magnetic Nanoswimmers for Biotechnology: Successes and Challenges
	15.00 - 15.45	<b>Lecture 11</b>	<b>Dr. Aruna Maharolkar (INUP User)</b>	
	15.45 - 16.15	Tea Break		
	16.15 - 17.00	<b>Lecture 12</b>	<b>Dr. Ranajit Sai</b>	Microwave Magnetics: Enabling 5G and more
	17.00 - 18.00	Hi Tea	<b>Poster Session - Group 2 &amp; Interaction with Faculty (Third floor = TF-08)</b> <b>Clean Room and MNCF Tour - Group 1</b>	
<b>22 June 2018, Friday</b>	09.00 - 10.00	<b>Lecture 13</b>	<b>Dr. Sanjeev Srivastava</b>	About INUP & I-STEM
	10.00 - 11.00	<b>Lecture 14</b>	<b>Dr. Vijay Mishra</b>	Sensors to Systems: Prototype making at CeNSE
	11.00 - 11.30	Tea Break		
	11.30 - 12.15	<b>Lecture 15</b>	<b>Dr. Suresha S J</b>	XRD & TEM
	12.15-13.00	<b>Lecture 16</b>	<b>Dr. Swarnagowri Addepalli</b>	Nanoscale Characterization of Materials
	13.00- 14.00	Lunch Break (Third floor = TF-08)		
	14.00 - 14.30	<b>Talk</b>	<b>Mr. Shishir</b>	About I2N Technologies
	14.30 - 15.00		Valedictory Function / Feedback / Certificate Distribution	



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**Local Bangalore Tour – 23<sup>rd</sup> June 2018, Saturday**

**Agriculture Tour – 24<sup>th</sup> June 2018, Sunday**

**25<sup>th</sup> June 2018, Tuesday**

Time	Event
10:00 AM – 1:00 PM	TEM and other Instruments (MNCF)
1:00 PM – 2:00 PM	Lunch Break (3 <sup>rd</sup> floor = TF-08)
2:00 PM to 4:00 PM	Visit to I2N Technologies

**26<sup>th</sup> June 2018, Tuesday**

Batch Photovoltaic Cell 10:00 AM – 1:00 PM	Batch MEMS Cantilever 10:00 AM – 1:00 PM	Batch Photovoltaic Cell 10:00 AM – 1:00 PM	Batch MEMS Cantilever 10:00 AM – 1:00 PM
PV Lab Training	Gas Sensor and Polymer Lab	SEM / XPS	XRD / Raman / Solar Simulator

1:00 PM – 2.00 PM: Lunch Break (3<sup>rd</sup> floor = TF-08)



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<b>Photovoltaic Cell</b> 2:00 PM – 5:00 PM	<b>MEMS Cantilever</b> 2:00 PM – 5:00 PM	<b>Photovoltaic Cell</b> 2:00 PM – 5:00 PM	<b>MEMS Cantilever</b> 2:00 PM – 5:00 PM
<b>Gas Sensor and Polymer Lab</b>	<b>PV Lab Training</b>	<b>AFM / LDV</b>	<b>SEM / XPS</b>
<b>5:00 PM - 5:30 PM</b>	<b>Tea Break (2<sup>nd</sup> Floor Cafeteria)</b>		

**27<sup>th</sup> June 2018, Wednesday**

<b>Photovoltaic Cell</b> 10:00 AM – 1:00 PM	<b>MEMS Cantilever</b> 10:00 AM – 1:00 PM	<b>Photovoltaic Cell</b> 10:00 AM – 1:00 PM	<b>MEMS Cantilever</b> 10:00 AM – 1:00 PM
<b>Step 1: Wafer Cleaning (RCA)</b>  <b>Step 2: Diffusion</b>	<b>Introduction to Ebeam lithography</b> + <b>Introduction to thin films</b>	<b>Probe Station 2 / RF Probe Station</b>	<b>MOS Capacitor - Sample Processing</b>

**1:00 PM – 2.00 PM: Lunch Break (3<sup>rd</sup> floor = TF-08)**

<b>Photovoltaic Cell</b> 2:00 PM – 5:00 PM	<b>MEMS Cantilever</b> 2:00 PM – 5:00 PM	<b>Photovoltaic Cell</b> 2:00 PM – 5:00 PM	<b>MEMS Cantilever</b> 2:00 PM – 5:00 PM
<b>Step 3: PSG removal</b>  <b>Step 4: Top Metal Deposition (EBeam Evaporation)</b>  <b>Introduction to Ebeam lithography</b>	<b>Step 1: Wafer Cleaning (RCA)</b>  <b>Step 2: LPCVD Silicon Nitride</b>	<b>PV Lab Training</b>	<b>MOS Capacitor - Sample Processing</b>
<b>5:00 PM - 5:30 PM</b>	<b>Tea Break (2<sup>nd</sup> Floor Cafeteria)</b>		



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**28<sup>th</sup> June 2018, Thursday**

Photovoltaic Cell 10:00 AM – 1:00 PM	MEMS Cantilever 10:00 AM – 1:00 PM	Photovoltaic Cell 10:00 AM – 1:00 PM	MEMS Cantilever 10:00 AM – 1:00 PM
Step 5: Optical Lithography (Top Metal Patterning)  Step 6: Metal Wet Etching	Step 3: Measurement  Step 4: Lithography	MOS Capacitor - Sample Processing	Probe Station 2 / RF Probe Station

**1:00 PM – 2.00 PM: Lunch Break (3<sup>rd</sup> floor = TF-08)**

Photovoltaic Cell 2:00 PM – 5:00 PM	MEMS Cantilever 2:00 PM – 5:00 PM	Photovoltaic Cell 2:00 PM – 5:00 PM	MEMS Cantilever 2:00 PM – 5:00 PM
Step 7: Sputter Metal (Bottom Metal)  Step 8: Annealing  Introduction to Dry etch	Step 5: Nitride etch  Step 6: Silicon etch  Step 7: PR ashing	MOS Capacitor - Sample Processing	PV Lab Training
5:00 PM - 5:30 PM	Tea Break (2 <sup>nd</sup> Floor Cafeteria)		

**29<sup>th</sup> June 2018, Friday**

Photovoltaic Cell 10:00 AM – 1:00 PM	MEMS Cantilever 10:00 AM – 1:00 PM	Photovoltaic Cell 10:00 AM – 1:00 PM	MEMS Cantilever 10:00 AM – 1:00 PM
MOS Capacitor - Sample Processing	XRD / Raman / Solar Simulator	Step 1: Wafer Cleaning (RCA)  Step 2: Diffusion	Introduction to Ebeam lithography + Introduction to thin films

**1:00 PM – 2.00 PM: Lunch Break (3<sup>rd</sup> floor = TF-08)**



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Photovoltaic Cell 2:00 PM – 5:00 PM	MEMS Cantilever 2:00 PM – 5:00 PM	Photovoltaic Cell 2:00 PM – 5:00 PM	MEMS Cantilever 2:00 PM – 5:00 PM
MOS Capacitor - Sample Processing	Probe Station 2 / RF Probe Station	Step 3: PSG removal  Step 4: Top Metal Deposition (EBeam Evaporation)  Introduction to Ebeam lithography	Step 1: Wafer Cleaning (RCA)  Step 2: LPCVD Silicon Nitride
5:00 PM - 5:30 PM	Tea Break (2 <sup>nd</sup> Floor Cafeteria)		

**30<sup>th</sup> June 2018, Saturday and 1<sup>st</sup> July 2018, Sunday**

**Mysore & Madikeri Study Tour**

**2<sup>nd</sup> July 2018, Monday**

Photovoltaic Cell 10:00 AM – 1:00 PM	MEMS Cantilever 10:00 AM – 1:00 PM	Photovoltaic Cell 10:00 AM – 1:00 PM	MEMS Cantilever 10:00 AM – 1:00 PM
AFM / LDV	MOS Capacitor - Sample Processing	Step 5: Optical Lithography (Top Metal Patterning)  Step 6: Metal Wet Etching	Step 3: Measurement  Step 4: Lithography

**1:00 PM – 2:00 PM: Lunch Break (3<sup>rd</sup> floor = TF-08)**



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Photovoltaic Cell 2:00 PM – 5:00 PM	MEMS Cantilever 2:00 PM – 5:00 PM	Photovoltaic Cell 2:00 PM – 5:00 PM	MEMS Cantilever 2:00 PM – 5:00 PM
Raman / XRD / Solar Simulator	MOS Capacitor - Sample Processing	Step 7: Sputter Metal (Bottom Metal) Step 8: Annealing Introduction to Dry etch	Step 5: Nitride etch Step 6: Silicon etch Step 7: PR ashing
5.00 PM - 5.30 PM	Tea Break (2 <sup>nd</sup> Floor Cafeteria)		

**3<sup>rd</sup> July 2018, Tuesday**

Photovoltaic Cell 10:00 AM – 1:00 PM	MEMS Cantilever 10:00 AM – 1:00 PM	Photovoltaic Cell 10:00 AM – 1:00 PM	MEMS Cantilever 10:00 AM – 1:00 PM
SEM / XPS	AFM / LDV	Raman / XRD / Solar Simulator	Gas Sensor and Polymer Lab

**1:00 PM – 2.00 PM: Lunch Break (3<sup>rd</sup> floor = TF-08)**

Photovoltaic Cell 2:00 PM – 5:00 PM	MEMS Cantilever 2:00 PM – 5:00 PM	Photovoltaic Cell 2:00 PM – 5:00 PM	MEMS Cantilever 2:00 PM – 5:00 PM
Probe Station 2 / RF Probe Station	SEM / XPS	Gas Sensor and Polymer Lab	AFM / LDV
5.00 PM - 5.30 PM	Tea Break (2 <sup>nd</sup> Floor Cafeteria)		



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**4th July 2018, Wednesday**

Time	Event
10:00 AM - 11:00 AM	Talk - Flying visit to IPR World - Dr. Narahari (1 <sup>st</sup> Floor Multimedia Classroom = FF-11)
11:00 AM - 12:00 PM	Prof. Akshay Naik – NEMS Device Applications
12:00 PM - 1:00 PM	Prof. Supradeepa V R - Laser Technology
1:00 PM - 2:00 PM	Lunch Break (3 <sup>rd</sup> floor = TF-08)
2.00 PM - 3:00 PM	Prof. Prosenjit Sen - 3 D Integration (1 <sup>st</sup> Floor Multimedia Classroom = FF-11)
3.00 PM - 4:00 PM	Prof. Digbijoy N Nath - GaN Power Transistor

**5th July 2018, Thursday**

Time	Event
10:00 AM - 1:00PM	Thin Film Lab (Introduction & Sample Processing)
1:00 PM - 2:00 PM	Lunch Break (3 <sup>rd</sup> floor = TF-08)
2:00 PM - 3:00 PM	Visit to SID, IISc
3:00 PM - 4:00 PM	Visit to Materials Dept., IISc

**6th July 2018, Friday**

Time	Event
10:00 AM - 1:00 PM	Feedback / Certificate Distribution / Concluding Session (1 <sup>st</sup> Floor Multimedia Classroom = FF-11)
1:00 PM - 2:00 PM	Lunch Break (3 <sup>rd</sup> floor = TF-08)