COMPLETION REPORT

PART – 1

1	Title of the project	**"Setting up of facilities for Fabrication of micro electro mechanical systems (MEMS) devices."**
2	Implementing Organisation	**Tezpur University**
3	DIT Sanction No. and Date	**9(8)/2012-MDD dated 24/09/2015**
4	a. Total Budget Outlay	
	i. Original	**Rs. 326.43 lakh**
	ii. Revised, if any	**Rs. 332.77 lakh**
	iii. Actual received	**Rs. 318.01 lakh**
	b. Duration of project	**3 years**
	c. Date of completion and reason for delay, if any	**24.03.2016**
5	Total funds spent under various approved budgetary Heads/actual expenditure. Reasons for deviation, if any (as per enclosed Table1)	**Refer Table 1**
6	Details of equipment/assets acquired out of DIT funds with the name of equipment, Source of supply, total cost/ whether Indigenous or imported (as per enclosed Table 2.1,2.2 and 2.3)	**Refer Table 2.1, 2.2, 2.3**
7	Details of manpower associated with the Project (as per enclosed Table 3)	**Refer Table 3**
8	Details of year-wise audited statements of Accounts and utilization certificates submitted to DIT(as per GFR 19 &19 A)	**Refer GFR 19 & 19 A**

PART – II

1. Project work and Achievements :

a) Executive Summary : refer part III.
(Please enclose detail Technical Report separately)

b)

Activity	Target	Achievement	Reasons of Variation
i) Objective(s)/Scope	1. Setting up of facilities for fabrication of MEMS. 2. Impart training to 60 nos. in-house Ph. D. scholar, PG students and researcher for fabrication of MEMS. 3. Impart training to 30 nos. Ph. D. scholar, PG students and researcher of nearby institutes and research organizations for fabrication of MEMS. 4. Providing facilities for fabrication of MEMS devices for Research scholar and PG students	1. Apart from existing facility (Photolithography, Oxidation Furnace, Clean Room facility (class 1000 & 10000), Thin Film deposition setup with e-beam facility), following equipment has been procured under this project. i. PECVD, ii. RIE, iii. Wet Chemical Bench (3 nos.) 2,3. **In-house** Research scholar : 28 Faculty: 4 M.Tech: 58 B.Tech : 14 Total : 104 **Nearby institutes** Faculty: 15 Research scholar: 2 M.Tech: 9 B.Tech: 8 Total: 37 4. **RS and PG students involved:** Research scholar : 7 M.Tech: 13 Completed or undergoing project.	Not required
ii) No. of Systems/Sub-system with specifications or feasibility report on futuristic studies	The target area of this project is related to MEMS fabrication facility development, train the manpowers inhouse and nearby institutes	1. MEMS fabrication facility has been setup as mentioned earlier. 2. We have trained the manpower inhouse and nearby institutes as mentioned earlier.	Not required
iii) No. of Research papers/ Technical Reports		5 nos.	Not required

iv) No. of trained manpower	**Nearby Institutes : 30** **In-house : 60**	**In-house** Research scholar : 28 Faculty: 4 M.Tech: 58 B.Tech : 14 **Total : 104** **Nearby institutes** Faculty: 15 Research scholar: 2 M.Tech: 9 B.Tech: 8 **Total: 37** **Total: 141**	Not required
v) Anticipated know-how transfer to industry	N/A	N/A	N/A
vi) Technology/know-how developed(Hardware, software& other details, if any); know-how document available or not	N/A	N/A	N/A
vii) No. of industries shown interest for know-how utilization/ commercialization	N/A	N/A	N/A
viii) No. of users interested for taking prototype/finished product	N/A	N/A	N/A
ix) No. of industries /users interested in applying the know-how developed for enhanced productivity	N/A	N/A	N/A

Additional information:

1	Details of patents registered, if any	NIL
2	Technological spin offs, seeding of a major activity and how the project has helped in enhancing the technological base/capabilities in the country.	Microfabrication Facilty has been set up in the dept. of ECE, Tezpur University. Faculty members, research scholars, M.Tech/B.Tech students are involved with the facility, doing their research work. Persons from other institutes are availing the facility for research work. Numbers of people have been trained in the facility.
3	Future areas for work.	The following areas of work will be pursued in future: a. Design and Development of micro opto electro mechanical systems (MOEMS) for faster optical network of smart city. b. Optimization of process parameters of SnO with different dopants for sensitivity enhancement of tea gas sensor. c. Design and development of low power heater of Tea gas sensor. d. Design and Development of sensor for detection of bitterness for Fruit processing industries. e. Design and Development of micro-electrode sensor for measurement of cell voltage. f. Design and Development of Lab on Chip for medical application.

PART III. Technical report.

1. The PECVD is optimized for deposition of Silicon dioxide, silicon nitrite, and silicon oxinitride.
2. RIE is optimized for Si etching.
3. E-Beam/thermal deposition of Aluminium, Silver, Zinc Oxide(ZnO)-Tin Oxide(SnO), palladium and Chromium has been done for fabrication of thin film heater for ZnO gas sensor..
4. Oxidation furnace has been optimized.
5. Design and Fabrication of MEMS based capacitive Gas Sensor fabrication is done.
6. Design and Fabrication of MEMS based resistive Gas Sensor fabrication is done.
7. Design and Fabrication of MEMS based cantilever resistive Sensor fabrication is done.
8. Design and Fabrication of MEMS based diaphragm capacitive Sensor fabrication is done.
9. Design and Fabrication of micro-heater is done.

10. Chromium microheater using chromium etchant has been attained.
11. Chromium microheater using lift-off process has been repeated for smooth edges.
12. Repeatability of deposition of SiO2 using PECVD varying the parameter (Flow rate, power, time etc) is going on.
13. Seeding and Growth of Zinc-Oxide nanorods over silicon substrate.
14. Deposition of Zinc-Oxide nano-rods by hydrothermal process has been done.
15. Deposition of titanium oxide by sol gel method over silicon substrate. MOS Capacitor high K dielectric (TiO2). Raman spectroscopy and Fourier transform infra red (FTIR) spectroscopy of the deposited film has been done.
16. Deposition of Titanium dioxide doped with potassium ion using sol gel method over silicon substrate for humidity sensor.

A. Picture Of Fabricated Devices/Sample:

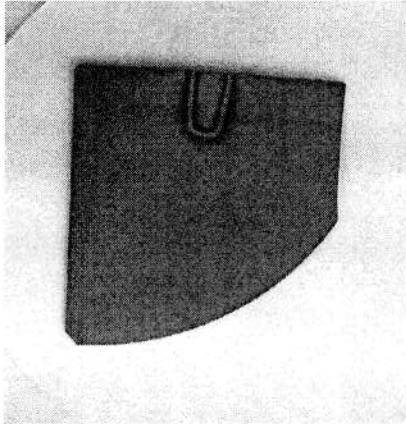


Fig: PECVD SiO_2 Sample (1250nm)

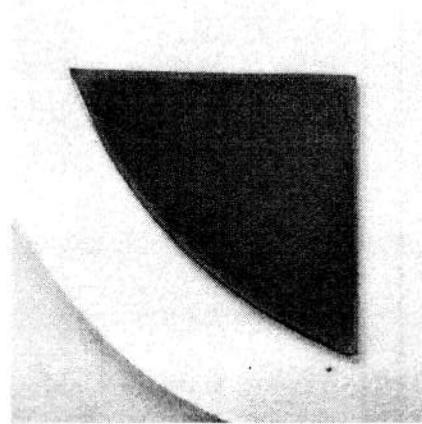


Fig: PECVD Silicon Nitride Sample(800nm)

Fig:PECVD Silicon Oxynitride Sample(650 nm)

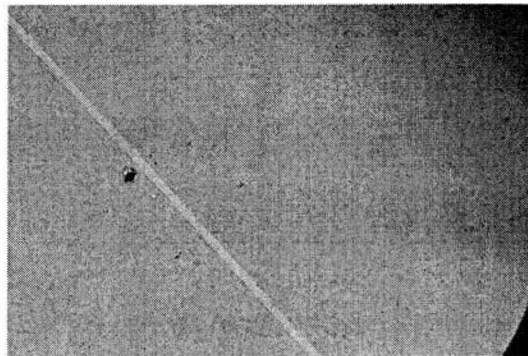
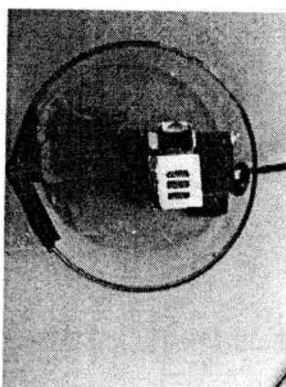
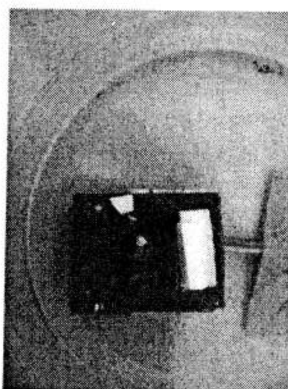


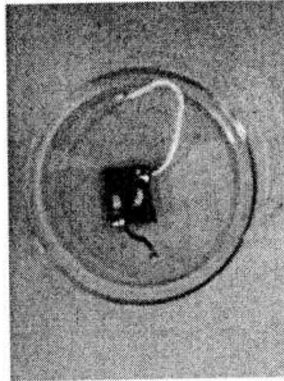
Fig: Reactive ion etching of SiO_2



Relative Humidity sensor
Type: Resistive
Detecting range: 10 to 95% RH
Coating on Si: TiO2 dopped with K+ ion
Process used: sol-gel method, spin coating, Annealing, Metallization
Characterization: Undergoing



MOS Capacitor Fabrication using High K dielectric material (TiO_2)
Leakage current Improvement and capacitance
Coating on Si: Titanium dioxide (TiO_2)
Capacitance-Voltage Curve analysis (comparison to conventional SiO2 MOS capacitor)
Process used: Sol-Gel method, spin coating, Annealing, Metallization
Characterization: Undergoing



Synthesis and Characterization of ZnO nanorods by hydrothermal process and its application in gas sensing.
Type: Resistive
Coating on Si: ZnO
Process: hydrothermal, dipcoating, annealing, metallization
Structural characterization
I-V characterization
Methane, ethane, acetic acid gas sensing
Characterization: Undergoing

B. 1. Characterization of PECVD

i. SiO2 (Silicon dioxide) deposition

2% SiH4/N2= 180 sccm,
Temperature=300°C
Pressure= 0.8 Torr
RF =40 Watt
Duration = 30 min

Sl no-	N_2O (in sccm)	Thickness	Deposition rate
1	30	875 nm	29.17 nm/min
2	50	1150 nm	38.33 nm/min
3	100	1250 nm	41.67 nm/min

2. Characterization of Oxidation

Sl. No.	Time of Dry Oxidation	Time of Wet Oxidation	Temp^r [°C]	Flow rate	Color code	Thickness [nm]	Oxidation rate [nm]/minute
1	1 hour	No	1000	2 slpm	Metallic to very light yellow-green	175	2.916
2	1.5 hour	No	1000	2 slpm	Light gold or yellow slightly metallic To Gold with slight yellow-orange	200 To 225	2.222 To 2.5
3	30 minute	1.5 hour	1000	2 slpm	Orange (rather broad for orange) To Dull, light red-violet	800 To 850	6.667 To 7.083
4	30 minute	1 hour & 45 minute	1000	2 slpm	Dull, light red-violet	850	6.296

3. Wet Etching Characterization

Si- Etch rate using TMAH

Sl no	**Temperature**		
TMAH concentration	60°C	70 °C	80 °C
3%	15um/hr	30 um/hr	60um/hr
4%	25um/hr	40 um/hr	70um/hr
5%	40um/hr	50 um/hr	80um/hr
25%			30um/hr

ii. **Si_3N_4 (Silicon Nitride)** deposition

2% SiH4/N2= 180 sccm,
Temperature=300°C
Pressure= 0.8 Torr
RF =40 Watt
Duratiuon= 30min

Sl no-	NH_3 (in sccm)	Thickness	Deposition rate
1	20	15nm	0.5 nm/min
2	30	50nm	1.67 nm/min
3	40	120nm	4 nm/min

iii. **Si_2N_2O (Silicon oxynitride)** deposition

2% SiH4/N2= 180 sccm,
Temperature=300°C
Pressure= 0.8 Torr
RF =40 Watt
Duratiuon= 30min
NH_3 = 30 sccm

Sl no-	N_2O (in sccm)	Thickness	Deposition rate
1	50	375 nm	12.5 nm/min
2	75	570 nm	19 nm/min
3	100	710 nm	23.67 nm/min

C. Training Programme:

Five Hands on training programme were conducted on 'Basic MEMS Fabrication Techniques' to faculty members, Research Scholars, M.Tech and B.Tech students of Tezpur University as well as nearby Institutes. The details of the training Programme is given below.

Sl.no.	Training Period	To Whom
1	29.05.2015 to 03.06.2015	B.Tech Student of Tezpur University
2	04.06.2015 to 10.06.2015	M.Tech/Phd student of Tezpur University
3	11.06.2015 to 16.06.2015	Research scholar of other Institutes of North East and outside north east
4	22.07.2015 to 01.08.2015	Project staff and faculty member of Tezpur university
5	03.08.2015 to 08.08.2015	Research scholar of other Institutes of North East and outside north east

Following is the training module:

	Topic	Contents
Day1	Introduction	• Introduction lecture on Micro-fabrication & MEMS devices • Process integration technology
	Lab-Visit	• Introduction to the available Micro-fabrication facility • Introduction & brief on **Clean room** processes & requirements
Day 2	Wafer Selection and Cleaning	• Types of wafers • Handling of wet benches • Safety measures • Wafer cleaning procedures (RCA/PIRANA)
	PECVD	• Introduction on oxidation & Plasma Enhanced Chemical Vapour Deposition process. • Complete oxidation process & requirements • Demonstration of the PECVD unit available • Complete PECVD process
Day 3	Thermal Oxidation	• Dry oxidation • Wet oxidation
	Photolithography	• Introduction to Photolithography & procedures • Process requirements • Demonstration of Mask aligner MJB4 • Development process
Day 4	Dry Etching /RIE	• Introduction to Dry etching • Requirements • Reactive Ion Etch procedure • Demonstration of the RIE unit
	Thin Film Deposition	• Thin Film Deposition process • Requirements • Demonstration of a complete process
Day 5	Wet Etching	• Introduction to Wet Etching • Requirements • Etching of Silicon based materials using TMAH, and HF, Aluminum etching

Research Scholar from Tezpur University:

Sl. No.	Name	Department	Course/ Designation	Training Period	Title of training
1	Mr. Nabadweep Chamuah	Physics	PhD	15th- 23rd Dec 2014	Hands on training for Basics steps on MEMS fabrication techniques
2	Iftak Hussain	Physics	PhD		
3	Mr. Lachit Dutta	ECE	PhD		
4	Mr. Champak Talukdar	ECE	PhD		
5	Sourav Bhowmik	ECE	PhD	23rd to 30th March 2015	Hands on training for Basics steps on MEMS fabrication techniques
6	Deep Jyoti Das	Physics	Project Fellow	11.06.2015 to 16.06.2015	Hands on training for Basics steps on MEMS fabrication techniques
7	Anil Hazarika	SAIC/ ECE	Technical Officer/ Ph.D		
8	Soma Chakraborty	ECE	Ph.D		
9	Shashikala Kalita	ECE	Ph.D		
10	Nilima Gogoi	ECE	Ph.D		
11	Rocktotpal Baruah	Physics	Ph.D		
12	Arunav Phukan	Physics	Ph.D		
13	Bikash Kar Nath	Tezpur University	Ph.D		
14	Shyamalima Sharma	Chemical Science	Ph.D		
15	Momina Khannam	Chemical Science	Ph.D		
16	Bibha Boro	Energy	Faculty/PhD		
17	Madhabi Devi	Physics	PhD		
18	Saurabh Jyoti Hazarika	Physics	PhD		
19	Ms. Amrita Deka	Physics	Ph.D	03.08.2015 to 07.08.2015	Hands on training for Basics steps on MEMS fabrication techniques
20	Ms. Pangkita Deka	Chemical Science	Ph.D		
21	Ms. Dipshikha Bharali	Chemical Science	Ph.D		
22	Mr. Kumar Kashyap Hazarika	Chemical Science	Ph.D		
23	Ms. Himadri Saikia	Chemical	Ph.D		

		Science			
24	Bidyut Deka	ECE	Ph.D	For PhD	Hands on training for Basics steps on MEMS fabrication techniques
25	Aradhna Dutta	ECE	Ph.D		
26	Mukut Senapati	ECE	Ph.D		
27	Palash Phukan	ECE	Ph.D		
28	Jagat Das	ECE	Ph.D		

Faculty of Tezpur University:

1	Dr. Santanu Sharma	ECE	22.07.2015 to 01.08.2015	Hands on training for Basics steps on MEMS fabrication techniques
2	Ratul Kumar Baruah	ECE		
3	Priyanka Kakoty	ECE		
4	Bibha Boro			

M.Tech From Tezpur University:

Sl. No.	Name	Department	Course	Training Period	Title of training
1	Mr. Satyabrat Malla Bujar Baruah	ECE	M.Tech	15th- 23rd Dec 2014	Hands on training for Basics steps on MEMS fabrication techniques
2	Mr. Rakesh Bhattarai	ECE	M.Tech		
3	Plabita Gogoi	ECE	M.Tech		
4	BHAGYASHREE ROY	ECE	M.Tech		
5	Harun Al Rashid MD Ghalib	ECE	M.Tech		
6	Partha Pratim Baruah	ECE	M.Tech		
7	Jagat Das	ECE	M.Tech		
8	Ramanand Kr Pandit	ECE	M.Tech		
9	Awanish Kumar	ECE	M.Tech		
10	Geetashree Bordoloi	ECE	M.Tech		
11	Raj Kumar Sharma	ECE	M.Tech		
12	Rewrewa Narzary	ECE	M.Tech		
13	Cesham Nasir Khan	ECE	M.Tech		
14	Pankaj Saikia	ECE	M.Tech		
15	Abhijit Barman	ECE	M.Tech	23rd to 30th March 2015	Hands on training for Basics steps on MEMS fabrication techniques
16	Dhanesh Barnam	ECE	M.Tech		
17	Ritusmita Malakar	ECE	M.Tech		Hands on training for
18	Swapna Bharali	ECE	M.Tech		

19	Asifa Yesmin	ECE	M.Tech	04th June to 10th June 2015	Basics steps on MEMS fabrication techniques
20	Midusmita Mazumdar	ECE	M.Tech		
21	Pooja Dutta	Mechanical	M.Tech		
22	Gargi Konwar	ECE	M.Tech		
23	Silpi Sikha Lahon	ECE	M.Tech		
24	Swagata Devi	ECE	M.Tech		
25	Honey Brahma	ENERGY	M.Tech		
26	Deepsikha Bordoloi	ECE	M.Tech		
27	Lipi Chakrabarty	ECE	M.Tech		
28	Lipika sarkar	ECE	M.Tech		
29	Kakoli Das	ECE	M.Tech		
30	Alka Kumari	ECE	M.Tech		
31	Rahul Sharma	ECE	M.Tech		
32	Rajesh Barman	ECE	M.Tech		
33	Sanjib Kalita	ECE	M.Tech		
34	Rekib Uddin Ahmed	ECE	M.Tech		
35	Darshana Saikia	ECE	M.Tech		
36	Nilotpal Das	ECE	M.Tech		
37	Kongkona Bora	ECE	M.Tech		
38	Rishiparna Choudhury	ECE	M.Tech		
39	Pranami Datta	ECE	M.Tech		
40	Jumilee gogoi	ECE	M.Tech		
41	Nabamita Talukdar	ECE	M.Tech		
42	Dwithun wary	ECE	M.Tech		
43	Minmay Deka	ECE	M.Tech		
44	Aschintyo Roy	ECE	M.Tech		
45	Md. Abdul Mazid	ECE	M.Tech		
46	Javed Ismail	ECE	M.Tech		
47	Amrita choudhury	ECE	M.Tech		
48	Sweta Karmakar	ECE	M.Tech		
49	Bijeet Bordoloi	ECE	M.Tech		
50	Bijay Mainali	ECE	M.Tech		
51	S. Babina Devi	ECE	M.Tech		
52	Nazmin Tazmin	ECE	M.Tech		
53	Manas Das	ECE	M.Tech		
54	Jayeeta Sharma	ECE	M.Tech	For M.Tech Project	
55	Milan Jyoti Hazarika	ECE	M.Tech		
56	Bhargav Sharma	ECE	M.Tech		
57	Maibam Sanju Meetei	ECE	M.Tech		
58	Borat Bosumotari	ECE	M.Tech		

B.Tech Student from Tezpur University:

Sl. No.	Name	Dept.	Training Period	Title of training
1	Ravi Kant Verma	ECE	29.05.2015 to 03.06.2015	Hands on training for 'Basics steps on MEMS fabrication Techniques'
2	Amit Kumar Pandey	ECE		
3	Shourya Munim	ECE		
4	Puneet Sharma	ECE		
5	Mandadi Nithin Kumar Reddy	ECE		
6	Goudu Vara Prasad	ECE		
7	Preetam Bhattacharjee	ECE		
8	Jayanta Deka	ECE		
9	Salam Jimkeli Singh	ECE		
10	Ashuli Manikho	ECE		
11	Ashim Deb	ECE		
12	Munna Kumar	ECE		
13	Anurag Kumar	ECE		
14	Bhupendra Gupta	ECE		

List Of External Candidate:

Sl. no	Name	Institute	Department	Course/ Designation	Training Period	Title of training
1	Subra Mukherjee	Assam Don Bosco University	ECE	Faculty	23rd to 30th March 2015	Hands on training for Basics steps on MEMS fabrication techniques
2	Hironmay Deb	Assam Don Bosco University	ECE	Faculty		
3	Mriganaka Gogoi	Assam Don Bosco University	ECE	Faculty		
4	Rukshat Azmi	RIST	ECE	B.Tech		
5	Karabi Mushahary	RIST	ECE	B.Tech		
6	Arundhuti Deka	RIST	ECE	B.Tech		
7	Menusunu Natso	RIST	ECE	B.Tech		
8	Rajesh Saha	NIT, AP	ECE	M.Tech		
9	Shankar Bhattacharjee	NIT, AP	ECE	M.Tech		
10	Argho Sarkar	NIT, AP	ECE	M.Tech		
11	Ngasetam Monica Devi	NIT, AP	ECE	M.Tech		
12	Rashi Borgohain	AEC	ETE	Faculty	29.05.2015 to	Hands on training for

					03.06.2015	Basics steps on MEMS fabrication techniques
13	Mrs. Rini Lahiri	NIT Nagaland	ECE	Faculty	11.06.2015 to 16.06.2015	Hands on training for Basics steps on MEMS fabrication techniques
14	Monalisa Hazarika	NIT Nagaland	ECE	Faculty		
15	Chandrama Kalita	Gauhati University	Instrumentation	Faculty		
16	Kaustubh Bhattacharyya	Assam Don Bosco University	ECE	Faculty		
17	Mr. Kumaresh Sarmah	Gauhati University	ECE	Faculty		
18	Al-Mamun Sheikh	NIT Durgapur	ECE	Ph.D		
19	Vijay Kr. Jayswal	Babasaheb Bhimrao Ambedkar Central University, Lucknow	Environmental Science	Faculty		
20	Hirendra Das	Gauhati University	ECE	Ph.D		
21	Ms. Bornali Bora Patowary	CIT, Kokrajhar	ECE	Faculty	03.08.2015 to 07.08.2015	Hands on training for Basics steps on MEMS fabrication techniques
22	Mr. Lalit Baruah	Biswanath College, Sonitpur, Assam.	Physics	Faculty		
23	Ms. Abhishruti Bhuyan	RIST	ECE	Faculty		
24	Jyothirmai Garapati	RIST	ECE	Faculty		
25	Mr. Anup Baishya	Pondicherry University	Centre for Nanoscience and Technology	M.Tech		
26	Shantanu Maity	NIT, AP	ECE	Faculty	----	

List Of Candidate for Long Term internship/Project work:

Sl. no	Name	Institute	Depart-ment	Course/ Designation	Training Period	Title of training
1.	Rukshat Azmi	RIST	ECE	B.Tech	1st Jan, 2015 to 30th june, 2015	6 month Project work, MEMS resistive Pressure Sensor
2.	Karabi Mushahary	RIST	ECE	B.Tech		
3.	Arundhuti Deka	RIST	ECE	B.Tech		
4.	Menusunu Natso	RIST	ECE	B.Tech		
5.	Vivek Kumar Gupta	Shri Mata Vaishnu Devi University	ECE	B.Tech	15th Dec. 2015 to 15th Jan 2016	One month Internship on MEMS fabrication
6.	Krishna Gopal Paul	Shri Mata Vaishnu Devi University	ECE	B.Tech		
7.	Pooja Nath	North East Hill University	ECE	B.Tech		
8.	Rupam Sharma	Gauhati University	ECE	M.Tech	1st Aug,2015 to 30th May, 2016	Project work
9.	Pranab Kumar Rabha	Gauhati University	ECE	M.Tech		
10.	Sujata Longmailai	Gauhati University	ECE	M.Tech		
11.	Laisram Chaubi	Gauhati University	ECE	M.Tech		

Nos. of persons trained in the Facility		
Candidate from Tezpur University		
Sl. No.	Designation	Nos.

1	Faculty	4
2	Research scholar	28
3	M.Tech	58
4	B.Tech	14
	Total	104
External Candidate		
1	Faculty	15
2	Research scholar	2
3	M.Tech	5
4	B.Tech	4
	Total	26
External Candidate (internship)		
1	M.Tech	4
2	B.Tech	7
Total persons trained		
1	Faculty	19
2	Research scholar	30
3	M.Tech	67
4	B.Tech	25
	Total	141

D. Thesis Title on-going/completed:

Sl No.	Name	Title	Status

Ph.D:			
1	Bidyut Deka	Design and Development of Two mode interference and multiple interference couplers for Photonic integrated Devices.	completed
2	Arradhna Dutta	Study of Integrated Optic Sensor for Rapid Detection of Adulteration of Petroleum Product and Blood Glucose Concentration.	completed
3	Nilima Gogoi	Surface Plasmonics based Optical Devices.	On-going
4	Shantanu Maity	Silicon Solar Cell and its Characteristics.	On-going
5	Mukut Senapati	MEMS Based Sensor.	On-going
6	Palash Phukan	MEMS based micro-electrode	On-going
7	Rewrewa Nurzery	MEMS Based Sensor.	On-going
M.Tech:			
1	Lachit Dutta	Neural Network based Methane Gas discrimination using Nano-Structured Zinc Oxide Sensor.	completed
2	Jayeeta Sharma	Design and Fabrication of MEMS based Gas Sensor.	completed
3	Milan Jyoti Hazarika	Design and Fabrication of Condenser Capsule for MEMS Microphone.	completed
4	Bhargav Sharma	Study of Hydrogen Gas sensing behavior of ZnO- SnO_2 based Composites.	completed
5	Maibam Sanju Meetei	Embedded Neural Network Based recognition of Methane and Hydrogen using nano-ZnO Gas Sensor.	completed
6	Borat Bosumotari	Synthesis and Hydrogen gas sensing behaviour of Zinc Stannate microstructures.	completed
7	Rewrewa Narzary	Synthesis, Characterization and Fabrication of Hydrogen Gas Sensor based on ZnO-SnO_2 Nanocomposite	completed
8	Raj Kumar Sharma	Design and Fabrication of Extracellular Microelectrode for Recording of Cultured Cell Action Potential	completed
9	Gitashree Bordoloi	Design and Fabrication of MEMS Spot Capacitive Gas Sensor	completed
10	Jagat Das	Diaphragm based mems capacitive pressure sensor	completed
11	Cesham Nasir Khan	Detection of Glucose using Surface Plasmon Resonance	completed
12	Ritusmita Malakar	Synthesis and characterization of ZnO nanowires by hydrothermal process and its application in gas sensing.	On-going
13	Deepsikha Bordoloi	Titanium oxide based MEMS gas sensor	On-going
14	Parag Kalita	MOS Capacitor Fabrication using High K dielectric material(TiO_2)	On-going
15	Ramanand Kumar	Relative Humidity Sensor using MEMS Technology	On-going
16	Karan Senapati	Fabrication of Tin Oxide based MEMS Capacitive Gas sensor	On-going

GFR 19(A)

Utilization Certificate

Financial year 2012-13 to 2015-16

Project Title: "Setting up of Facilities for Fabrication of Micro-Electro-Mechanical Systems (MEMS) Devices"

Sl. No.	Letter No. and Date	Amount
1.	9(8)/2012-MDD dated-25/03/2013	Rs. 2,65,34,000.00 lakh
2.	9(8)/2012-MDD dated 18/03/2015	Rs. 30,02,000.00 lakh
3.	9(8)/2012-MDD dated 24/09/2015	Rs. 20,62,706.00 lakh
Total		Rs. 3,15,98,706.00 lakh

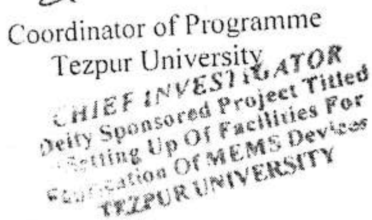
Certified that out of **Rs. 3,15,98,706.00** grants-in-aid sanctioned during the year 2015-16 in favour of Tezpur University Under the Ministry/Department (Ministry of Communication and Information Technology, Department of Electronics and Information Technology) letter No. given in the margin, **Rs. 2,03,104.00** interest earned on project fund and **Rs. NIL** on account of unspent balance, a sum of **Rs. 3,17,49,458.00** has been utilized for the purpose of project for which it was sanctioned and that the balance of **Rs. 52,352.00** remaining unutilized at the end of the year.

Interest earned 01.04.2013-31.03.2014:	**2,00,040.00**
Interest earned 01.04.2014-31.03.2015:	**1294.00**
Interest earned 01.04.2015-31.03.2016:	**1770.00**
Total:	**2,03,104.00**

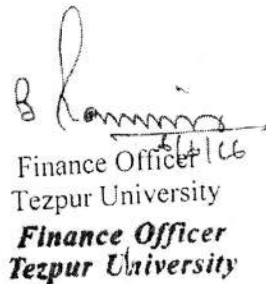
2. Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled/are being fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Kinds of checks exercised:

1. Payments are made under direct supervision of Finance Officer.
2. Accounts are audited by the CAG every year.



Coordinator of Programme
Tezpur University
CHIEF INVESTIGATOR
Deity Sponsored Project Titled
Setting Up Of Facilities For
Fabrication Of MEMS Devices
TEZPUR UNIVERSITY



Finance Officer
Tezpur University
Finance Officer
Tezpur University

Registrar
Tezpur University
Registrar
Tezpur University

CONSOLIDATED STATEMENT OF EXPENDITURE
For the Financial year 2012-13 to 2015-16

University: **Tezpur University**

(in Rupees) Sanction Letter No. & Date: No. 9(8)/2012-MDD dated-25/03/2013, 9(8)/2012-MDD dated 18/03/2015, 9(8)/2012-MDD dated 24/09/2015

Sl No.	Head	Total Grant Approved	Grant Received 2012-2013 (1st installment)	Grant Received 2014-2015 (2nd installment)	Grant Received 2015-2016 (3rd installment)	Total Grant Received	Expenditure incurred from 2013-14 (1st Year)	Expenditure incurred from 2014-15 (2nd Year)	Expenditure incurred from 2015-16 (3rd Year)	Total Expenditure incurred	Balance
1	Capital Equipment	2,40,70,000.0	2,40,70,000.0	--	--	2,40,70,000.00		2,40,39,000.0	--	2,40,39,000.00	31,000.00
2	Consumable Items	40,00,000.00	10,00,000.00	15,00,000.00	8,75,000.00	33,75,000.00	9,32,339.00	78 ,627.00	23,80,745.00	33,91,711.00	-16,711.00
3	Manpower	27,07,200.00	6,64,000.00	9,02,000.00	6,65,000.00	22,31,000.00	5,34,709.00	2,31,832.00	14,52,633.00	22,19,174.00	11,826.00
4	Travel & Training	12,00,000.00	4,00,000.00	4,00,000.00	2,33,000.00	10,33,000.00	2,18,924.00	2,62,126.00	5,87,791.00	10,68,841.00	-35,801.00
5	Contingencies	7,00,000.00	2,00,000.00	2,00,000.00	1,74,000.00	5,74,000.00	1,62,216.00	38,298.00	3,74,042.00	5,74,556.00	-556.00
6	Overheads	6,00,000.00	2,00,000.00	*0	**1,15,706.00	3,15,706.00	1,45,000.00	54,000.00	2,57,176.00	4,56,176.00	-1,40,470.00
	Total	**3,32,77,200.00**	**2,65,34,000.00**	30,02,000.00	**20,62,706.00**	**3,15,98,706.00**	**19,93,188.00**	**2,47,03,883.00**	**50,52,387.00**	**3,17,49,458.00**	**-1,50,752.00**

***Rs. 2,00,000.00 interest earned 01.04.2013-31.03.2014 has been adjusted in the overhead of 2nd installment.**

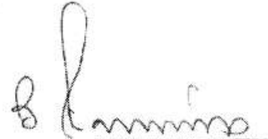
**** Rs. 1,294.00 interest earned 01.04.2014-31.03.2015 has been adjusted in the overhead of 3rd installment.**

Interest earned	Amount
Interest earned 01.04.2013-31.03.2014:	**2,00,040.00**
Interest earned 01.04.2014-31.03.2015:	**1294.00**
Interest earned 01.04.2015-31.03.2016:	**1770.00**

Item	Amount
Total Fund Received	**3,15,98,706.00**
Total Expenditure Incurred	**3,17,49,458.00**
Balance	**-1,50,752.00**
Interest earned	**2,03,104.00**
Unspent Balance	**52,352.00**

Signature
Coordinator
Of Programme

CHIEF INVESTIGATOR
Deity Sponsored Project Titled
Setting Up Of Facilities For
Fabrication Of MEMS Devices
TEZPUR UNIVERSITY



Signature 6/6/16
Competent financial
Authority
Finance Officer
Tezpur University

Project Title: **"Setting up of Facilities for Fabrication of micro electro mechanical systems (MEMS) devices."**

Implementing Organisation: **Tezpur University**

Chief Investigator: **Prof. P.P.Sahu**

Audited Statement of Accounts for the period from 25/3/2013 to 24/03/2016

Rs. In lakh

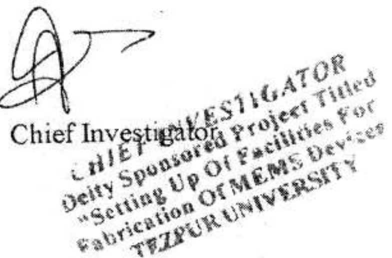
Sanctioned Budget head	Funds approved	Funds received	Expenditure incurred	Balance
Capital equipment including duty on import	2,40,70,000.0	2,40,70,000.00	2,40,39,000.00	31,000.00
Consumables stores	40,00,000.00	33,75,000.00	33,91,711.00	-16,711.00
Manpower	27,07,200.00	22,31,000.00	22,19,174.00	11,826.00
Travel & Training	12,00,000.00	10,33,000.00	10,68,841.00	-35,801.00
Contingencies	7,00,000.00	5,74,000.00	5,74,556.00	-556.00
Overheads	6,00,000.00	3,15,706.00	4,56,176.00	-1,40,470.00
Total	**3,32,77,200.00**	**3,15,98,706.00**	**3,17,49,458.00**	**-1,50,752.00**

Interest earned 01.04.2013-31.03.2014:	**2,00,040.00**
Interest earned 01.04.2014-31.03.2015:	**1294.00**
Interest earned 01.04.2015-31.03.2016:	**1770.00**

Total Fund Received	**3,15,98,706.00**
Total Expenditure Incurred	**3,17,49,458.00**
Balance	**-1,50,752.00**
Interest earned	**2,03,104.00**
Unspent Balance	**52,352.00**

Auditors' Report

We hereby certify that we have audited the Receipts and Payments account of the project entitled **"Setting up of facilities for Fabrication of micro electro mechanical systems (MEMS) devices"**, funded by MCIT, DeitY, Govt. of India and found them in accordance with books of accounts of the project submitted to us. Information and explanations required by us have been duly obtained. In our opinion, the above statement exhibits the true and correct state of affairs of the project subject to our observation that although the project was originally sanctioned in favour of **Prof. P.P.Sahu**, Chief Investigator, **Tezpur University**.



Chief Investigator

CHIEF INVESTIGATOR
Deity Sponsored Project Titled
"Setting Up Of Facilities For
Fabrication Of MEMS Devices
TEZPUR UNIVERSITY

For Company Name.

For SURAJIT CHAKRABORTY & CO
CHARTERED ACCOUNTANTS
10.06.2016
CA SURAJIT CHAKRABORTY
(Proprietor)
Membership No.- 305054

Chartered Accountants