Shri Ramdeobaba College of Engineering and Management, Nagpur-13

Department of Electronics & Communication

Session 2024-25

Course: Introduction to MEMS (ECT359-2)

VI Semester ECE Sec A & B (2024-2025)

Teachers Assessment (10 marks)

Report on MEMS Technology

Objectives:

- To enhance students' understanding of key concepts in Micro-Electromechanical Systems (MEMS) through independent research.
- To develop students' ability to effectively communicate technical content.
- To assess students' depth of knowledge and clarity through a viva-voce (oral examination).
- To promote self-directed learning and academic inquiry in the field of MEMS

Students prepared reports on the following topics-

Section A

Sr. No.	Class Roll no.	Name of Student	Name of Topic
1	2	Aditi Thakre	Clamped-Clamped beam resonator
2	4	Anshika Jain	MEMS in consumer electronics
3	11	Aayush Jain	MEMS based sensors for explosive detection
4	12	Aditya Suryawanshi	Micro actuators (valves, pumps)
5	14	Allen J Chamathil	MEMS magnetometers (for direction used in navigation)
6	16	Ansh Rakesh Shahu	MEMS based temperature sensor
7	22	Atharva Lohakare	MEMS filter
8	24	Ayush Dhomne	Recent Progress of MEMS/NEMS resonators
9	35	Ishika Patne	Perspectives, Difficulties, and Future Prospects of Artificial Intelligence Integration with Micro-Nano systems
10	36	Kalyani Bobade	Lab-on-Chip (Biochips are biological microchips)
11	43	Harsh Praful Gandhi	RF MEMS capacitor
12	47	Himanshu Itankar	MEMS micro-mirrors
13	53	Ritik Bisen	Performance parameters of RF MEMS devices
14	74	Sudarshan Sharma	MEMS based sensors for chemical detection
15	101	Himanshi koturwar	MEMS accelerometer
16	102	Pratyaksha Yadav	MEMS resonator (disk structure)
17	105	Shravani Ambekar	Medicine and Bio-MEMS

Section B

Sr. No.	Class Roll no.	Name of Student	Name of Topic
1	2	Agraja Pande	MEMS based gas sensor
2	5	Anushka Kadu	Research on MEMS technology: Last decade, current scenario and future
3	8	Kanchan Assudani	MEMS microrphones
4	12	Ameya Joshi	MEMS capacitive Switch
5	13	Aniket Pimplikar	Applications of RF MEMS in space and defense area
6	14	Anish Ghosh	RF MEMS inductor
7	15	Ankit Singh	MEMS mass sensor
8	17	Bharat Joshi	Fluidic MEMS
9	18	Bhavesh Zarbade	MEMS electrostatic resonator
10	21	Hardik Maity	Comb/ interdigited drive MEMS resonator
11	22	Jagat Guru	MEMS gyroscopes (rotation rate)
12	23	Jivesh Kalmegh	MEMS based digital e-compasses
13	32	Krishna Malani	Applications of MEMS devices in agricultural sector
14	33	Mansi Ratnaparkhi	MEMS based energy harvester
15	35	Niharika Dhakate	MEMS optical switches
16	36	Pari Bhagat	Applications of MEMS in automobile sector
17	38	Pragati Nagwani	Integration of MEMS with Electronics
18	41	Keyur Gore	3D Printing of MEMS
19	46	Mohit Thakare	MEMS-based devices for real-time monitoring of environmental parameters
20	50	Onkar Yende	Investigating MEMS devices incorporate smart materials, structures and systems.
21	51	Paritosh Patra	Nanotechnology and MEMS
22	52	Parth Bais	Metal-insulator-Metal switch
23	53	Pranay Pawar	MEMS Packaging & Reliability issues
24	63	Saloni Morey	MEMS based pressure sensor
25	66	Shabnam Razi Quadri	MEMS for Telecommunications
26	71	Rishi Sadavarti	Resonant gate transistor
27	76	Siddhesh Chandrayan	Polymers used in MEMS
28	81	Yash Vijay Rathi	Micro-Ring resonator
29	82	Vaibhav Tekade	MEMS memory units
30	105	Gaurang Janwar	Micro-grippers and micro pumps

Evaluation Parameters

Points required to be addressed in the study report (for 7 marks)					Viva/ Seminar	Total marks
Indexing of the report (including topic title, sub-title, page number etc.) & Abstract	Introduction/ Methodology etc. of the topic/work (relevant images/ diagrams are also expected) Current technology/ materials used	Advantages, lacuna, applications of the devices/materials/ systems etc. (comparison between existing devices/ method/materials)	Summary of the reported work	References used while report preparation (min. 5 references)		
1	2	2	1	1	3	10

* Sample report is attached

P P Deshpande 13.4.25
(Course coordinator) 2/p

Shri Ramdeobaba College of Engineering and Management, Nagpur

Department of Electronics and Communication Engineering

VI Semester (Session 2024-25)

Teacher's Assessment (10 marks)

A Report on allotted topic

Course: Introduction to MEMS (ECT359-2)

Course Coordinator: Dr. P. P. Deshpande

Class Roll no.	Section (A/ B)	Name of the Student	Title of the Topic	Student's Signature with date
33	B	Mansi Ratnaparkhi	MEMS based energy harvester	Mrat.

Rubric for evaluation

Points required to be addressed in the study report (for 7 marks)					Viva/ Seminar	Total marks
Indexing of the report (including topic title, sub-title, page number etc.) & Abstract	Introduction/ Methodology etc. of the topic/work (relevant images/ diagrams are also expected) Current technology/ materials used	Advantages, lacuna, applications of the devices/materials/ systems etc. (comparison between existing devices/ method/materials)	Summary of the reported work	References used while report preparation (min. 5 references)		
1	2	2	1	1	3	10
1	1	2	1	1	3	09

- citations of references
- more literature review may be done

PPDeshpande
11/04/2025

Contents

1. Abstract

Microelectromechanical Systems (MEMS)-based energy harvesters are emerging as a viable solution for powering micro- and nano-scale devices by converting ambient energy from the environment into usable electrical power. These systems address the growing need for sustainable, maintenance-free energy sources for low-power applications, especially in scenarios where battery replacement is impractical or impossible. MEMS harvesters can scavenge energy from a variety of sources such as mechanical vibrations, thermal gradients, solar radiation, and radio frequency (RF) waves. Each energy harvesting method is based on distinct physical mechanisms such as piezoelectricity, thermoelectric effects, photovoltaic conversion, or electromagnetic induction.

Recent advancements in MEMS technology have enabled the fabrication of highly miniaturized, integrated, and efficient energy harvesting devices. Academic studies and patents have documented numerous innovations, including the development of flexible piezoelectric materials, nanostructured thermoelectric layers, and highly sensitive RF harvesting antennas. These technologies have enabled the integration of MEMS energy harvesters in biomedical implants, wireless sensor networks (WSNs), industrial monitoring systems, wearable devices, and aerospace applications.

Despite these advancements, challenges such as low energy output, variability of ambient energy sources, and the need for efficient power conditioning circuits remain. Ongoing research is focused on improving material efficiency, optimizing energy conversion architectures, and exploring hybrid energy harvesting solutions that combine multiple sources to enhance reliability. This report aims to provide a comprehensive overview of MEMS-based energy harvesters, including their operating principles, applications, design challenges, and future trends, while incorporating insights from recent academic research and patented innovations.

10.References

1. M. I. Hossain, M. S. Zahid, M. A. Chowdhury, M. M. M. Hossain, and N. Hossain, "MEMS-based energy harvesting devices for low-power applications – a review," *Heliyon*, vol. 9, no. 6, Jun. 2023. [Online]. Available: https://doi.org/10.1016/j.heliyon.2023.e17892.ResearchGate

2. N. U. Khan et al., "RF energy harvesters for wireless sensors, state of the art, future prospects and challenges: a review," *Physical and Engineering Sciences in Medicine*, vol. 47, pp. 385–401, Jan. 2024. [Online]. Available: https://doi.org/10.1007/s13246-024-01382-4.SpringerLink

3. H. Feng et al., "Multimodal MEMS vibration energy harvester with cascaded flexible and silicon beams for ultralow frequency response," *Microsystems & Nanoengineering*, vol. 9, no. 1, Mar. 2023. [Online]. Available: https://doi.org/10.1038/s41378-023-00500-8.Nature

4. L. Sun et al., "Recent developments in wearable piezoelectric energy harvesters," *Review of Scientific Instruments*, vol. 95, no. 4, Apr. 2024. [Online]. Available: https://doi.org/10.1063/5.0159073.

5. Y. Li and Z. Sun, "Self-Sustained Artificial Internet of Things Based on Vibration Energy Harvesting Technology: Toward the Future Eco-Society," *Advanced Engineering Science*, Apr. 2024. [Online]. Available: https://doi.org/10.1002/aesr.202400116.

6. M. R. Sarker et al., "Micro energy harvesting for IoT platform: Review analysis toward future research opportunities," *Heliyon*, vol. 10, no. 4, Apr. 2024. [Online]. Available: https://doi.org/10.1016/j.heliyon.2024.e03809.

good work

11/4/25