



UGC RECOGNIZED

PDEU PANDIT
DEENDAYAL
ENERGY
UNIVERSITY

Formerly Pandit Deendayal Petroleum University (PDPU)

Issue 33

Jan 2022



THE EDITORIAL TEAM

DR ANIRUDH KULKARNI

MRS POOJA NIMAVAT

The newsletter intends to provide updates on the monthly happenings of the Department of Mechanical Engineering, School of Technology of Pandit Deendayal Energy University.

MECHANICAL DEPARTMENT
NEWSLETTER

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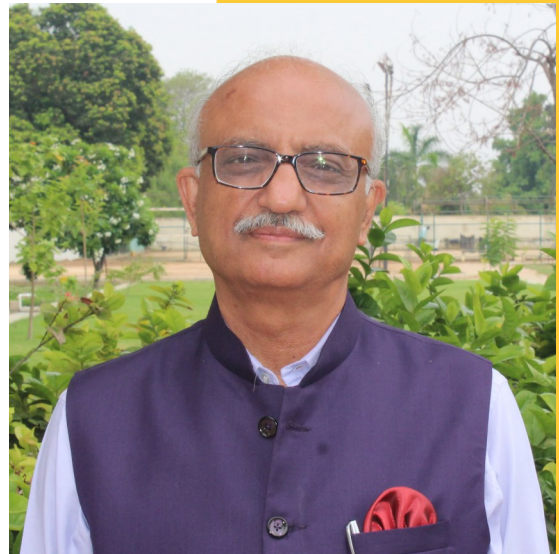
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MESSAGE FROM THE DIRECTOR'S DESK

PROF SUNIL KHANNA

DIRECTOR, SOT.



Dear Colleagues and Students:

Industry 4.0 (the fourth Industrial Revolution) encapsulates the future development trends to achieve more intelligent manufacturing. As we @ PDEU (formerly PDPU) embark on this journey towards Industry 4.0, I am Happy to Introduce the next issue of the Newsletter which not only share with all its readers the latest news and developments in the Department of Mechanical Engineering but would also be sensitizing all of us on the latest trends and developments in the Fourth Industrial Revolution.



The limitless power of technology to do good and the conviction of my faculty colleagues and students that the golden age is ahead of us and not behind us brings about the best in all of us which is reflected in their achievements. Compliments to the editorial team for their passion for perfection and unbound creativity which makes me always look forward to the next edition of the Newsletter.

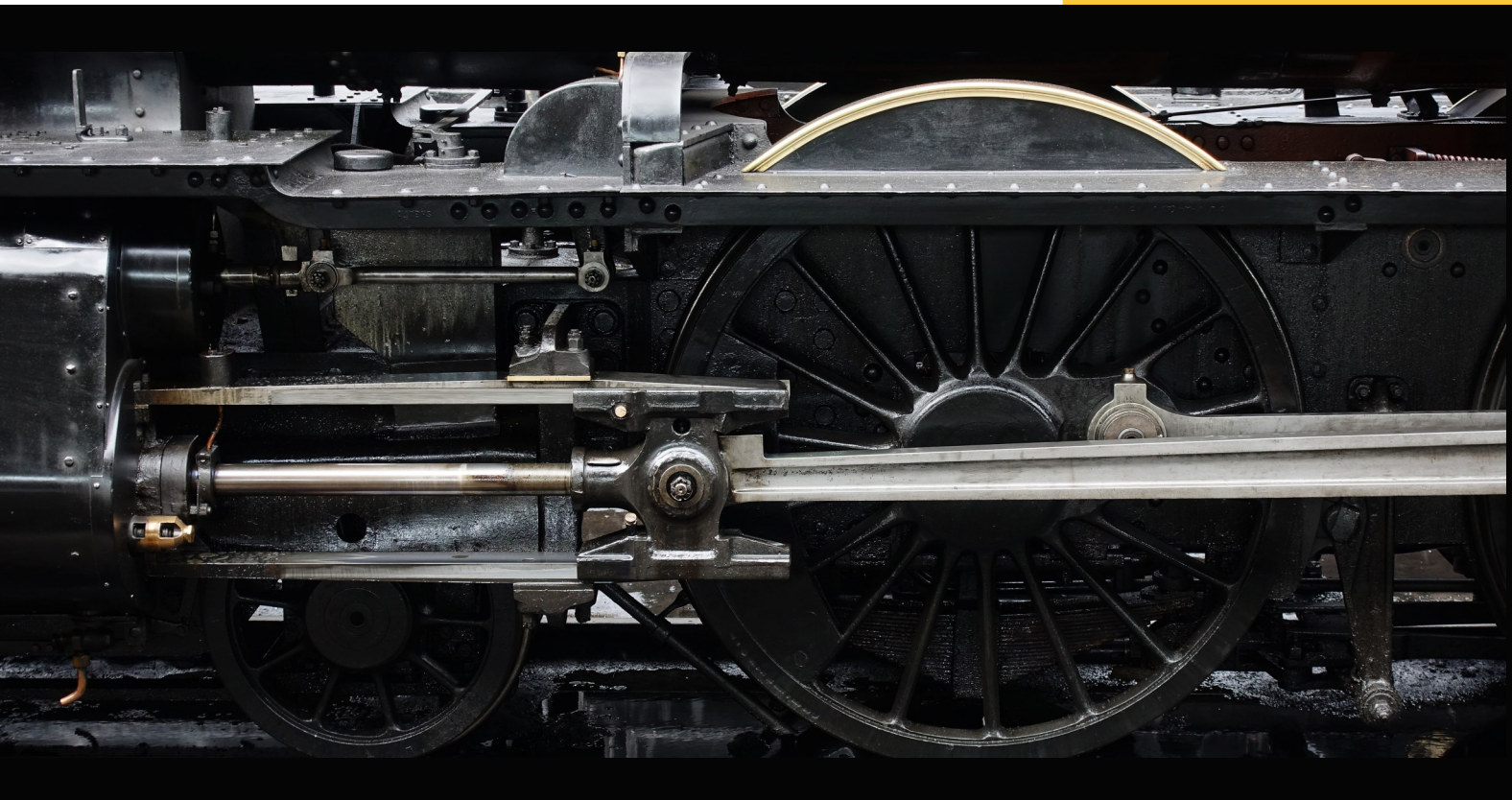
MESSAGE FROM THE HEAD'S DESK

PROF VISHVESH BADHEKA

HOD, DEPT OF MECH ENGG.



It gives me immense pleasure to share Newsletter of the Mechanical Engineering Department, **January 2022**. Mechanical Engineering Department is the most happening Department of the School of Technology. Newsletter gives an overview of the activities carried out by students, staff and faculties during the month. You may please share your feedback, comments & suggestions to the coordinators.



PHASE CHANGE MATERIALS AND THEIR APPLICATIONS

DR RAJAT SAXENA

ASSISTANT PROFESSOR

Energy consumption across the globe increased at twice the rate in 2018 than it was in 2010, by 2.3%. This was due to the sharp growth of the global economy and the increasing need for energy in most countries of the world. As a result, CO₂ emissions in 2019 increased by 1.7% compared to 2018. Thus, this increase in energy consumption is leading to a crisis. With limited resources, to ensure energy supply for our future generations, it is vital to realize the necessity of conserving energy and utilizing it judiciously. The researchers are working on the multiple solutions to this problem. One such solution can be use of Phase Change Materials (PCMs). When material transforms from one phase to another, it absorbs/releases energy, which is called 'latent heat' and the temperature is called the phase change temperature (melting or boiling point). The temperature here is the key and materials are chosen based on the application, such that, the latent heat can be exploited. As this energy of phase transformation is large, the storage size is reduced significantly. This article just introduces the idea of using PCMs to the readers and develop understanding on the topic thereby can find out solutions that can be handy and easily implemented. Few of the examples are also discussed, from environmental management to human comfort solutions, for better understanding.

Materials when are supplied with heat, there temperature tends to increase followed by phase change at a constant temperature this can be well understood from Figure 1.

This heat during phase change can be utilized to store the heat or coolness, which can be significantly large and useful for various application. For example Mr. Sonam Wangchuk, an innovator who changed the lives of people in Ladakh. He stored the coolness of winter and utilized it to conserve the runaway water. This was done using water as PCM. The coolness was stored in form of ice-stupas as shown in Figure 2.

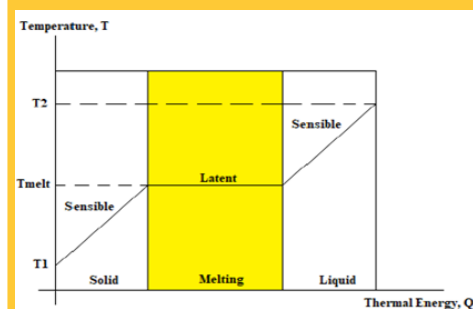


Figure 1: Material undergoing through various phases during heating/ cooling



Figure 2: An ice stupa by Sonam Wangchuk (Credit: Rolex Awards; <https://www.rolex.org/rolex-awards/environment/sonam-wangchuk>)

PHASE CHANGE MATERIALS AND THEIR APPLICATIONS

The downstream water was made to pass through pipes, and flow was controlled using the valves. During the night at sub-zero temperature, the water is sprinkled which solidifies immediately and settles forming a stupa. The structure grows big enough such that it could sustain and hold up to 200 million liters of water. The Ice-stupa holds the Guinness Book of the world record of the most massive human-made ice structure, which is a simple application of water as phase change material. These structures melt during March-April and provide water to the locals for Irrigation etc. when it is most required. This unique concept has helped to replenish the melting glaciers and helped the locals to sustain life in Ladakh.

PCMs within building elements can be utilized for passive conditioning, by increasing the thermal mass of the component without increasing the thickness thus saving on the construction cost and providing cooler living space. The concept is same which keeps the palaces and large structures cooler. For example, Taj Mahal is cool from inside even on a bright summer afternoon. It is true for any other such monuments. This is because of the thick walls, which keep the living spaces cool. In same way, PCM acts as a thermal reservoir increasing the thermal mass of the building element, thus providing a higher thermal gradient. The experimental study carried out for New Delhi showed temperature reduction of 6-10 degrees across the PCM embedded brick compared to a conventional one.

PCMs are also utilized for enhancing the storage capacity for a solar thermal power plant. They help in storing large amount of heat in smaller volume and overcome the intermittence in solar radiation. Hope this article provided you with some new knowledge and would inspire you to read more, gather information on the topic and instill thirst for research, in the area of Phase change materials and their applications.

HIGHLIGHTS

- ✘ With emphasis on more energy production through renewable sources, PCM based storage can prove to be of vital significance
- ✘ It is a passive energy storage option with no or minimal auxiliary power requirement
- ✘ Energy is stored in its natural form (heat) as received from sun and is converted only as and when required or utilized
- ✘ Inherent losses due to energy conversion can be reduced
- ✘ Application potential in water heating, solar drying, space heating/cooling and other thermal management operations.

JOURNAL

FACULTY

The following journal was published in January 2022:

- ◆ Hardik D. Vyas, Kush P. Mehta, **Vishvesh Badheka**, Bharat Doshi, "Microstructure evolution and mechanical properties of continuous drive friction welded dissimilar copper-stainless steel pipe joints", Materials Science and Engineering: A, Volume 832,142444, ISSN 0921-5093, 14 January (2022)

<https://doi.org/10.1016/j.msea.2021.142444>

- ◆ V Dave, H Thakker, **V Vakharia**, "Fault Identification of Ball Bearings using Fast Walsh Hadamard Transform, LASSO Feature Selection, and Random Forest Classifier", FME Transactions, Vol.50 (1),202-210 (2022).

<https://www.mas.bg.ac.rs/istrazivanje/fme/start>

PUBLICATIONS

PATENT

FACULTY

The following Design patents were filed during January 2022:

- ◆ Pandit Deendayal Energy University, Uttamkumar Vyas, Dr. Dhruvesh Patel, **Dr. Vinay Vakharia**, Mrunalini Rana , Venish Suthar, "Aramid Reinforced Cotton (ARC) Irrigation Techniques, Application No: 356068-001 (accepted)
- ◆ Pandit Deendayal Energy University, UttamKumar Vyas, Dr. Dhruvesh Patel, Milind Shah, **Dr. Vinay Vakharia**, Kishanlal Darji, Matrix Irrigation Unit, Application No.: 355916-001 (accepted)

STUDENT

Shrawan Srivastava (20MMD015) along with his team members Venish Suthat, Milind Shah, Rajdeepsinh Zala and guide **Dr. Vinay Vakharia** filed the following patents two of which were accepted in January 2022:

- ◆ Universal support for household bucket heaters, Application No. – 354221-001 (accepted)
- ◆ High latency fluid transportation frame Application No. – 354220-001 (accepted)
- ◆ Grooved clutcher, Application No. - 354219-001 (under process.)

PUBLICATIONS

CONFERENCE

FACULTY

The following papers were presented in the DST-SERB supported "International Conference on Futuristic Advancements in Materials, Manufacturing and Thermal Sciences-ICFAMMT 2022" organised by IITRAM from 20th - 22nd January 2022

ICFAMMT-137 **Jayaprakash Sharma Panchagnula**, Vishvesh J. Badheka, Naga Vamsi Krishna Jasti, Kishore Kumar Panchagnula "A Review on Metal Additive Manufacturing Techniques".

STUDENT

The following papers were presented in the DST-SERB supported "International Conference on Futuristic Advancements in Materials, Manufacturing and Thermal Sciences-ICFAMMT 2022" organised by IITRAM from 20th - 22nd January 2022

IC-FAMMT 62 : **Namrata Thakkar**, Vishvesh J. Badheka et al "Tool Design for Friction Stir Welding Variants".

ICFAMMT-58 : **Ruchir Soni**, Purvank Shah, Vishvesh J. Badheka, "Laser Arc Hybrid Welding Processes: A Review".

ICFAMMT-93 : **Meet Gor**, Harsh Soni, and Vishvesh J. Badheka, "Cooling assisted Friction stir welding of Al6061 to SS304".

BOOK CHAPTER

FACULTY

The following Book Chapters were published In Parwani A.K., Ramkumar P., Abhishek K., Yadav S.K. (eds), Lecture Notes in Intelligent Transportation and Infrastructure, Springer, Singapore. First Online 01 January (2022)

- ◆ **Rakesh Chaudhari**, Vrund Shah, Sakshum Khanna, **Kumar Abhishek, and Jay Vora**, "A Review on Key Technologies of Industry 4.0 in Manufacturing Sectors." , pp. 417-426
- ◆ **Rakesh Chaudhari**, Hem Shah, Izaro Ayesta, L. N. Lacalle, and **Jay Vora**, "Experimental Investigations and Optimization of WEDM Parameters Using Taguchi Analysis of Pure Titanium.", pp. 349-358.
- ◆ **Rakesh Chaudhari**, Manav Sheth, Het Patel, **Kishan Fuse**, Izaro Ayesta, L. N. Lacalle, and **Jay Vora**, "Multi-response Optimization of Alumina Powder-Mixed WEDM Process Using Taguchi-TOPSIS Approach of Nitinol SMA.", pp. 359-367.
- ◆ **Rakesh Chaudhari**, Het Patel, Manav Sheth, Nisarg Prajapati, **Kishan Fuse, Kumar Abhishek, and Jay Vora**, "Effect of Different Tool Electrodes (Wire) of WEDM Process of Inconel 718.", pp. 317-327.
- ◆ **Vora Jay**, Nisarg Prajapati, Smit Patel, Shlok Sheth, Aditya Patel, Sakshum Khanna, Izaro Ayesta, L. N. Lacalle, and **Rakesh Chaudhari**, "Multi-response Optimization and Effect of Alumina Mixed with Dielectric Fluid on WEDM Process of Ti6Al4V.", pp. 277-287.

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- ◆ Shah Vrund, **Jay Vora**, Smit Patel, and Rakesh **Chaudhari***, "A Review on Cloud Manufacturing Technologies of Industry 4.0.", pp. 305-316
- ◆ **Vora Jay**, Chintan Patel, **Kumar Abhishek**, and **Rakesh Chaudhari***, "Influence of Machining Parameters of Fiber Laser Cutting on Al6061-T6.", pp. 437-447
- ◆ **Vora Jay**, Aryan Jain, Manav Sheth, Kunj Gajjar, **Kumar Abhishek**, and **Rakesh Chaudhari***, "A Review on Machining Aspects of Shape Memory Alloys.", pp. 449-458.
- ◆ Khanna Sakshum, Sagar Paneliya, Priyanka Marathey, Khilan Shah, **Parth Prajapati**, **Rakesh Chaudhari**, and **Jay Vora**, "Investigation of Thermophysical Properties of Synthesized N-Hexacosane-Encapsulated Titania Phase Change Material for Enhanced Thermal Storage Application", pp. 107-118

STUDENT

- ◆ **Kavathia K.**, Badheka V. , "Application of Friction Stir Welding (FSW) in Automotive and Electric Vehicle", pp 289-304
https://doi.org/10.1007/978-981-16-7660-4_26
- ◆ **Patel T.A.**, Badheka V. , "Rail Welding Technology: Processes and Welding Quality", pp 369-381
https://doi.org/10.1007/978-981-16-7660-4_33

BOOK CHAPTER

FACULTY

Dr. Vinay Vakharia published the following Book Chapters in Advances in Mechanical and Materials Technology, Springer, Singapore :

- ◆ V Dave, **V Vakharia**, "Fault Diagnosis of Ball Bearing Using EEMD IMF Features, ReliefF, and Machine Learning", pp. 1009-1019
https://link.springer.com/chapter/10.1007/978-981-16-2794-1_88
- ◆ **V Vakharia**, J Sanghvi, H Thakker, "Material Removal Rate and Surface Roughness Prediction in Turning and Milling Operations Using Taguchi Analysis, Support Vector Machine and Gaussian Process Regression, pp. 515-524
https://link.springer.com/chapter/10.1007/978-981-16-2794-1_46.
- ◆ D Shukla, A Patil, P Dholiya, SJ Singh, **V Vakharia**, "An Experimental Study to Determine the Optimum Order of Design Review Parameters for Designing Review in Immersive Virtual Environment", pp. 313-319
https://link.springer.com/chapter/10.1007/978-981-16-2794-1_28

EVENTS

EXPERT TALK DELIVERED

FACULTY

Dr. Rajat Saxena delivered an expert talk on "Phase Change Material Utilization for Energy Conservation and Environment Management Applications" in AICTE - ISTE sponsored one week online short term training program on " Energy Conservation and Energy Management" organized by Department of Mechanical Engineering, B & B Institute of Technology (BBIT), Vallabh Vidyanagar, Gujarat on 11th January 2022.

ATTENDED

Members of Department attended Republic Day Celebration on 26th January 2022.



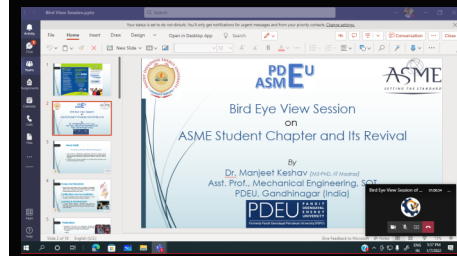
EVENTS

ORGANIZED

FACULTY

Dr. Manjeet Keshav organized the following events:

- ◆ "Bird Eye View Session" on "ASME Student Chapter and Its Revival" under student activity club "ASME PDEU Student Section" on 7th January 2022 at 5 PM.



Students were made aware of ASME student club, its activities and way forward.

- ◆ An invited talk by Er. Tania Rodrigues, ASME India Office as an "Online ASME Awareness Session" for under- and post-graduate students and faculty members on 28th January 2022. She discussed opportunities and activities for student and faculty member.

Today's Speaker

- **Tania Rodrigues**
 Engineer – Student & Early Career Programs
 ASME India Pvt. Ltd.
- Tania is a graduate in mechanical engineering.
- Her involvement with ASME began during her engineering studies. She works for ASME as the Engineer – SECD and supports Student & Early Career Programs, Sections and Membership initiatives in India.
- She also co-hosts ASME's "Exploration into Technology", a weekly video series on the latest developments and news in engineering technology.
- Her interests lie in the fields of developing and strengthening the network between undergraduate students and young engineering professionals' community.

@ PDEU

FACULTY

Dr. Vishvesh Badheka coordinated the following visits at Department of Mechanical Engineering:

- ◆ Dr Kush Mehta, Associate Professor, Mechanical Engineering, LUT School of Energy System, Finland, visited on 7th January 2022.
- ◆ UG and PhD students of IITRAM visited to perform experiments during 10th -11th January 2022
- ◆ Mr Satyen Engineer, CEO, YHONK, Navaragapura, Ahmedabad along with his team discussed the technical proposal on 25th January 2022. Meeting was also attended by Dr Krunal Mehta and Mr Kunal Lalwani.

OUTSIDE PDEU

FACULTY

Dr. Vishvesh Badheka interacted with the following industries during January 2022:

- ♦ Interacted with Mr. Shaurin Patel, Co-founder, Vexma Technologies Pvt. Ltd, at Vadodara on 13th January 2022 regarding ongoing Comprehensive Projects (M. Tech - Design).
- ♦ Prof. J Krishan (Ex-BARC), L & T Chair Professor, Metallurgy Department, Prof D S Haram & Dr Piyush Gohil, Mechanical Engineering Dept, Prof S K Agrawal (Retd), and Prof S N Soman (Retd), Metallurgy Dept of the M.S. University Baroda visited on 13th January 2022.
- ♦ Mr. Viral Thanki, Thanki Engineering Solution on 15th January 2022 at Vadodara.
- ♦ Attended BoS of the Department of Materials and Metallurgical Engineering, Indus University, Ahmedabad, on 19th January 2022.
- ♦ Attended 7th BoS meeting of Mechanical Engineering, GSFC University held on 24th January 2022.
- ♦ Presented activities of IIW-PDEU Students' Chapter during 7th Managing Committee Meeting of IIW Baroda Branch and also to Working Group of Young Professional of International Institute of Welding (WG-YP-IIW) on 31st January 2022.

INDUSTRY - INSTITUTE INTERACTION

TRAINING/INSTALLATION - MAJOR EQUIPMENT

FACULTY

Dr. Jay Vora coordinated the visit of Mr. Darshil Rajpura (Assistant Manager), Modsoni Instruments Mfg. Co. Pvt. Ltd, Naroda, Ahmedabad who demonstrated installation and training of the Ultrasonic Flaw Detection System followed hands on training held on 25th January 2022.



Dr. Vishvesh Badheka coordinated the visit of Mr Virendra Prajapati, Application Engineer, Aavishkar Group, Vatav, A'bad, along with his team who demonstrated Welding Simulator followed hands on training held on 25th January 2022.



INDUSTRY - INSTITUTE INTERACTION

TRAINING/INSTALLATION
MAJOR EQUIPMENT

FACULTY

Dr. Krunal Mehta coordinated the visit of Mr Chintan Dave, Director, Unicus TechScience Pvt Ltd, Sarkhej, Ahmedabad along with his team who demonstrated modified version of Tribo Tester under wet and dry condition on 28th January 2022.



ADMINISTRATIVE ASSIGNMENTS

FACULTY

Dr. Vishvesh Badheka took up the following administrative assignments during January 2022:

- ◆ Attended IIC: NIDHI EIR- Evaluation and Monitoring committee meeting on 7th January 2022
- ◆ Attended NAAC meeting 7th January 2022
- ◆ Coordinated Orientation of the workshop facility for the NBA visit on 26th January 2022
- ◆ Coordinated NBA visit on 28-29th January 2022
- ◆ Submitted faculty recruitment proposal of Automobile Engineering.

Faculty Members from Department conducted special classes to help students in their preparation for GATE-2022 for various key topics of Mechanical Engineering. The classes were arranged for both UG as well as PG students.

ACADEMICS - DC MEETING

STUDENT

DC Review	Date	Name of PhD Scholar	External Expert	Guide/Supervisor
9th DC	03rd January 2022	Rahul Deharkar (16RME009)	Dr. Anurag Mudgal	Dr. Subarna Maiti
9th DC	04th January 2022	Bhasuru Abhinaya (17RME001)	Dr. Nagababu Garlapati & Dr. S.S. Kachhawaha	Dr. Vikas Lakhera
5th DC	19th January 2022	Deepika Harwani (18RME001)	Dr. Vishvesh Badheka & Dr. Vivek V. Patel	Dr. Komal G. Dave
6th DC	07th January 2022	Raghavendra Darji (18RME008)	Dr. Vishvesh Badheka & Dr. Kush Mehta	Dr. Manoj Kumar Gupta
6th DC	07th January 2022	Hardik Vyas (18RME009)	Dr. Kush Mehta & Dr. Vishvesh Badheka	Dr. Manoj Kumar Gupta
5th DC	11th January 2022	Hardik Jani (19RME002)	Dr. S.S. Kachhawaha & Dr. Garlapati Nagababu	Prof. N. M. Bhatt
Comprehensive Exam & 2nd DC	07th January 2022	Pandya Milap (20RME003)	Dr Nirav Patel & Dr Kush Mehta	Dr. Harshit K.Dave, SVNIT
Comprehensive Exam & 2nd DC	27th January 2022	Deepjyoti Basak (20RME005)	Dr. Garlapati Nagababu & Dr. Jaydeep Patel	Dr. N. M. Bhatt, L.D.C.E
2nd DC	06th January 2022	Uttakantha Dixit (20RME006)	Dr. Ramesh Guduru	Dr. Rakesh Mote, IIT Bombay
2nd DC	17th January 2022	Kuldeep Narwat (20RME009)	Dr. Abhishek Kumar	Dr. Divyang H.Pandya, LDRP
1st DC	17th January 2022	Abrarkhan Pathan (21RME002)	Dr. Abhshek Kumar & Dr. Vishvesh Badheka	Dr.Harshit K.Dave, SVNIT
1st DC	27th January 2022	Sanjay Tiwari (21RME003)	Dr. S.S. Kachhawaha	Dr.Nirav I. Jamnapara, IPR
1st DC	16th January 2022	Pratik Patel (21RME004)	Dr. Rajesh Patel	Prof. N. M. Bhatt, L.D.C.E
1st DC	27th January 2022	Amruta Mahajan (21RME005)	Dr. Vishvesh Badheka	Dr. Paritosh Cahudhuri , IPR
1st DC	27th January 2022	Kshitij Acharya (21RME006)	Dr. Vishvesh Badheka	Dr. Jyoti V Menghani, SVNIT
1st DC	19th January 2022	Chaina Ram (21RME007)	Dr. Anirudh Kulkarni & Dr. S.S. Kachhawaha	Dr. Vinod Narayanan, IIT Gandhinagar
1st DC	11th January 2022	Darshan Bhatt (21RME008)	Dr. Pankaj Sahlot & Dr. Jay Vora	Prof. Indravadan Dave, GEC, Gandhinagar

ACADEMICS - IIRS OUTREACH PROGRAMME

STUDENT

Department of Mechanical Engineering, PDEU is the network institute of the IIRS outreach network.

Indian Institute of Remote Sensing (IIRS) under Indian Space Research Organisation (ISRO), Department of Space, Govt. of India is a premier Training and Educational Institute set up for developing trained professionals in the field of Remote Sensing, Geoinformatics and GNSS Technology and its applications in natural resources monitoring, environmental and disaster management.

Indian Institute of Remote Sensing (IIRS) organized various Outreach programs, based on attendance and online examination, IIRS-ISRO awarded the certificate of participation.

Course name	Registered students	Eligible students for certificate
94- IIRS Outreach Programme on Overview of Geoprocessing using Python	67	20
73- IIRS Outreach Programme on Overview of Geoprocessing using Python	7	4
91- IIRS Outreach Programme on Fundamentals of Remotesensing and GIS Technology	7	2
86- IIRS Outreach Programme on Remote Sensing & Digital Image Analysis	3	1
67- IIRS Outreach Programme on Understanding of Coastal ocean process using Remote Sensing and Numerical Modelling	3	2
63- IIRS Outreach Programme on Remote Sensing Applications in Agricultural Water Management	8	1
61- IIRS Outreach Programme on Satellite Photogrammetry and its Application	7	5

ACADEMICS - COMPREHENSIVE PROJECT

STUDENT

121 students of final year B.Tech (MC18) are undergoing their Comprehensive Projects at the following renowned companies:

- ◆ (LGM India) Kirloskar Oil Engines Ltd,
- ◆ AAAG India ,
- ◆ Al Ashfaq General Contracting Est.,
- ◆ Alstom,
- ◆ Bombardier Transportation Ind. Pvt. Ltd
- ◆ Amrut Energy Private Ltd.
- ◆ Arvind Advanced Materials,
- ◆ Balief Corporation,
- ◆ Bosch Rexroth Pvt Ltd,
- ◆ Buhler India Pvt. Ltd. ,
- ◆ Castech Foundries Pvt Ltd,
- ◆ Compocan Industries,
- ◆ Emission free world,
- ◆ Envitect Aluminium Composite Panel,
- ◆ Essar port bulk terminal pvt Ltd.
- ◆ GERMI,
- ◆ Ghanshyam engineering company,
- ◆ Goldmen Projects,
- ◆ Hallmark compressor Pvt Ltd.
- ◆ Hams-Bi Metal,
- ◆ Harsha Engineers,
- ◆ Ice Make Refrigeration Ltd,
- ◆ Imagine Powertree, Pvt. Ltd.,
- ◆ Indian Space Research Organization- Space Applications Center
- ◆ Intech Additive ,
- ◆ Joy E-Bikes,
- ◆ Jyoti CNC Automation Ltd,
- ◆ Kalpataru Power Transmission Ltd,
- ◆ KalpvruX Converting Products Pvt. Ltd,
- ◆ Kishan Autoparts Pvt. Ltd.,
- ◆ Klockner Desma machinery Pvt. Ltd.,
- ◆ L & T,
- ◆ Linde Engineering Pvt Ltd,
- ◆ Luhar metals solutions,
- ◆ Maheshwar Steel Cast,
- ◆ Mahitx Technologies Pvt. Ltd.,
- ◆ Make3D,
- ◆ Match graphics Pvt. Ltd
- ◆ Mediscient Devices,
- ◆ NITA Alloys,
- ◆ Npf polyfilms Pvt Ltd,
- ◆ Opal industries,
- ◆ Parmeshwar Metal Pvt. Ltd,
- ◆ Prashant casting Pvt. Ltd.
- ◆ R. K Synthesis,
- ◆ Rang Engineers,
- ◆ Reliance Industries Limited,
- ◆ Rudra Solar energy,
- ◆ S. B. Enterprise,
- ◆ Sciative solutions,
- ◆ Shah Bhoglal Jethalal & Bros.,
- ◆ Shree Giriraj costspin Pvt. Ltd
- ◆ Soleos Solar energy Pvt Ltd,
- ◆ Suzlon Energy Limited,
- ◆ SYN bearings,
- ◆ Taylormade Renwebles Ltd.,
- ◆ Thaker Engineering Co. Pvt. Ltd.,
- ◆ TVI Industry,
- ◆ Vintech Ind. Pvt. Ltd. ,
- ◆ Welltex industry,
- ◆ White Carbon Motors,
- ◆ Windsor Machines Limited,
- ◆ Xylem water Solutions,
- ◆ Zedex Clothing Pvt. Ltd.