

# 10<sup>TH</sup> INTERNATIONAL MECHANICAL ENGINEERING CONFERENCE

being held on the occasion of NED Centennial Year (1921-2021)



**12th  
FEBRUARY  
2021**

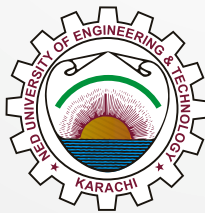
20-21  
**imec**

## GREEN PRACTICES IN MECHANICAL ENGINEERING

Organized by



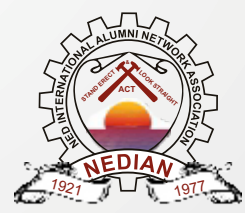
The Institution of Engineers Pakistan  
Karachi Centre



NED University of Engineering &  
Technology, Karachi



Mehran University of Engineering  
and Technology Jamshoro



NEDIAN International  
Alumni Network Association

In Collaboration With



Federation of Engineering  
Institutions of South &  
Central Asia (FEISCA)



Federation of Engineering  
Institutions of Islamic  
Countries (FEIC)



Balochistan University of  
Engineering & Technology  
Khuzdar



Balochistan University of  
Information Technology Engineering  
& Management Sciences



Dawood University of  
Engineering &  
Technology, Karachi



DHA Sui a  
University



Hamdard  
University



Quaid-e-Awam  
University of Engineering  
Science & Technology



Pakistan Navy  
Engineering College - NUST,  
Karachi



Pakistan HVACR  
Society



The American Society  
of Heating, Refrigerating and  
Air-Conditioning Engineers



Petroleum Institute  
of Pakistan



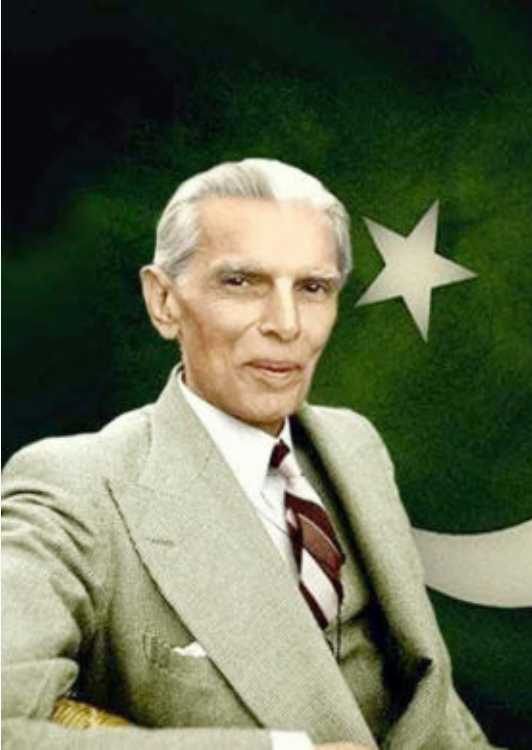
Pakistan Society of  
Plumbing Professionals



Institution of Mechanical  
Engineers - Pakistan

MESSAGE FROM THE

## FATHER OF NATION



UPON THE INDEPENDENCE OF PAKISTAN,  
THE ABOVE NATIONAL MOTO WAS INTRODUCED  
AND ADOPTED BY THE COUNTRY'S FOUNDER  
MUHAMMAD ALI JINNAH

NATIONAL MOTO OF  
**PAKISTAN**

ایمان، اتحاد  
تنظیم

**FAITH, UNITY  
DISCIPLINE**

”

### Muhammad Ali Jinnah

*"If Pakistan is to take its proper place among the progressive nations of the world, it will have to take up a good deal of leeway in the realm of scientific and technical education which is so necessary for the proper development of the country and the utilization of its resources. The establishment of institution like the Institute of Engineers will greatly stimulate technical research and help in disseminating available information.*

*The Institute of Engineers will not only benefit the engineers themselves by improving their technical knowledge but also bring lasting benefits to public services which they are called upon to perform.*

*I wish the Institute every success"*

”

QUAID-E-AZAM'S message to the  
first inaugural meeting of the  
Institute of Engineers Pakistan  
on 20th June 1948.



## CHIEF MINISTER SINDH



**Engr. Syed Murad Ali Shah, FIE(Pak)**  
Chief Minister Sindh



I am pleased to know that The Institution of Engineers Pakistan (IEP) and NED University of Engineering & Technology and Mehran University of Engineering & Technology, Jamshoro are jointly organizing the 10th International Mechanical Engineering Conference (IMEC-20-21) in collaboration with NED International Alumni Network Association, Federation of Engineering Institutions of Islamic Countries, Federation of Engineering Institutions of South & Central Asia, Pakistan HVCAR Society, ASHRAE Pakistan Chapter, Petroleum Institute of Pakistan, Pakistan Society of Plumbing Professionals, Institution of Mechanical Engineers, Pakistan, Balochistan University of Information Technology, Engineering and Management Sciences, Balochistan University of Engineering & Technology - Khuzdar, Dawood University of Engineering & Technology, DHA Suffa University, Quaid-e-Awam University of Engineering, Science & Technology, Nawabshah, Hamdard University, Pakistan Navy Engineering College-NUST.

In my opinion, the theme of this year's conference i.e. "Green Practices in Mechanical Engineering" is of paramount importance keeping in view the ongoing technological advancements in the world. There is no doubt that rapid technological advances are having a major impact on our professional and personal life as they are changing the nature of work.

Creativity and innovation of engineering professionals is central to building up a resilient community. They are, therefore, required to come up with new ideas and smart solutions. Transforming the businesses in line with new technologies helps to expand the business foot print, introduce innovation and boost the output through innovation.

Having a more ancient IT infrastructure equipped with new technologies allows public administrations to get quality work done and improve service delivery. While the government is playing its due role for improvement in governance through IT based initiatives, it is equally important that engineers develop a fundamental understanding of their professional responsibilities. They are architect and builder of the nation in terms of infrastructure development, innovation and entrepreneurship.

I am confident that this Conference will be of great benefit to the engineers and will prove to be a milestone in the history of IEP and NED. Moreover, the Conference will also enhance the knowledge of participants in raising the efficiency and increasing the productivity of the engineering sector.

I wish the organizers of this Conference all the success in their endeavours.



## PRESIDENT

Federation of Engineering Institutions  
of Islamic Countries (FEIIC)



**Engr. Dr. Saad Al Shahrani**  
President, FEIIC

“ The Federation of Engineering Institutions of Islamic Countries (FEIIC) is an international non-profit professional organization, established in 1989, with the aim of fostering cooperation in engineering education, research and professional practice in the Islamic Countries. It comprises of 22 member countries and a number of corporate and institutional members from amongst academic and research institutions, consultants, contractors and national organizations.

FEIIC, in cooperation with its members, has organized many scientific and research conferences, seminars, and workshops in its member countries on various aspects of engineering and related issues, such as engineering education, accreditation of engineering qualifications, and affordable housing etc. We are committed to share and exchange the experiences and expertise of the member countries with each other in addressing the crucial challenges in engineering and technological fields and in adopting the emerging trends and new concepts in engineering education, research and development and their implementation.

This 10th International Mechanical Engineering Conference (IMEC-20-21) on “Green Practices in Mechanical Engineering” is one of such efforts by the Institution of Engineers Pakistan, an active member of FEIIC, which we hope will bring the researchers and practicing engineers together on a shared platform to share and exchange their expertise and experiences.

Finally, I would like to congratulate and commend the partners and Organizing Committee of the Conference for all their efforts and wish all the participants a very successful and enriching experience at the Conference.



## PRESIDENT

The Federation of Engineering  
Institutions of South & Central Asia (FEISCA)



**Engr. Jayavilal Meegoda**

President – FEISCA

Immediate Past President - IESL



It is with pleasure that I send this message on the occasion of the 10th International Mechanical Engineering Conference (IMEC-20-21) on “Green Practices in Mechanical Engineering”

Papers presented being of good level in International authorship and topics range, the Conference will be a forum that will enrich the regions knowledge and expertise potentials and be a platform for sharing innovations and advances in Mechanical Engineering and related disciplines among countries in the region.

The Federation of Engineering Institutions of South & Central Asia (FEISCA) as a collaborating partner to the event looks forward to the improved professional collaboration that would result among engineering institutions of the region.

The FEISCA hopes that the confluence of technology and expertise would ultimately flow to the engineering community at large contributing to the sustainable socio-economic development in the region.

While congratulating the IEP, Karachi Centre and NEDUET, Karachi for successfully organizing the IMEC-20-21, I also convey my well wishes to all the fellow collaborating partners of this event.

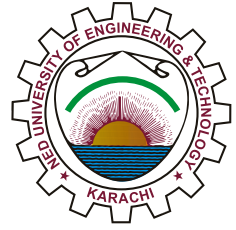
I wish all the participants a very successful and enriching experience at the Conference.





## VICE-CHANCELLOR

NED University of Engineering & Technology, Karachi  
Members Executive Committee – FEIIC, FEISCA & ACECC



**Engr. Prof. Dr. Sarosh H. Lodi, FIE (Pak)**

Vice Chancellor,  
NED University of  
Engineering and Technology, Karachi

“ I am pleased to know that the Institution of Engineers, Pakistan, Karachi Centre in collaboration with NED University of Engineering & Technology and Mehran University of Engineering & Technology, Jamshoro along with other partner universities is organizing 10th International Mechanical Engineering Conference which is in continuation of previously arranged conferences in earlier years. Such events with having several institutions being on-board will certainly help getting innovative research outcome promptly shared with students, faculty members and other researchers who will be participating in this event.

Last few decades have witnessed several inventions in the discipline of mechanical engineering specially in automotive domain which resulted enormous developments in this discipline. These inventions were as a result of integration between several engineering disciplines including mechanical, electronic, mechatronics. Hence, the barriers which existed between various engineering disciplines up to an extent the barriers between engineering and medical sciences disciplines have also become almost invisible which will gradually get vanished. This trend will lead towards an environment whereby all engineering and sciences disciplines will have very soft barriers in between and individuals belonging to each one of them will get fully benefited from the counterparts. The theme of this Conference being 'Green Practices in Mechanical Engineering' will hopefully address all such innovative aspects are explored which will have a focus on green and sustainable environment.

Finally, I would like to congratulate all the members of Organizing Committee whose untiring efforts have made it possible to organize this 10th IMEC and hope that all participants will be fully benefited by this Conference.



## VICE-CHANCELLOR

Balochistan University of IT, Engineering  
and Management Sciences (BUITEMS)



**Engr. Ahmed Farooq Bazai (S.I)**

Vice Chancellor

Balochistan University of IT, Engineering  
and Management Sciences (BUITEMS)

“ I congratulate Honorable Vice Chancellor of NED University Engr. Prof. Dr. Sarosh Hashmat Lodi and Chairman IEP, Karachi Centre Engr. Sohail Bashir on organizing jointly the 10th International Mechanical Engineering Conference (IMEC-20-21) under the theme of Green Practices in Mechanical Engineering". The conference aims at providing a platform for the exchange of thoughts on the latest development in the field of Mechanical Engineering for industrial applications, among researchers and engineers in academia and industries, and to seek opportunities for collaboration among the participants.

There has been a tremendous innovation in emerging technologies during recent years including, nanomaterials, super alloys, protective coatings, 3-D printing, smart cars, flying vehicles, hi-tech batteries, industrial and nano robots with innovative mobility, virtual reality, and many others. These and many other developments have unlocked new boundaries of research provoking advanced industrial revolution.

I anticipate that the conference is committed to meet the expectations of all its stakeholders to realize its vision to emerge as an occasion of excellence in Mechanical Engineering both at the national and international levels.



## VICE-CHANCELLOR

Balochistan UET Khuzdar



**Engr. Prof. Dr. Ehsanullah Khan, FIE (Pak)**

Balochistan UET Khuzdar

“ I am delighted to have the opportunity to share a few thoughts at the time of 10th International Mechanical Engineering Conference (IMEC-20-21). It is a great initiative taken by Institution of Engineers Pakistan (IEP) Karachi Centre and NED University of Engineering and Technology Karachi along with other reputed partners including Balochistan University of Engineering and Technology, Khuzdar. The 10th edition of the conference itself is an indicator of the quality and credibility of the Conference Internationally. The theme of the Conference “Green Practices in Mechanical Engineering” is very relevant in modern times as technological advancements have made a huge impact on Mechanical Engineering globally. The tracks included in the conference reflect the futuristic trends occurring in the field of Mechanical Engineering especially applications of Nano-technology and Artificial Intelligence as they are also significantly important in terms of future of Pakistan.

I firmly believe that this conference will open a new era of research with a focus on futuristic trends resulting in technological transformation in the field of Mechanical Engineering

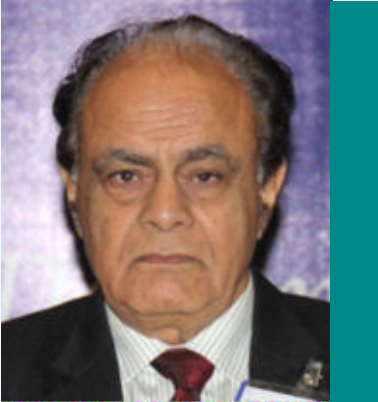
I warmly congratulate the organizers of the conference for holding such a high quality International Conference and assure them that Balochistan UET, Khuzdar will continue to collaborate in such future endeavours as well.





## PRESIDENT

The Institution of Engineers, Pakistan



**Engr. Dr. Javaid Younas Uppal, FIE(Pak)**

President

The Institution of Engineers, Pakistan



It is a matter of great pride that The Institution of Engineers Pakistan, Karachi Centre (IEP), NED University of Engineering and Technology, Karachi and Mehran University of Engineering Technology, Jamshoro are holding 10th International Mechanical Engineering Conference on 12th February, 2021 at NEDUET in collaboration with National, International and Regional sister Engineering organizations and universities.

It is also a matter of great satisfaction that renowned experts from within the country and from abroad shall be presenting their valuable papers during the conference under the theme “Green Practices in Mechanical Engineering (IMEC-20-21)”. This event will provide the opportunity to young Engineers to benefit from the knowledge of experienced Engineers in their relevant fields.

The Institution of Engineers Pakistan, Karachi Center is working hard for dissemination of knowledge by holding National/International Engineering Conferences, Technical Seminars, Workshops and lectures for the benefit of Engineering profession and development of the Country.

The Chairman, Chief Organizer, Secretary and Local Council Members of Karachi Centre deserve appreciation for organizing the Engineering Conference and Technical lectures on various Engineering topics for the benefit of engineering community.

I pray for the success this of 10th International Mechanical Engineering Conference.



## SECRETARY GENERAL

The Institution of Engineers, Pakistan



**Engr. Amir Zamir Ahmed Khan, FIE (Pak)**

Secretary General

The Institution of Engineers Pakistan



It is matter of great pleasure that The Institution of Engineers Pakistan, Karachi Centre (IEP), NED University of Engineering and Technology, Karachi and Mehran University of Engineering & Technology, Jamshoro are holding 10th International Mechanical Engineering Conference on 12th February, 2021 at NEDUET, Karachi in collaboration with National, International and Regional sister Engineering organizations and Universities.

The Institution of Engineers Pakistan is the premier body of Engineers in Pakistan and has made significant contributions to the development of the country. The role played by the Institution in dissemination of knowledge is highly commendable. Recent advancements in Science and Technology have placed enormous resources at our disposal which must be harnessed for the welfare of humanity. Pakistan possesses vast natural resources and it is the duty of our scientists and engineers to utilize these for the welfare of the society and eradication of disease, ignorance, poverty and hunger.

I am sure the 10th International Mechanical Engineering Conference will provide an excellent opportunity to the participants to benefit from the experiences of renowned experts authors from within the country and from abroad who shall be presenting their valuable papers during the conference under the theme “Green Practices in Mechanical Engineering.

I wish the Institution of Engineers Pakistan, Karachi Centre and participants of the Conference all the success.



### CHAIRMAN

The Institution of Engineers Pakistan, Karachi Centre  
Members Executive Committee – FEIIC, FEISCA & ACECC



#### Engr. Sohail Bashir, FIE (Pak)

Chairman IEP, Karachi Centre



The Institution of Engineers Pakistan, (IEP) is playing a vital role in the development of Pakistan since its inception within the frame work of its aims & objectives which revolves around the promotion of technology, advancement of the engineering practice, application of principles of science in engineering and dissemination of technical knowledge. Upholding its tradition continuously for the last ten years, this year also the 10<sup>th</sup> International Mechanical Engineering Conference is being hosted by IEP Karachi Centre, NED University of Engineering and Technology, Mehran University of Engineering and Technology and NEDIAN Association in hybrid mode (Physical & Zoom) with more zeal and enthusiasm. The theme for this year conference is “Green Practices in Mechanical Engineering”.

The conference shall dwell on the latest technological development in the field of Mechanical Engineering and allied engineering disciplines which would not only broaden the vision of participants but shall led them to the frontiers of the existing knowledge and the way forward. Indeed to hold such International gathering, in the present **COVID-19** scenario was not only a challenge but was also an uphill task for which IEP, Karachi Centre, NEDUET, MUET & NEDIAN Association and all collaborating Institutions i.e. Federation of Engineering Institutions of South and Central Asia (FEISCA), Federation of Engineering Institutions of Islamic Countries (FEIIC), deserves all commendation. The collaborative role of Department of Mechanical Engineering of NED University of Engineering & Technology, Balochistan University of Engineering and Technology, Khuzdar, Balochistan University of Information Technology, Engineering & Management Sciences (BUIEMS), Quetta, Dawood University of Engineering and Technology, Karachi, DHA SUFFA University, Hamdard University, Quaid-e-Awam University of Engineering Sciences and Technology, Pakistan Navy Engineering College NUST, Karachi, Pakistan HVACR Society, ASHRAE-Pakistan Chapter, Petroleum Institute of Pakistan, Pakistan Society of Plumbing Professionals, Institution of Mechanical Engineers Pakistan deserves special commendation.

On behalf of The Institution of Engineers Pakistan, Karachi Centre and the Organizing Committee of IMEC-2020-2021, I would like to express my sincere appreciation for active participation, both from academia and industry. Indeed, all the members of Advisory Board, Management Committee, Coordination Committee and Technical Review Committee worked extremely hard to make this event happen. I have no doubt whatsoever that without their cooperation, support and active participatory role, this event would not have been possible for which I record my appreciation for all of them. Special thanks to the Conference Invited talk Speakers Dr. Liming Wang, Associate Professor, Shandong University, China, Dr. Mahmoud Rababah, Associate Professor, Hashemite University, Jordan and Dr. Tim Anderson, Associate Professor, Auckland University of Technology, New Zealand. Special thanks also to Engr. Prof. Dr. Muhammad Aslam Uqaili, Vice-Chancellor MUET, Jamshoro, Engr. Asim Murtaza Khan, President, NED International Alumni Network (NEDIAN) Association, Engr. Ayaz Mirza, Vice-President (Mechanical & Allied), IEP, Engr. Farooq Arbi, Secretary IEP, Karachi Centre, Engr. M. Aijaz Ul Haque, Vice-Chairman (Mechanical), IEP, Karachi Centre, Engr. Abdul Wahab Tajwani, Member Central Council, IEP, Engr. Jilani Yousuf, Member Central Council, IEP and Engr. Abdul Rahim, Member, Local Council, IEP, Karachi Centre. I also take this opportunity to pay my sincere gratitude to the Chief Guest Engr. Nadeem Rasul, Managing Director, Pakistan Machine Tool Factory (PMTF) for sparing his valuable time for this event. My sincere gratitude is to Engr. Prof. Dr. Sarosh Hashmat Lodi, Vice-Chancellor, NEDUET, for his guidance & help in organizing IMEC-2020-2021.

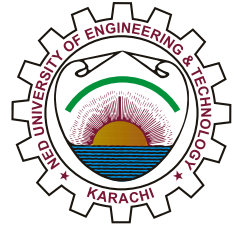
I would like to take this opportunity to place on record my sincere appreciation to Engr. Prof. Dr. Muhammad Tufail, Pro Vice-Chancellor, NED UET, Prof. Dr. Syed Amir Iqbal, Dean, Faculty of Mechanical and Manufacturing Engineering, NED UET, Engr. Prof. Dr. Mubashir Ali Siddiqui, Chairman, Department of Mechanical Engineering, NED UET, Engr. Prof. Dr. Nasiruddin Sheikh, Engr. Abbas Sajid, Engr. Ghulam Farooq Maniar, Chief Organizer, IMEC-2020-2021, Engr. Dr. Muhammad Uzair, Secretary, IMEC 2020-2021 for their hard work.

Finally, I would like to welcome each one of the participant and hope that they will find IMEC-2020-2021 not only useful in enhancing their technical knowledge but also to be a forum to meet many highly respected engineers under one roof for effective interaction in future.



## PRO VICE-CHANCELLOR

NED University of Engineering & Technology, Karachi  
& Convener 10th IMEC-20-21



### **Engr. Prof. Dr. Muhammad Tufail, FIE (Pak)**

Pro Vice-Chancellor  
Engineering NED University of  
Engineering & Technology, Karachi  
& Convener 10th IMEC-22-21

“ Institution of Engineers, Pakistan, Karachi Centre has continuously been putting its efforts for benefiting engineers; one such act being arranging seminars, workshops and conferences on regular basis. In order to inculcate new knowledge among engineers, IEP in collaboration with NED University, Mehran University of Engineering & Technology, Jamshoro and other partner universities will be arranging the 10th International Mechanical Engineering Conference. These conferences do provide a platform for the participants to share their research outcome as well as get benefited from other researchers.

Mechanical Engineering discipline has tremendously evolved during recent past. Autonomous vehicles are introduced, all mechanical based equipment are either fully automated or semi-automated with minimum human intervention. Systems have also been developed for fully utilizing sources of renewable energy. Similarly, new materials with enhanced properties have been developed which are being used by mechanical engineers. The theme of this Conference being 'Green Practices in Mechanical Engineering' will hopefully cover all these aspects and make the participants aware about such relevant developments.

I hope that the participants apart from getting knowledge about new research will also have interaction with other participating institutions which will lead towards establishing collaboration between the institutions within Country and abroad.

Finally, I would like to congratulate the Organizing Committee of 10th IMEC for their commendable efforts for organizing this event and hope that this event will be a successful one with all participants fully benefited from the event.



## VICE-PRESIDENT (Mechanical)

The Institution of Engineers Pakistan



### Engr. Ayaz Mirza

Vice-President (Mechanical), IEP

“ It is a matter of great pride that The Institution of Engineers Pakistan, Karachi Centre , NED University of Engineering & Technology, Mehran University of Engineering & Technology, Jamshoro and NED International Alumni Network Association are jointly holding 10th International Mechanical Engineering Conference on Friday 12th February, 2021 at NEDUET, Karachi in collaboration with National and International Engineering Universities.

It gives me great satisfaction that renowned experts from within the country and from abroad shall be presenting their valuable papers during the conference. This event will provide the opportunity to young engineers to benefit from the knowledge of experienced engineers in their relevant fields.

The Institution of Engineers Pakistan, Karachi Centre is working hard for dissemination of knowledge by holding National/International Engineering Conferences, Technical Seminars, Workshops and Lectures for the benefit of Engineering profession and development of the Country.

The Chairman, Vice-Chairman, Secretary and Local Council Members of Karachi Centre deserve appreciation for organizing the Conference in hybrid mode for the benefit of engineering community in this situation of COVID -19.

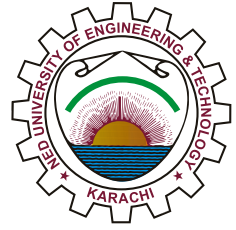
As Vice-President, IEP I am confident the delegates, participants and corporate members attending the Conference, will be benefited by the presentations to be made by the experts from all over Pakistan and abroad, the participants will be able to improve their skills in their fields. It is hoped the participants attending this Conference will be able to apply their improved knowledge for better productivity in their practical life.

I pray for the success of the 10th International Mechanical Engineering Conference.”



## **DEAN**

**Faculty of Mechanical  
& Manufacturing Engineering , NEDUET**



**Prof. Dr. Syed Amir Iqbal**

Dean Faculty of Mechanical  
& Manufacturing Engineering , NEDUET

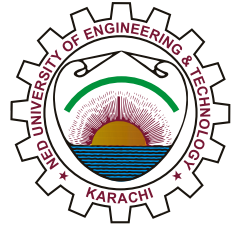
“ It is indeed a pleasure to see the efforts of NED University, and Institution of Engineers Pakistan (IEP), in collaboration with Federation of Engineering Institutions of Islamic Countries (FEIIC), Federation of Engineering Institutions of South & Central Asia (FEISCA), and other collaborating Institutions, ripening as 10th International Mechanical Engineering Conference on “Green Practice in Mechanical Engineering”

It is, at one end, essential to excel in current technologies while keeping an eye on futuristic trends on the other end, as it leads to technological advancement.

I hope that the papers in conference tracks on nanotechnology, artificial intelligence, power generation and others will prove beneficial to the society.

In the end, I would like to thank IEP and NED committee members, volunteers, and authors for their valuable contribution towards the Conference.

”



## CO-CONVENER

### 10th-IMEC-20-21



**Engr. Prof. Dr. Mubashir Ali Siddiqui, FIE(Pak)**

Chairman, Department of Mechanical Engineering, NEDUET  
& Co-Convener, 10th -IMEC-20-21

“ It is a great pleasure and pride to organize 10th International Mechanical Engineering Conference on February 12th, 2021, under the theme GREEN PRACTICES IN MECHANICAL ENGINEERING. For last several years, NED University of Engineering and Technology Karachi is consistently organizing conferences every year in collaboration with Institution of Engineers Pakistan and several other national and international institutions. It clearly shows an increasing trend towards research and development. These conferences provide a platform to academia and industries to present and share the ideas in latest technological advancements and innovations in their respective fields. This year the conference organizing committee has also invited speakers from industries which will help understanding the industrial potential and industrial issues to the academia.

I would like to congratulate and thanks IEP officials, organization committee, members of reviewer committee, authors, volunteers and all of my colleagues from NED University for their valuable contributions. They all have worked hard continuously and put their best efforts for the arrangement and success of this conference.

”

## VICE-CHAIRMAN (Mechanical)

The Institution of Engineers Pakistan, Karachi Centre



### **Engr. Muhammad Aijaz ul Haque, FIE (Pak)**

Vice-Chairman (Mechanical)

IEP Karachi Centre

“ The Institution of Engineers Pakistan is playing a vital role in the Development of Engineering Profession since its inception within the parameter of its approved aims and objectives, for the promotion and advancement of the practice and application of principles of Engineering, spread across Pakistan. As per its traditions, IEP, Karachi Centre, NEDUET and MUET is Jointly organizing the 10th International Mechanical Engineering Conference on the theme “ Green Practices in Mechanical Engineering”. The conference shall focus on latest Technological Development in the field of Mechanical Engineering not only to disseminate knowledge but will also broaden the vision of the participants, which led them to explore the new frontiers.

As Vice-Chairman (Mechanical) of the Institution of Engineers Pakistan, Karachi Centre and member of the 10th IMEC-20-21 Organizing Committee, I would like to express my sincere appreciation for all participants, through contributions to the conference and through their extremely hard work to make this event happen. Special thanks also go to the keynote speakers, invited speakers and authors.

I wish this conference every success

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# CHIEF ORGANIZER

10th-IMEC-2020-2021



**Engr. Ghulam Farooq Maniar, FIE (Pak)**

Chief Organizer

10th-IMEC-2020-2021



The Institution of Engineers Pakistan (IEP) is playing a vital role in the development of Pakistan since its inception within the frame work of its aims & objectives which revolves around the promotion of technology, advancement of the engineering practice, application of principles of science in engineering and dissemination of technical knowledge. Upholding its tradition, this year also the 10th International Mechanical Engineering Conference is being hosted by the IEP Karachi Centre with more zeal and enthusiasm. The theme of the conference is “Green Practices in Mechanical Engineering”.

The conference shall dwell on the latest technological development in the field of Mechanical Engineering and allied engineering disciplines which would not only broaden the vision of participants but shall lead them to the frontiers of the existing knowledge and the way forward. Indeed to hold such International gathering was not only a challenge but was also an uphill task for which IEP Karachi Centre, NEDUET and NEDIAN and all collaborating Institutions deserves all commendation. The collaborative role of Department of Mechanical Engineering NEDUET, Federation of Engineering Institutions of Islamic Countries, Federation of Engineering Institutions of South & Central Asia, Pakistan HVCAR Society, ASHRAE Pakistan Chapter, Petroleum Institute of Pakistan, , Balochistan University of Information Technology, Engineering and Management Sciences, Quetta, Balochistan University of Engineering & Technology, Khuzdar, Dawood University of Engineering & Technology, Karachi DHA Suffa University, Quaid-e-Awam University of Engineering Sciences & Technology, Nawabshah, Hamdard University, Pakistan Navy Engineering College-NUST deserve special appreciations.

As Chief Organizer of the Organizing Committee of IMEC-20-21, I would like to express my sincere appreciation for active participation, both from academia and industry. Indeed, all the members of Advisory Board, Management Committee, Coordination Committee and Technical Review Committee worked extremely hard to make this event happen. I have no doubt whatsoever that without their cooperation, support and active participatory role, this event would not have been possible for which I record my appreciation for all of them. Special thanks to the Conference Invited Speakers of Inaugural session, Dr. Liming Wang, Associate Professors, Shandong University, China, Dr. Mahmoud Rababah Associate professor, Hashemite University, Jordan, and Dr. Tim Anderson, Auckland University of Tech . New Zealand, invited speakers from industry, authors for strongly supporting the conference. I also take this opportunity to pay my sincere gratitude to the Chief Guest of Inaugural & Closing sessions for sparing their valuable time for this event. My sincere gratitude are to Engr. Prof. Dr. Sarosh Hashmat Lodi, Vice Chancellor, NEDUET, Engr. Sohail Bashir, Chairman, IEP, Karachi Centre, Engr. M. Farooq Arbi, Secretary, IEP, Karachi Centre and Engr. Ayaz Mirza Vice-President (Mechanical), IEP Centre for their guidance & help in organizing IMEC 20-21.

I would like to take this opportunity to place on record my sincere appreciations to Engr. Prof. Dr. Muhammad Tufail, Pro Vice-Chancellor, NEDUET & Convener IMEC-20-21, Eng. Prof. Dr. Mubashir Ali Siddiqui, Co-Convener, IMEC-20-21, Engr. Dr. Muhamamd Uzair, Secretary, IMEC 20-21, Engr. M. Aijazul Haque, Vice-Chairman (Mechanical) IEP, Karachi Centre and all the IEP Karachi Centre Staff for their hard work.



## SECRETARY

The Institution of Engineers Pakistan  
Karachi Centre



### **Engr. M. Farooq Arbi, FIE (Pak)**

Secretary,  
The Institution of Engineers Pakistan  
Karachi Centre

“ The Institution of Engineers Pakistan is playing a vital role in the Development of the Nation since its inception within the periphery of its approved aims and objectives, mostly revolving around the promotion and advancement of the practice and application of principles of Engineering, through its nine centres spread across Pakistan and four overseas Centres. Upholding its traditions, the 10th International Mechanical Engineering Conference jointly organized by The Institution of Engineers Pakistan, Karachi Centre, NED University of Engineering and Technology, Mehran University of Engineering and Technology, NEDIAN Association in hybrid mode (Physical & Zoom) this year. The Conference shall explore the latest technological development in the field of Mechanical Engineering and would broaden the vision of the participants.

On behalf of the Institution of Engineers Pakistan, Karachi Centre and the Organizing Committee, I would like to express my sincere appreciation for all participants, both from academia and industry, who played their role through contributions to the Conference and through their participation. In fact, all the members of the Technical Program Committee worked extremely hard to make this event happen. I have no doubt whatsoever that without their cooperation and their significant role and support, this event would have been possible. Special thanks also goes to the invited speakers and authors for strongly supporting the Conference while there are no words to thank the Chief Guest/Guest of Honor who have spared their valuable time for this important event..

Finally, I welcome each participant and hope that they will find the 10th International Mechanical Engineering Conference not only useful in many respects but also to be a good opportunity to meet people and connect positively through networking in available time slot.

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## The Institution of Engineers Pakistan

**The main goal of the Institution of Engineers, Pakistan is to Build Better World as appearing in its logo.**

**The aims and objectives of the Institution are:**

- a. To Promote and advance the science, practice, and business of engineering in all its branches throughout Pakistan.**
- b. To Promote efficiency in the engineering practice and profession.**
- c. To Regulate the professional activities and assist in maintaining high standard in the general conduct of its members.**
- d. To Lay down professional code of ethics and to make it mandatory for its members in their professional conduct.**
- e. To Help in the acquisition and exchange of technical knowledge.**
- f. To Promote the professional interest and social welfare of its members.**
- g. To Encourage original research in engineering and conservation and economic utilization of the country's materials resources.**
- h. To Foster coordination with similar institutions in other countries and Engineering Universities, Institutions and Colleges in Pakistan and in other countries for mutual benefits in furthering the objects of Institution.**
- i) To diffuse among its members information on all matters affecting engineering and to encourage, assist and extend knowledge and information connected therewith by establishment and promotion of lectures, discussions or correspondence, by the holding of conferences, by the publication of papers, periodicals and journals, proceedings, reports, books, circulars and maps or other literary undertaking, by encouraging research work or by the formation of library or libraries and collection of models, designs, drawings, and other articles of interest in connection with engineering or otherwise howsoever.**
- j) To promote the study of engineering with a view to disseminating the information obtained for facilitating the scientific and economic development of engineering in Pakistan.**



## The Institution of Engineers Pakistan

- k) To establish, acquire, carry on, control or advise with regard to colleges or other educational establishments where students and apprentices may obtain a sound education and training in engineering on such terms as may be settled by the Institution.
- l) To encourage, regulate and elevate the technical and general knowledge of persons engaged in or about to engage in engineering or in any employment manual or otherwise in connection therewith and with a view thereto function as an Educational Institution and to provide for holding of coaching wherever possible and to test by examination or otherwise the competence of such persons and to institute and establish professor-ships, student-ships, scholar-ships, rewards and other benefactions and to grant certificates of competency whether under any Act of the Government of Pakistan or Local Government under the Bye-Laws of the Institution regulating the conduct and qualification of engineer or otherwise howsoever.
- m) To-operate with various Government agencies and industrial and commercial enterprises connected with engineering and advising them in matters concerning the profession and practice of engineering and promotion of technical education.
- n) To encourage inventions and investigate and make known their nature and merits.
- o) To arrange and promote the adoption of equitable forms of engineering contracts and other legal documents, to encourage settlement of disputes by arbitration and to act as and nominate arbitrators and to act as and nominate arbitrators and umpires on such terms as may be expedient.
- p) To promote just and honorable dealing and to suppress mal-practice in engineering
- q) To do all such other acts and things as are incidental or conducive to the above objects or any of them.

The Institution ever since its inception has been taking concerted efforts to upgrade the knowledge and technical know-how of its member engineers by undertaking various technical activities. IEP has, on number of occasions, conducted numerous studies on various technical problems, and has submitted its recommendations to the government.

## LIST OF ORGANIZATIONS, INSTITUTIONS HAVING AGREEMENT OF CO-OPERATION / AFFILIATIONS WITH IEP

1. World Federation of Engineering Organizations (WFEO)
2. Federation of Engineering Institutions of Islamic Countries (FEIIC)  
(comprising all Engineering Institution of Islamic Countries).
3. Federation of Engineering Institutions of South and Central Asia (FEISCA),  
(all Engineering Institutions of SAARC Countries are its Members.)
4. Asian Civil Engineering Coordinating Council (ACECC)
5. Common-Wealth Engineers Council (CEC)  
(which works under the aegis of United Nations Organization).
6. International Federation of Automatic Control (IFAC)
7. Consortium of Affiliates of International Programme (CAIP)
8. American Association for Advancement of Sciences (AAAS), USA.
9. International Association for Bridges & Structural Engineering (IABSE), USA.
10. Russian Engineering Academy, Russia
11. American Society for Civil Engineers, USA.
12. Canadian Society for Civil Engineering, Canada.
13. Royal Aeronautical Society, U.K.
14. Institution of Structural Engineers, UK.
15. Institution of Civil Engineers, UK.
16. Institution of Electrical Engineers UK.
17. Institution of Mechanical Engineers UK.
18. China Civil Engineering Society, China
19. China Mechanical Engineering Society, China.
20. China Highways & Transportation Engineering Society, China.
21. Chinese Society of Electrical Engineers, China.
22. China Institution of Electronics, China.
23. Cyprus Professional Engineers Association, Cyprus.
24. Institution of Engineers, Bangladesh.
25. Institution of Electrical Engineers of Japan
26. Institution of Engineers Sri Lanka.
27. Nepal Engineers' Association, Nepal.
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29. Institution of Engineers Indonesia.
30. Engineering Academy of Tajikistan.
31. Engineering Academy of Uzbekistan.
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35. Institution of Engineers Afghanistan.
36. Council of Aeronautical Science, USA.
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38. Institution of Engineers, Australia.
39. Union of Chambers of Engineers & Architects, Turkey.
40. Korean Society of Civil Engineers, Korea.
41. Japan Society of Civil Engineers, Japan
42. Institution of Electrical and Electronics Engineers, USA.
43. Institute of Marine Engineering, Science & Technology, UK.
44. Bahrain Society of Engineers, Bahrain.

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# 10<sup>th</sup> INTERNATIONAL MECHANICAL ENGINEERING CONFERENCE

Friday 12th February, 2021  
at Video Conferencing Hall, NEDUET



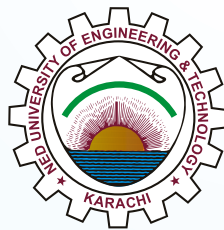
1921-2021

being held on the occasion of  
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The Institution of Engineers Pakistan  
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Plumbing Professionals



Institution of Mechanical  
Engineers - Pakistan





## The Institution of Engineers Pakistan

### 10th International Mechanical Engineering Conference (IMEC-2021) Friday 12th February, 2021 at Video Conferencing Hall, NEDUET

09:00 - 9:45 am	Registration	11:10 am - 12:35 pm	<b>Technical Session-1</b>
9:45 am	Recitation from the Holy Quran	12:35-12:45 pm	<b>Question &amp; Answer</b>
9:50 am	National Anthem	12.45-2:00 pm	<b>Break for Lunch / Jum'm'ah Prayer</b>
9: 50 - 9:55 am	<b>Conference briefing by</b> <b>Engr. Prof. Dr. Mubashir Ali Siddiqui, FIE,PE</b> Chairman, Department of Mechanical Engineering, NEDUET & Co- Convener, IMEC-20-21	2:00-3:00 pm	<b>Technical Session-2</b>
9:55-10:00 am	<b>Address by</b> <b>Engr. Prof. Dr. Muhammad Tufail, FIE,PE</b> Pro-Vice Chancellor, NEDUET & Convener, IMEC-20-21	3:00-3:10 pm	<b>Question &amp; Answer</b>
10:00 - 10: 05 am	<b>Welcome Address by</b> <b>Engr. Sohail Bashir, FIE,PE</b> Chairman, IEP, Karachi Centre	3:15-3:55 pm	<b>Technical Session-3</b>
10:05-10:15 am	<b>Invited Talk by</b> <b>Dr. Liming Wang,</b> Associate Professor, Shandong University, China	3:55-4:05 pm	<b>Question &amp; Answer</b>
10:15-10:25 am	<b>Invited Talk by</b> <b>Dr. Mahmoud Rababah</b> Associate Professor, Hashemite University, Jordan	<b>Closing Ceremony (4:10-4:50 pm)</b>	
10:25-10:35	<b>Invited Talk by</b> <b>Dr. Tim Anderson,</b> Assoc. Prof., Auckland University of Tech., New Zealand	4:10-4:15 pm:	<b>Conferencing Highlights by</b> <b>Engr. Prof. Dr. Syed Amir Iqbal</b> Dean, Faculty of Mechanical and Manufacturing Engineering, NEDUET
10:35-10:40	<b>Address by</b> <b>Prof. Dr. Mohammad Aslam Uqaili</b> Vice Chancellor, MUET	4:15-4:20 pm	<b>Address by</b> <b>Engr. Sohail Bashir, FIE, PE</b> Chairman, IEP, Karachi Centre
10:40- 10:45 am	<b>Address by</b> <b>Engr. Prof. Dr. Sarosh Hashmat Lodi, FIE,PE</b> Vice Chancellor , NEDUET	4:20-4:25 pm	<b>Address by</b> <b>Engr. Prof.Dr. Sarosh Hashmat Lodi, FIE,PE</b> Vice-Chancellor, NEDUET
10:45- 10:50 am	<b>Address by Chief Guest</b> <b>Engr. Nadeem Rasul</b> Managing Director, Pakistan Machine Tool Factory(PMTF)	4:25-4:30	<b>Address by Chief Guest</b> <b>Engr. Asim Murtaza Khan, FIE,PE</b> President NED International Alumni Network Association (NEDIAN) & CEO, Petroleum Institute of Pakistan
10:50-10-55 am	<b>Presentation of Conference Mementos/Certificates</b>	4:30-4:35 pm	<b>Presentation of Chairman IEP Medal for Best Paper</b>
10:55 - 11:00 am	<b>Vote of Thanks by</b> <b>Engr. Farooq Arbi, FIE,PE</b> Secretary, IEP, Karachi Centre	4:35-4:40 pm	<b>Conference Recommendations by</b> <b>Engr. Dr. Muhammad Uzair</b> Secretary, IMEC-20-21
11:00- 11:10 am	<b>Refreshments</b>	4:40- 4:45 pm	<b>Presentation of Conference Mementos</b>
		4:45-4:50	<b>Vote of Thanks</b> <b>Engr. Ayaz Mirza, FIE, PE</b> Vice-President (Mechanical), IEP
		4:50 pm	<b>Tea</b>



## The Institution of Engineers Pakistan

Technical Session-1
<p><b>11:10 am- 12:35 pm</b>  <b>Video Conferencing Hall, NEDUET</b>  <b>Session Chairs:</b>  <b>Engr. M. Aijazul Haque</b>  Vice-Chairman ( Mechanical), IEP, Karachi Centre  <b>Engr. Muhammad Abbas Sajid</b>  Secretary, NED Alumni International Network (NEDIAN) Association  <b>Prof. Dr. Murtuza Mehdi</b>  Department of Mechanical Engineering, NEDUET</p>
<p><b>CYCLE TIME REDUCTION OF ASSEMBLY LINE USING VALUE STREAM MAPPING</b>  <b>Muhammad Danish Saleem, Dr. Nasir Uddin Shaikh</b>  Mechanical Engineering Department, NED University of Engineering &amp; Technology, Karachi, Pakistan</p>
<p><b>INVESTIGATION OF ENHANCED THERMAL CONDUCTIVITY BY ADDING NANOPARTICLES IN LUBRICANT OIL</b>  <b>Mohammad Ehteshamul Haque<sup>1</sup>, A.B. Rosli<sup>2</sup></b>  <sup>1</sup>Mechanical Engineering Department, NED University of Engineering &amp; Technology, Karachi, Pakistan  <sup>2</sup>Mechanical Engineering Department, Pahang University, Malaysia.</p>
<p><b>DEVELOPMENT OF A HIGH EFFICIENT RESIDENTIAL WATER-COOLED AIR CONDITIONER</b>  <b>Muzammil Ejaz, Muhammad Oun, Kalim Ullah, Talha Alam</b>  <sup>1</sup>Mechanical Engineering Department, NED University of Engineering &amp; Technology, Karachi, Pakistan</p>
<p><b>TECHNO-ECONOMIC ANALYSIS OF A HYBRID PHOTOVOLTAIC-THERMAL (PV/T) AIR COLLECTOR</b>  <b>Asad A. Naqvi<sup>1</sup>, Ahsan Ahmed<sup>1</sup>, Muhammad Kazim<sup>2</sup></b>  <sup>1</sup>Mechanical Engineering Department, NED University of Engineering &amp; Technology, Karachi, Pakistan  <sup>2</sup>Department of Mechanical Engineering, Texas A&amp;M University, USA</p>
<p><b>NUMERICAL CHARACTERIZATION AND COMPARISON STUDY OF MICRO HYDROKINETIC TURBINES FOR RIVER APPLICATIONS</b>  <b>Muzammil Ejaz , Osama Rauf, Mehdi Rizvi, Jalil Ali, Danyal Yousuf</b>  Mechanical Engineering Department, NED University of Engineering &amp; Technology, Karachi, Pakistan</p>
<p><b>EVALUATION OF NATURAL REFRIGERANTS FOR AN ORGANIC RANKINE CYCLE DRIVEN VAPOR COMPRESSION CYCLE</b>  <b>Muhammad Tauseef Nasir</b>  Department of Mechanical Engineering, PUSAN National University, South Korea</p>
<p><b>12:35 pm-12:45 pm</b>  <b>Question &amp; Answer</b></p>
<p><b>12:45 pm -2:00 pm Break for Lunch/Jumm'ah Prayer</b></p>



## The Institution of Engineers Pakistan

### Technical Session-2

**2:00 pm-3:00 pm**

**Video Conferencing Hall, NEDUET**

**Session Chairs:**

**Engr. Ghulam Farooq Maniar**

Member Central Council, IEP & Chief Organizer, 10<sup>th</sup> IMEC 20-21

**Engr. Abdul Wahab Tajwani**

Member Local Council, IEP, Karachi Centre

**Dr. Muhammad Shakaib**

**Department of Mechanical Engineering NEDUET**

### **MODELLING AND SIMULATION OF A COGENERATION PROCESS IN A DAIRY FARM.**

**Mahnoor Syed 1, Zahra Mushtaq 1, Muhammad Sabir Javed 1, Osaid ul Hasan Syed 1, Zeeshan Anwar2**

1PNEC NUST, Karachi, Pakistan 2Technical University of Munich, Germany

### **THERMAL MANAGEMENT OF LITHIUM ION BATTERIES FOR ELECTRIC VEHICLES**

**Waqas Ahmed1, Abid Hussain1**

1Department of Mechanical Engineering, University of Engineering & Technology Taxila, Pakistan.

### **DESIGN AND DEVELOPMENT OF PAINT SPRAYING ROBOTIC MECHANISM**

**Muhammad Faizan Shah1\*, Syed Saad Farooq1, Zareena Kausar2, Aqdas Nadeem1, Muhammad Shaheer Wassi1, Hasnain Ahmed1, and Muhammad Sohaib1**

1 Department of Mechanical Engineering, Khwaja Fareed University of Engineering & IT Rahim Yar Khan, Pakistan.

2Department of Mechatronics Engineering, Air University, Islamabad, Pakistan.

### **EFFECT OF CORNERING CHARACTERISTICS OF A NON-PNEUMATIC TIRE ON HANDLING PERFORMANCE OF A VEHICLE**

**Mubashir Jaleel1\*, Raja Amer Azim2, Hasan Aftab Saeed3, Syed Gul Hassan Naqvi4**

1Department of Mechanical Engineering, College of E&ME, National University of Sciences and Technology, Pakistan

2,3,4Faculty of Department of Mechanical Engineering, College of E&ME, National University of Sciences and Technology, Pakistan

**3:00 pm-3:10 pm**

**Question & Answer**



## The Institution of Engineers Pakistan

### Technical Session-3

**3:10 pm -4:00 pm**

**Video Conferencing Hall, NEDUET**

**Session Chairs:**

**Engr. Jilani Yousuf**

Member Central Council, IEP

**Engr. Abdul Rahim**

Member Local Council, IEP, Karachi Centre

**Engr. Dr. Maaz Akhtar**

Department of Mechanical Engineering, NEDUET

### **ENERGY ANALYSIS OF ORC-VCC BASED COGENERATION SYSTEM POWERED BY LOW-GRADE HEAT SOURCES**

**Rajnesh Kumar, Abdul Ghafoor Memon, Faqeer Muhammad, Abdullah Tariq**

Mechanical Engineering Department, Mehran University of Engineering & Technology, Jamshoro, Pakistan

### **DESIGN OF A TWO-WHEELED MOBILE WELDING MANIPULATOR FOR SPHERICAL OBJECTS**

**Muhammad Faizan Shah<sup>1</sup>, Zareena Kausar<sup>2</sup> and, Aqdas Nadeem<sup>1</sup>,**

1. Department of Mechanical Engineering, Khwaja Fareed University of Engineering & IT Rahim Yar Khan, Pakistan.

2. Department of Mechatronics Engineering, Air University, Islamabad, Pakistan

### **DURING LONG-TERM ANALYSIS PERFORMANCE AND CARBON DEPOSITION IN COMPRESSION IGNITION ENGINE USING BIODIESEL BLENDED FUEL AS ADDITIVE**

**Ali Murtaza Ansari<sup>1</sup> Liaquat Ali Memon<sup>2</sup> Faheem Ahmed Solangi<sup>3</sup>**

1 PhD research scholar, Department of Mechanical Engineering, Quaid-e-Awam University of Engineering Science & Technology Nawabshah, Sindh Pakistan. (ali.murtaza4646@gmail.com)

2 Professor, Department of Mechanical Engineering, Quaid-e-awam University of Engineering Science & Technology Nawabshah, Sindh Pakistan. (liaquat.ali@quest.edu.pk)

3 Assistant Professor, Department of Mechanical Engineering, Department of Mechanical Engineering, Quaid-e-awam University of Engineering Science & Technology Nawabshah, Sindh Pakistan. (faheemahmed\_5@yahoo.com)

### **CONVECTIVE HEAT LOSSES IN A PARABOLIC DISH CAVITY RECEIVER**

**Muhammad Uzair<sup>1</sup>, M. Zeeshan Anwer<sup>1,2</sup>, Hamza Siddiqui<sup>1</sup>, S. Hamza Hasan<sup>1</sup>, M. Shahbaz Hussain<sup>1</sup>**

1 Mechanical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan

2 Technical University of Munich, Germany

**3:55 pm-4:05 pm**

**Question & Answer**

**Closing Ceremony**

**4:10-4:50 pm**

**4:50 pm**

**Tea**

## Session No. 1

**CYCLE TIME REDUCTION OF ASSEMBLY LINE USING VALUE STREAM MAPPING****Muhammad Danish Saleem, Dr. Nasir Uddin Shaikh**

Mechanical Engineering Department, NED University of Engineering &amp; Technology, Karachi, Pakistan

\*Corresponding author. Tel.: +92-3082120292 E-mail address: danish\_saleem@outlook.com

The manufacturing industry is considered as an important sector, which has a significant influence on the economic growth of a country. The increase of fierce competition among products requires organizations to satisfy their customers by making high-quality products with competitive prices and at on-time deliveries. Cycle time should be considered a viable option when an organization is trying to improve efficiency and productivity. This study aims to reduce the cycle time by using tools of lean manufacturing in an automotive manufacturing company. Value Stream Mapping (VSM) is used as a tool to identify waste, separating value added activities and non-value-added activities in the production process. A future state map is developed and implemented with new and improved processes. Future state map improved the process, made it more effective and more efficient resulted in a reduction of the cycle time from 88.17 min to 76.72 min. The efficiency of the line is increased from 74.94% to 83.36%, two workers have been eliminated, and the conveyor length has also been reduced and saved the floor space.

Keywords: Value Stream Mapping, Lean manufacturing, Cycle Time reduction, Kaizen

## Session No. 1

**INVESTIGATION OF ENHANCED THERMAL CONDUCTIVITY BY ADDING NANOPARTICLES IN LUBRICANT OIL****Mohammad Ehteshamul Haque<sup>1</sup>, A.B. Rosli<sup>2</sup>**<sup>1</sup>Mechanical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan<sup>2</sup>Mechanical Engineering Department, Pahang University, Malaysia. Email: mehaque@neduet.edu.pk

Addition of nanoparticles into the heat transfer fluids have resulted in a great increase in heat transfer efficiency. Nanofluids are engineered by dispersing metallic or non-metallic nanoparticles in the conventional heat transfer fluids. In this study, the thermal conductivity of Polyol Ester Oil (POE) containing a different concentration of Al<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub>, and SiO<sub>2</sub> nanoparticles are determined experimentally with the help of KD2 Pro instrument. The experimental results are compared with well-known correlations for predicting the thermal conductivity of nanofluids. The results show that the thermal conductivity of nanofluids increases linearly with nanoparticle concentration. Al<sub>2</sub>O<sub>3</sub> with 0.1% volume in the base fluid resulted in the highest thermal conductivity of 0.188 W.(mK)<sup>-1</sup>, an enhancement of 1.4 times higher than the base lubricant of POE oil.

Keywords: Heat transfer fluids; thermal conductivity; nanoparticles; nanofluids

## Session No. 1

**DEVELOPMENT OF A HIGH EFFICIENT RESIDENTIAL WATER-COOLED AIR CONDITIONER****Muzammil Ejaz, Muhammad Oun, Kalim Ullah, Talha Alam**<sup>1</sup>Mechanical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan

E-mail address: muzammil.ejaz@gmail.com

With the increase of advance technology Engineers are adapting to enhance the living standard of common people, by using alternate methods of extracting energy. If we look at developing countries of the world, most of the people of these developing countries are unable to purchase an AC just because of high electricity bills. As the electricity price increases day by day so we should make an attempt to facilitate our people. A simple prototype air conditioning unit driven by solar energy in daytime and with conventional electricity at night and is proposed to replace the conventional vapor compression air-conditioning systems which are not affordable by middle class families. The proposed model is supposed to be used in conditioning the Domestic purpose with lowest possible running cost.

Keywords: Air Conditioner, Air cooled condenser, Higher COP system, Underground water tank



## Session No. 1

**TECHNO-ECONOMIC ANALYSIS OF A HYBRID PHOTOVOLTAIC-THERMAL (PV/T) AIR COLLECTOR****Asad A. Naqvi<sup>1</sup>, Ahsan Ahmed<sup>1</sup>, Muhammad Kazim<sup>2</sup>**<sup>1</sup>Mechanical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan<sup>2</sup>Department of Mechanical Engineering, Texas A&M University, USA

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Photovoltaic System is the efficient renewable technology and is widely used for the generation of electricity. Photovoltaic systems convert the sunlight directly into electricity. The main disadvantage of the photovoltaic system is that its electricity is dropped as the ambient temperature is increased. On average the cell temperature of Photovoltaic module is 30 °C more than the ambient temperature. In this research the electrical efficiency of the Photovoltaic module is increased by integrating the air duct at the back of the panel. The PV module is converted into Hybrid PV/T module which is producing heat and electricity from the single system. The air is blown through the duct which ultimately cools the panel and increasing the electrical efficiency by around 3 %. The heat is also collected from the panel. The average heat available from the PV/T system is 352W. The total energy extracted from the panel includes around 75% heat and 25% electrical energy. The conversion of PV module into Hybrid PV/T module is an economic solution to improve the electrical efficiency of the PV module and can payback in just 9 months if there is a requirement of heat.

Keywords: Solar; PV/T; Economic; Payback

## Session No. 1

**NUMERICAL CHARACTERIZATION AND COMPARISON STUDY OF MICRO HYDROKINETIC TURBINES FOR RIVER APPLICATIONS****Muzammil Ejaz , Osama Rauf, Mehdi Rizvi, Jalil Ali, Danyal Yousuf**

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Many modifications have been made on conventional hydro kinetic turbines rotor blades to improve the performances. The rotor blade modification in this research paper is a blade combination where the circle-shaped conventional model is combined with the one of a concave elliptical model. Two different blade geometries have been analyzed using a detailed computational Fluid Dynamics approach. The blade design will affect the simplicity of construction and cost of manufacture of turbine rotors. The aim is to analyze the influence of the blade combination towards the performance of hydro-kinetic turbine for installation at a selected site. The research includes experimental method using open-type water tunnel of rotor's prototype with 2 different blade models of similar dimensions. The experiment shows, there are influences of the modification of the rotor blade to the performances of the turbine. The optimized blade design improves the performances of the Tip Speed Ratio (TSR) by 78 % while the Coefficient of thrust (CT) is improved by 58.3% at peak co-efficient of performance value of 0.47 for both the blade designs.

Keywords: Hydro-Kinetic Turbine , CFD Analysis, Power Coefficient, Coefficient of Thrust

## Session No. 1

**EVALUATION OF NATURAL REFRIGERANTS FOR AN ORGANIC RANKINE CYCLE DRIVEN VAPOR COMPRESSION CYCLE****Muhammad Tauseef Nasir**

Department of Mechanical Engineering, PUSAN National University, South Korea

Organic Rankine Cycle (ORC) has emerged as a proven heat conversion technology for low grade heat utilization into mechanical energy. In this paper, the prospects of using the mechanical energy to drive a vapor compression cycle for air conditioning applications have been explored. The natural refrigerant, ammonia, butane and propane are considered for the investigation. Additionally, R134a was also analyzed to have comparative assessment of the natural refrigerants with this contemporary working fluid. For the evaluation, COP, 2nd law efficiency, and number of Transfer Units (NTU) are chosen as the performance indices. A parametric study has been performed to identify and analyze the key performance parameters. The results indicate that propane driven ORC for all fluid pairs to be superior, and the ORC-VCC system holds a positive potential to be exploited for air conditioning applications.

## Session No. 2

**MODELLING AND SIMULATION OF A  
COGENERATION PROCESS IN A DAIRY FARM.****Mahnoor Syed 1, Zahra Mushtaq 1, Muhammad Sabir Javed 1, Osaid ul Hasan Syed 1, Zeeshan Anwar2**

1PNEC NUST, Karachi, Pakistan 2Technical University of Munich, Germany

In this Publication, a biogas fed with PEMFC with waste heat recovery is modelled using Simulink. Manure from Dairy farm is used an input to Biogas digester to produce methane. The methane is converted into hydrogen through Fuel Processor. The hydrogen gas produced will be input to PEMFC to produce electricity. The waste heat of PEMFC is recovered through Thermoelectric Generator which uses the waste heat to produce electricity.

## Session No. 2

**THERMAL MANAGEMENT OF LITHIUM ION BATTERIES FOR ELECTRIC VEHICLES****Waqas Ahmed1, Abid Hussain1**

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Looking at future perspective of electric & hybrid electric vehicles and its growing demand it is necessary to have a very efficient thermal management system that controls working temperature of Lithium ion batteries. In this research a non-active (Passive) type heat management system by utilizing unique composite (Aluminum foam paraffin wax) has been designed and studied for managing the temperature of highly powered Li-ion batteries. In this investigation a comparison has also been made with three other cooling modes i.e. a composition of nickel foam paraffin, natural air-cooling, pure PCM (Paraffin). The results exhibit that it is impossible to control the operating temperature by only utilizing the mode of cooling as natural air. It is necessary to have materials like PCM that can undergo through phase changing procedure and become effective for the lithium ion batteries. This phenomenon can be made more productive by employing composite of paraffin and aluminum foam that results in decrease of 32.6% in the temperature comparing with natural air cooling, 5.1% by composite of nickel & paraffin mode and 11.8% in comparison to the pure PCM, at 2C discharge rate. Metal foam shape influence has also been investigated, the geometry of the metal foam also plays role in temperature reduction of the battery surface, and the temperature of surface is optimized through reduction of pore density and porosity of the metal foam.

Keywords: Thermal management; Lithium ion batteries; Hybrid Electric Vehicle; Passive cooling;

## Session No. 2

**DESIGN AND DEVELOPMENT OF PAINT SPRAYING ROBOTIC MECHANISM****Muhammad Faizan Shah1\*, Syed Saad Farooq1, Zareena Kausar2, Aqdas Nadeem1, Muhammad Shaheer Wassi1, Hasnain Ahmed1, and Muhammad Sohaib1**

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This paper documents the design and implementation of a system to be used to spray all sides of any complex shaped object. The system is developed through a robotic mechanism. The mechanism is equipped with a paint spraying system, a curing system and a cooling system. The robotic mechanism has an ability to spray the object without any human interference. The spraying gun of the robotic system will be kept at a specific distance from the object to have a fine and neat finishing of the painted object and the painted object will be passed through a drying chamber to dry the paint. This robot is designed to paint any kind of three dimensional objects under one cubic feet size.

Keywords: Robotic Mechanism; Painting Manipulator; Drying Chamber;

## Session No. 2

**EFFECT OF CORNERING CHARACTERISTICS OF A NON-PNEUMATIC TIRE  
ON HANDLING PERFORMANCE OF A VEHICLE****Mubashir Jaleel<sup>1\*</sup>, Raja Amer Azim<sup>2</sup>, Hasan Aftab Saeed<sup>3</sup>, Syed Gul Hassan Naqvi<sup>4</sup>**<sup>1</sup>Department of Mechanical Engineering, College of E&ME, National University of Sciences and Technology, Pakistan<sup>2,3,4</sup>Faculty of Department of Mechanical Engineering, College of E&ME, National University of Sciences and Technology, Pakistan

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Non-pneumatic tires (NPTs) are making their way in research and development due to potential advantages of low rolling resistance, low contact pressure and enhanced safety. Low rolling resistance can reduce energy requirement of the vehicles adding to green engineering practices. Use of NPTs necessitates study of their impact on dynamic behaviour of vehicle. In this paper, influence of non-pneumatic tires on handling performance of a vehicle is investigated. Geometric, force and moment data of a non-pneumatic tire with hexagonal lattice spokes is used in vehicle dynamic simulations to assess handling performance of the vehicle. Vehicle selected for simulation with NPTs is having similar size of the pneumatic tires. Comparison is made by standard lane change manoeuvre. Aspects of speed, driver and environment are also studied by variation of vehicle speed, steering aggressiveness and friction. NPT enhances handling performance by increasing steering response and reducing yaw rate of the vehicle. Keywords: Non-pneumatic tire; handling; hexagonal lattice spokes; lane change

## Session No. 3

### ENERGY ANALYSIS OF ORC-VCC BASED COGENERATION SYSTEM POWERED BY LOW-GRADE HEAT SOURCES

**Rajnesh Kumar, Abdul Ghafoor Memon, Faqeer Muhammad, Abdullah Tariq**

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In this paper a thermodynamic analysis of cogeneration plant based on Organic Rankine Cycle (ORC) and Vapor Compression Refrigeration Cycle (VCC) powered by low-grade heat is presented. The plant is modeled in Engineering Equation Solver (EES) software and simulated under various conditions. The performance is assessed with three parameters; Net Power Output, Cooling Capacity and Energy Utilization Factor (EUF), calculated under three modes of operation, i.e., power only (P), power and cooling (P&C) and cooling only (C) while considering three working fluids namely R134a, R22 and R500. The behavior of system is analyzed under two conditions: transition from P to C and variation of source temperature. The P to C transition is obtained by varying power-to-cooling ratio of the system. For P to C transition, our results show that EUF of cooling mode is greater than the EUF of power mode. This implies that the work is high grade form of energy and therefore requires more input energy as compared to same units of cooling capacity. Regarding working fluids, R22 provides highest cooling capacity and EUF under a given power-to-cooling ratio, while variation in net power output remain same for all fluids. Moreover, R22 also exhibits greater sensitivity to the variation in source temperature, that is its rate of increase in net power output and cooling capacity is greater with the increase in source temperature compared to the other fluids under all modes of operation.

## Session No. 3

### DESIGN OF A TWO-WHEELED MOBILE WELDING MANIPULATOR FOR SPHERICAL OBJECTS

**Muhammad Faizan Shah<sup>1</sup>, Zareena Kausar<sup>2</sup> and, Aqdas Nadeem<sup>1</sup>,**

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Mobile manipulators have gained a lot of attention from the research community. This paper presents the multi-axis robotic welding system. The robotic system is designed to weld a seam on Sphere with known coordinates automatically. The methodology includes system design, inverse kinematics, and analysis of the robotic system. The system is proposed for an arc welding on Spherical objects which has a lot of applications in the industry. The robotic welding system may be used in the house as well as at a remote site.

**Keywords** Mobile Robots, Robotic Manipulator, Welding, Workspace

## Session No. 3

### **DURING LONG-TERM ANALYSIS PERFORMANCE AND CARBON DEPOSITION IN COMPRESSION IGNITION ENGINE USING BIODIESEL BLENDED FUEL AS ADDITIVE**

**Ali Murtaza Ansari<sup>1</sup> Liaquat Ali Memon<sup>2</sup> Faheem Ahmed Solangi<sup>3</sup>**

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In this study, engine Performance, sound pressure level and endurance test have been carried out using biodiesel blend and diesel fuel. (DF). The endurance test has been carried out for 60 hours of running. In this work, the single cylinder horizontal type diesel engine has been used without any modification. Over all 2 fuel samples have been tasted, such as JB30 (Jatropha) biodiesel 30 + Diesel 70) and diesel fuel (D100) as a base line. All parameters of the locomotive performance, and sound pressure were calculated at incessant speed of 1350 and variable loads 0.0 to 1.6 at an interval of 0.1 Kg-m. Whereas the endurance test result has been carried out at constant load of 1.0 Kg-m at constant RPM of 1350. The sound pressure level from the engine are also calculated from four different locations; front, left, back and top. From results it was noticed. (BSFC) of biodiesel blended was decreasing by increasing brake power on engine. The sound pressure level of all blended fuel was found to be reduced as contrasted to baseline fuel (DF). In durability test, the visual inspection of valves surface was carried out for analysis of deposition of aromatic compounds on Exhaust valves surface for all fuel samples (D100 and JB30). Detailed result of depositions has been taken by electron microscopic techniques. There are different aromatic compounds were found on Exhaust valve surface. The maximum deposition of carbon was found on diesel fuel, the result shows that 74.10% Exhaust valve of carbon element has been analysis on valve surface, whereas where as in the biodiesel blend (JB30) has 59.32% Exhaust valve.

Keywords: Engine Performance; Noise Emission level; Biodiesel blended; dedosition formation

## Session No. 3

### **CONVECTIVE HEAT LOSSES IN A PARABOLIC DISH CAVITY RECEIVER**

**Muhammad Uzair<sup>1</sup>, M. Zeeshan Anwer<sup>1,2</sup>, Hamza Siddiqui<sup>1</sup>, S. Hamza Hasan<sup>1</sup>, M. Shahbaz Hussain<sup>1</sup>**

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Parabolic dish cavity heat receivers are very efficient solar concentrating panels that generate electricity from the renewable resources. But at the same time, their efficiency decreases with the increase in temperature of cavity which creates a problem, that is heat loss, especially the convective heat loss. This paper aims to predict the most efficient shape of cavity receiver in the absence of dish structure at natural convection by investigating CFD analysis. Additionally, this paper also investigated the shape with greater heat losses, which is then further modified to different length to diameter ratios in order to provide information about maximum heat loss. There were few studies on the convective heat losses from the cavity with the dish attached but no significant studies were found on heat losses in the absence of dish structure. Seven different shapes of cavity receiver are considered for this study and at different tilt angles which varies from 0 to 90 degrees. It is a widely held view that this paper is favorable for numerical investigations and design of solar cavity receivers and provides a valuable information for the design of solar receiver which otherwise, may be ignored by the designers and results in inefficiency and decrease of cost effectiveness of the system. Consequently, generation of electricity can become more affordable in comparison with fossil fuels.

Keywords: Parabolic dish, cavity receiver; design; efficiency; convection heat loss; natural convection





# The Institution of Engineers Pakistan

## List of Papers presented in 9th International Mechanical Engineering Conference held on 15th & 16th March, 2019 at IEP, Karachi Centre

Key Note presentation on “**Clean Energy and Sustainability: Keys for Future Prosperity**” by Dr. Kamran Siddiqui, Professor in the Department of Mechanical and Materials Engineering and Associate, Dean (Acting) Graduate and Postdoctoral Studies, University of Western Ontario, Canada

A Key Note presentation on “**Restructuring of Pakistan Power Sector: Successes and Failures, Renewable Case Study – Bagasse Projects**” was given by Engr. Naveed Siddiq, Former Deputy Project Engineer, KESC Former Project Manager, Private Power Infrastructure Board (PPIB), Former Case Officer, NEPRA, Former Technical Advisor ETPT for 3 IPP's at Quetta, Kabirwala and Sheikhpura, Former Senior Energy Expert Policy Programme-USAID, Presently General Manager, Energy Project GFF Group,

**Invited Talk by Engr. Azeem Anwar**

**Invited Talk on New Trends in HVAC- A Green Approach by Engr. Fahad Hussain**

**Invited Talk: Engr. Abdul Majeed Shaikh**

**Invited Talk by Engr. Liaquat Raza**

**Invited Talk Renewable Energy Prospects and Projects by Engr. Mehfooz Kazi, (AEDB)**

**Invited Talk on A Case Study on Solar Power Generation by Engr. Shaaf Mehboob**

**Invited Talk by Engr. Irshad Hussain, CEO, Pak Oasis**

**A Meticulous Approach for Selection of Airfoils to Prepare a Blended Wing Body Aircraft** by Engr. Qais H. Suhail, H. Nayyer, J. Younus, K. Kamal, Engineering Sciences Department, NUST

**Effect of Trailing Edge Roundness of NACA 0012 Airfoil** by Engr. Absar Ahmed Khan, Office of Research, Innovation and Commercialization (ORIC, ZABIST), Engr. Sohail Hasnain, Mechanical Engineering Department, NEDUET, Engr. Syed M. Minhal Haider, Technische Universität Darmstadt, Germany

**Analysis of Experimental and Numerical Simulation of Various NACA Series Airfoils** by Engr. Bilal Ahmed, Engr. Ateeq Ahmed, Engr. Nasiruddin Shaikh, Department of Mechanical Engineering, NEDUET, Engr. Muhammad Waseem, School of Engineering, Computer & Mathematical Science, AUT University, Auckland, New Zealand, Engr. Abdul Fatah, and Engr. Dur Muhammad, Mechanical Engineering Department, MUET

**Building our New Energy Future** by Engr. Adeeba Mehboob

**Chilled Water Plant at Emporium Mall, Lahore – A Case Study** by Engr. Fahim Siddiqui

**Stress Analysis of Gas Turbine High Pressure Compressor Stage 4 Blade at Different Loading Conditions** by Engr. Junaid Ahmed Khalid, Engr. Murtuza Mehdi and Engr. Maaz Akhtar Department of Mechanical Engineering, NEDUET

**Effect of Specific Charge in the Primary Atomization Zone of Electrostatically Charge Bio-Diesel Sprays** by Engr. Shehzaib Yousuf Khan, School of Aerospace, Mechanical and Mechatronic Engineering, The University of Sydney, NSW, Australia

**Experimental Analysis of Diesel and Dual-Fuel Engine** by Engr. Tanweer Hussain, Department of Mechanical Engineering I, QUEST, Engr. Ateeq Ahmed, Engr. Bilal Ahmed, Department of Mechanical Engineering, NEDUET, Engr. Dur Muhammad, Engr. Abdul Fatah, Mechanical Engineering Department, MUET, Engr. Muhammad Waseem, School of Engineering, Computer & Mathematical Science, AUT University, Auckland, New Zealand

**Sol-Gel Based Synthesis of New Perovskite Material** by Engr. Syed Raheel Adeel, Engr. Dr. Murtuza and Engr. Dr. Maaz Akhtar Department of Mechanical Engineering, NEDUET

**Growth Optimization by Analyzing Sustainability Components: A Case Study of Ceramics Industry** by Engr. Muhammad Waseem, Aerospace Engineering Department, Engr. Qazi Muhammad Usman Jan, Industrial Engineering Department, College of Aeronautical Engineering NUST, PAF Academy Asghar Khan, Engr. Irfan Ullah, Industrial Engineering Department, UET Peshawar

**Design and Analysis of Aluminum Mold for Injection Molding Process of Polymers** by Engr. Qazi Muhammad Usman Jan, Industrial Engineering Department, Engr. Muhammad Waseem, Aerospace Engineering Department, College of Aeronautical Engineering NUST, PAF Academy Asghar Khan, Engr. Sahar Noor, Engr. Tufail Habib, Industrial Engineering Department, UET Peshawar

**Tidal Energy Potential in Coastal Regions of Pakistan** by Engr. Absar Ahmed Khan, Office of Research, Innovation and Commercialization (ORIC, SZABIST) Engr. Sohail Hasnain, Mechanical Engineering Department, NEDUET, Engr. Muhammad Ali Syed, Mechanical Engineering Department, Nazeer Hussain University, Engr. Syed M. Minhal Haider, Technische Universität Darmstadt, Germany

**Design and Fabrication of Cost Effective Solar Water Heater for Single House Utility** by Engr. S. Sheraz Ali, Mechanical Engineering Department (PNEC-NUST), Engr. Ateeq Ahmed, Engr. Bilal Ahmed, Engr. Sumiya Mohsin Mechanical Engineering Department NEDUET, Engr. Shahzaib Abbas, Department of Power Engineering, Karachi Institute of Power Engineering (KINPOE)

**Energy Efficiency Improvement of Water-Cooled Chillers Using Organic Rankine Cycle Integrated With Renewable Energy Sources** by Engr. Muhammad Tauseef Nasir, Engr. Hamza Hamid Taimuri, PAF-KIET, Karachi

**Carbon Steel Calibration Tube Inspection by Internal Rotary Inspection System (IRIS) Technique** by Engr. Faisal Ahmed, Engr. Dr. Syed Anwar Ul Hasoon, Karachi Institute of Power Engineering, Engr. Mahmood Khan, Department of Material Science and Engineering, Institute of Space Technology, Islamabad.

**Process Optimization for Flue Gas Scrubbing Using Ionic Liquid as Solvent** by Engr. Bilal Kazmi, Engr. Zahoorul Hussain Awan, Engr. Syed John Hassan Zaidi, Department of Chemical Engineering, NEDUET, Engr. Junaid Haider, School of Chemical Engineering, Yeungnam University, Korea, Engr. Saud Hashmi, Engr. Shahzar Khan, Department of Polymer and Petrochemical Engineering, NEDUET

**Simulation & Modeling of LNG Integrated Air Separation Process** by Engr. Muhammad Naqi Raza, Engr. Zahoor Ul Hussain Department of Chemical Engineering, NEDUET, Engr. Saud Hashmi, Department of Polymer and Petrochemical Engineering NEDUET

**Flow and Heat Transfer Characteristics of Micro-channel Heat Sink with Cylindrical Ribs and Cavities** by Engr. Faraz Ahmed, Engr. Taqi Ahmad Cheema, Engr. M. Mohib Ur Rehman, Faculty of Mechanical Engineering, GIK Institute of Engineering Sciences and Technology, KPK

**Study of the Effect of Confluence Angle on Mixing Quality in Micro mixers Using CFD** by Engr. Urooj Fatima, Engr. Inayatullah Memon, Chemical Engineering Department, NEDUET, Engr. M. Shakaib, Mechanical Engineering Department, NEDUET

**Thermodynamic Analysis of Vacuum Membrane Distillation (VMD) to Desalinate Sea Water Using Solar Energy** by Engr. Syed Asad Jamal, Engr. Muhammad Asif, Engr. Muhammad Suleman, Faculty of Mechanical Engineering, GIK Institute of Engineering Sciences and Technology, KPK



# The Institution of Engineers Pakistan

GLIMPSES OF  
9TH INTERNATIONAL MECHANICAL CONFERENCE  
held on 15th & 16th March, 2019



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